STAFF EXHIBIT 32

RAS 14599

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of US Army Jefferson Proving Grou
Docket No. 40-8838-MLA Official Exhibit No. 32
OFFERED by: Applicant/Licensee Intervenor
NRC Staff Other
IDENTIFIED on Witness/Panel
Action Taken: ADMITTED REJECTED WITHDRAW
Reporter/Clerk

CONTROLLED BURN AIR SAMPLING TECHNICAL REPORT

FINAL
August 2001

Prepared for

Directorate of Safety, Health and Environment
U.S. Army Garrison
Aberdeen Proving Ground, Maryland

Prepared by

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GP-R-711E00060

TEMPLATE = SECY-027

SECY-02

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ACRONYMS AND ABBREVIATIONS

ALI	Annual Limit on Intake
ANL	Argonne National Laboratory
APG	Aberdeen Proving Ground
ATC	Aberdeen Test Center
CFR	Code of Federal Regulations
DAAMS	Depot Area Air Monitoring System
DAC	Derived Air Concentration
DDT	Dichlorodiphenyltrichloroethane
DU	Depleted Uranium
ECBC	Edgewood Chemical Biological Center
EPA	U.S. Environmental Protection Agency
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/FID	Gas Chromatography/Flame Ionization Detector
GC/FPD	Gas Chromatography/Flame Photometric Detector
GC/MS	Gas Chromatograph/Mass Spectrometer
HPLC	High Performance Liquid Chromatography
HQ	Hazard Quotient
ICP	Inductively Coupled Plasma
IRP	Installation Restoration Program
K-40	Potassium-40
MDE	Maryland Department of the Environment
µg	microgram
$\mu g/m^3$	microgram per cubic meter
m^3/min	cubic meters per minute
mph	miles per hour
OSHA	Occupational Safety and Health Administration
Pb-212	Lead-212
PCB	Polychlorinated Biphenyl
PCi	pico-Curies
pCi/m^3	pico-Curies per cubic meter
PEL	Permissible Exposure Limit
ppb	parts per billion
PUF	Polyurethane Foam
Ra-223	Radium-223
Ra-224	Radium-224
RBC	Risk-Based Concentration
RfD	Reference Dose
RF-RBC	Range Fire Risk-Based Concentration
TAP	Toxic Air Pollutant
TCE	Trichloroethene
TIC	Tentatively Identified Compound
TLV	Threshold Limit Value
VOC	Volatile Organic Compound
U-235	Uranium-235
UXO	Unexploded Ordnance

1.0 INTRODUCTION

The Aberdeen Proving Ground (APG) Installation Restoration Program (IRP) identified the need to conduct a limited number of controlled burns at test ranges in the Aberdeen and Edgewood Areas of APG to support sampling of air emissions produced by range fires. The purpose of the study was to generate, to the extent possible, quantifiable emissions representative of fires occurring at APG test ranges to allow a screening assessment of potential human health impacts. This Technical Report documents the controlled burn air emissions sampling conducted during three events, and provides human health risk screening of the analytical data obtained.

APG lies on the northwestern shore of the Chesapeake Bay in southern Harford County and southeastern Baltimore County, Maryland (Figure 1). Major geographical areas bordering APG include the Chesapeake Bay and its tributaries; Gunpowder Falls State Park; the Crane Power Plant; and the towns of Bel Air, Edgewood, Joppatowne/Magnolia, Aberdeen, and various smaller residential areas. APG occupies 72,500 acres of land and water, of which approximately 75 percent are range areas. The Bush River divides the Installation into two noncontiguous areas commonly referred to as the Aberdeen Area and the Edgewood Area.

Since 1917, the Edgewood Area has been the center for the research, development, testing and manufacturing of military-related chemicals and agents. Activities at the Edgewood Area have included laboratory research and development, field testing, and pilot- and production-scale manufacture of chemical warfare agents. Chemical warfare materiel, hazardous wastes, and low-level radiological wastes have been stored at the Edgewood Area. The Aberdeen Area was established as the Ordnance Proving Ground in 1917, and has been the site of intense research and development, large-scale testing of munitions, weapons, and materiel, and a training school for ordnance officers and enlisted specialists.

2.0 BACKGROUND

Ordnance firing, other test activities, residual white phosphorus in subsurface soils, and lightning strikes occasionally cause accidental fires in the test range areas of APG. These accidental fires may occur under unfavorable weather conditions (e.g., meteorological conditions may create wind directions that transport range fire smoke plumes toward residential communities), and the amount of vegetative fuel and acreage burned cannot always be controlled during these unplanned burns.

APG's long history of weapons testing and past disposal practices caused members of the public to express concerns that contaminants accumulated in surface soils and vegetation could be transported in smoke plumes produced by such fires. The potential transport and deposition of contaminants via the smoke plume and the associated health risks were of greatest concern to the public. Sources of contamination could include residues in and on vegetative matter and surface soils from previous weapons testing and disposal of hazardous substances; chemicals released from burning of uncontaminated vegetation; and detonation or rupture of unexploded ordnance (UXO).

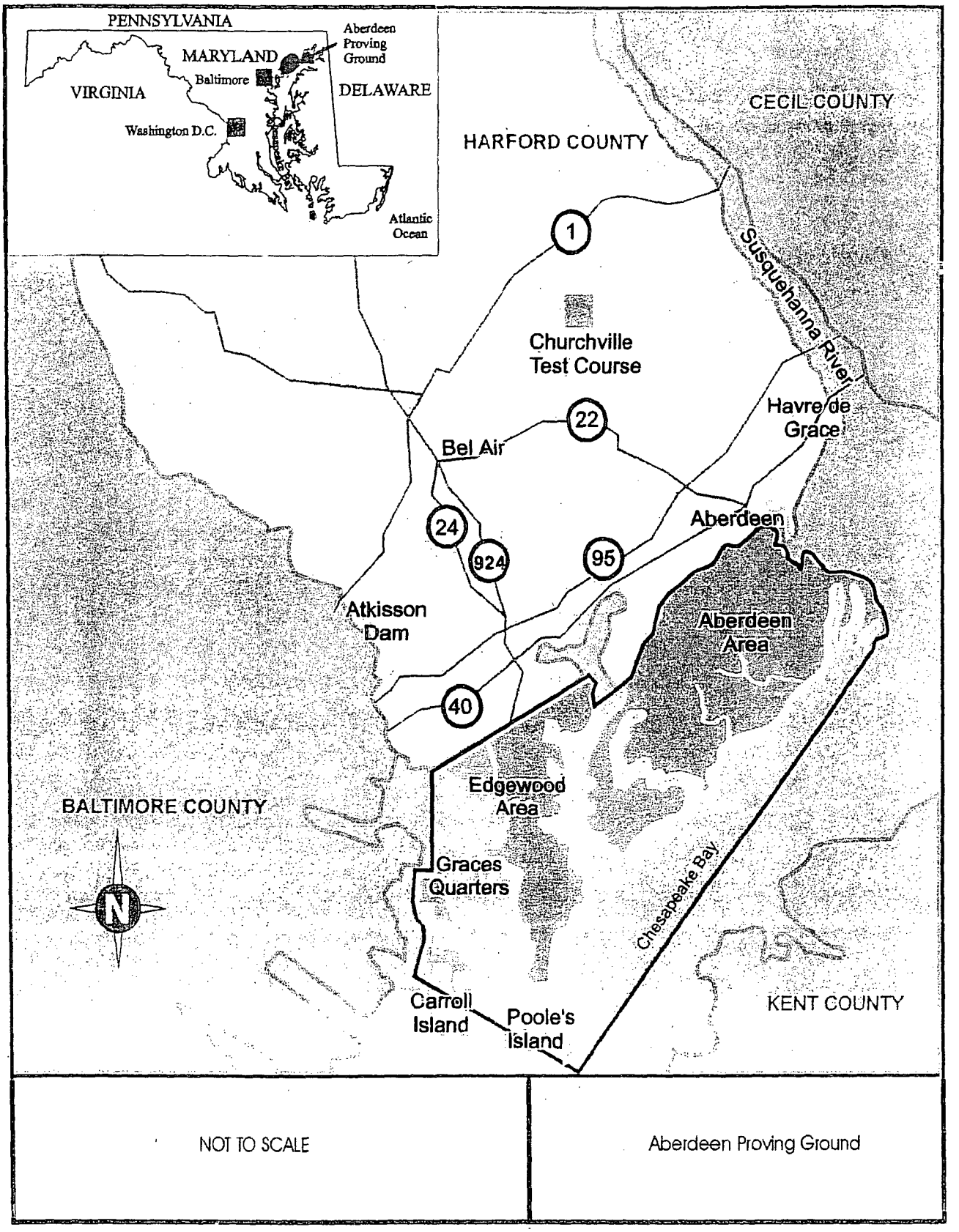


Figure 1. Location of Aberdeen Proving Ground

3.0 OTHER STUDIES

3.1 Argonne National Laboratory 1998 Report

The Environmental Assessment Division of Argonne National Laboratory (ANL) completed a study in 1998 in response to the public concerns. The study, entitled "Potential Human Health Impacts from Range Fires at Aberdeen Proving Ground, Maryland," used atmospheric dispersion models to evaluate potential human health impacts resulting from exposure to contaminants resulting from range fires. The screening study focused specifically on five contaminants considered most likely to be present in surface soils and vegetation as a result of past activities at APG, two chemical agents, and two naturally-occurring compounds released during burning of uncontaminated vegetation. The contaminants, selected with input from APG personnel and a citizens advisory committee, were lead, arsenic, depleted uranium (DU), trichloroethene (TCE), dichlorodiphenyltrichloroethane (DDT), vinyl acetate, 2-furaldehyde, and mustard and phosgene in UXO. The modeling results were compared to U.S. Environmental Protection Agency (EPA) action levels.

The study concluded that range fires at APG do not pose a significant health risk to APG workers or the surrounding populations. Use of conservative assumptions in the study provided an upper bound estimate of potential risk. The study recommended future efforts be directed at fire management and control to reduce the occurrence and duration of range fires. The IRP elected to conduct a series of controlled burns for data collection purposes in response to on-going public concerns relating to range fires and potential risk to human health.

3.2 Argonne National Laboratory 2000 Report

The original report prepared by ANL in 1998 was modified in October 2000 to include actual air emissions data collected during the J-Field controlled burn conducted in April 2000. The updated report incorporated measured contaminant levels in vegetation samples taken from the Toxic Burn Pit area of J-Field. The data was used in the FIREPLUME computer model to calculate estimated ground-level contaminant concentrations during a range fire. The study then estimated exposure levels using conservative assumptions to evaluate impacts to human health. The model-predicted concentrations were one to two orders of magnitude greater than the field measured concentrations due to the use of conservative assumptions. The study concluded that the risk of adverse health effects from mobilization of contaminants as a result of range fires is extremely small. The study again recommended that future efforts be directed at range management to reduce the number of unplanned fires. The range management efforts could effectively include controlled burns.

3.3 Environmental Protection Agency Data Collection

Lockheed Martin, under contract to the EPA through the Response, Engineering, and Analytical Contract, collected air samples for analysis during two O-Field burn attempts and the J-Field controlled burn. Samples were collected for analysis of dioxins, metals, polynuclear hydrocarbons, inorganic acids, volatile organic compounds (VOCs), and chemical agents. Particulate monitoring was also conducted using an MIE DataRAM. The three trip reports for these sampling events are included in Appendix A for reference. The data was not incorporated into the evaluation performed as part of this report.

4.0 CONTROLLED BURN STUDY PARAMETERS

The controlled burn study parameters were developed in close coordination with the U.S. Army Aberdeen Test Center (ATC), the agency responsible for range management and control at APG. Meteorological and range control personnel supported the development of the study parameters. In addition, close coordination with the APG Fire Department and Safety personnel provided guidance for developing sampling protocols and selecting range sites for the controlled burns. Input from the citizens advisory committee was solicited regarding potential controlled burn locations.

4.1 Meteorological Conditions

The controlled burns for air emissions sampling were conducted under specific meteorological conditions to minimize potential impacts to civilian communities and to facilitate data collection. Wind directions were selected to minimize travel of the plumes toward populated areas. In general, the controlled burns were initiated with north-northeast or west-southwest wind directions. Controlled burns were initiated only with wind speeds of 15 miles per hour (mph) or less. Greater wind speeds would have resulted in difficulty in controlling and extinguishing the fires, as well as a reduction in the sampling period. Atmospheric stability Class D or Class C conditions were selected as burn parameters to obtain the most rapid return of range fire smoke to ground level and limited atmospheric dispersion. The site-specific burn plans developed for each controlled burn location provide specific details and procedures.

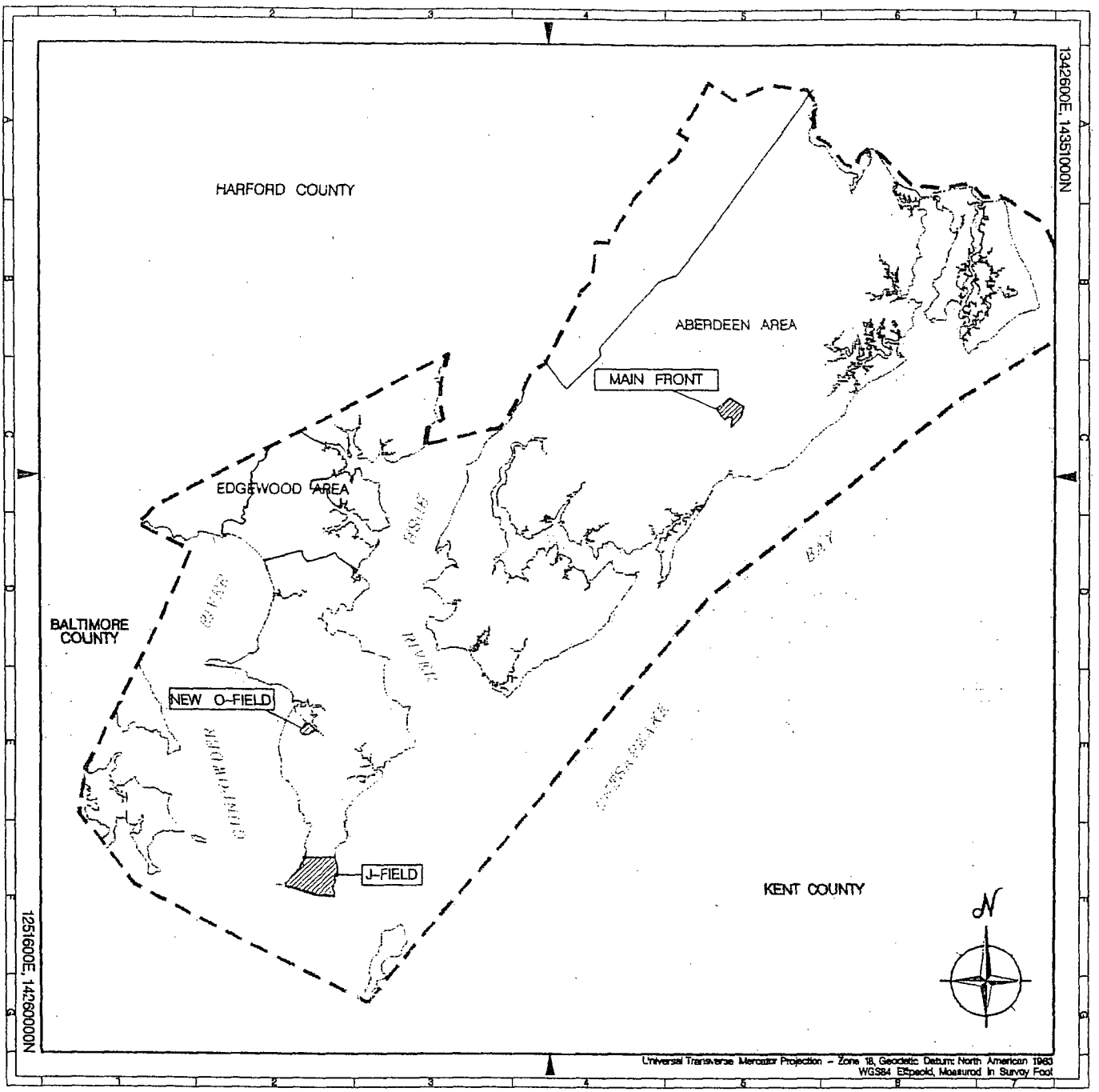
4.2 Test Range Selection

Selection of range areas with the most potential surface soil contamination provided a "worst case" scenario for the controlled burn sampling events. With input from IRP, ATC, Fire Department, and Safety personnel, and the citizens advisory committee, three range areas (Figure 2) were selected for controlled burns and air emissions sampling:

- Main Front range in APG Aberdeen Area — selected as representative of test ranges with the highest potential DU contamination and other toxic compounds
- J-Field in APG Edgewood Area — selected as representative of worst-case air emissions due to historical testing and disposal activities, and based on soil contamination data collected as part of the IRP
- New O-Field in APG Edgewood Area — selected as representative of worst-case air emissions due to historical testing and disposal activities, and based on contamination data collected as part of the IRP

4.3 Sampling Locations and Analytes

For each controlled burn, monitoring involved the collection of both upwind and downwind air samples. Upwind samples were collected during each burn to measure the level of potential contaminants in ambient air. Downwind sample locations were placed at specified distances from the fire ignition point to capture air samples within the smoke plumes upon return to ground level.



14000 10500 7000 3500 0 7000 14000 28000

GRAPHICAL SCALE

IN FEET (1" = 14000') 1:168000

L E G E N D

- Aberdeen Proving Ground
- Water
- Study Area Boundary
- Installation Boundary
- Range Area Selected For Controlled Burn

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TITLE:

RANGE AREAS SELECTED FOR CONTROLLED BURNS

CARTOGRAPHER:	APPROVED BY:	DATE:	FIGURE:
M. BROOKS	K. THORPE	11-07-00	2

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Sampling collection and analysis methods are listed in Table 1. Equipment setup is illustrated in photographs provided in Appendix B.

Table 1. APG Controlled Burn Sample Collection and Analysis Methods

Analyte	Sampling Method	Equipment	Analytical Method
Volatile Organic Compounds	USEPA TO-14	Summa Canister – 3-hour sampling valve	GC/MS GC/FID
Explosives	TO-4 Modified	High-Volume Sampler Glass Fiber Filter and PUF	HPLC
Pesticides/PCBs	TO-4	High-Volume Sampler Glass Fiber Filter and PUF	GC/ECD
Inorganics	6010 Modified	High-Volume Samplers (2) Quartz Filter	ICP
Chemical Agents	DAAMS	Calibrated Pump and DAAMS Tubes	ECBC Analytical Method
Gross Alpha/Beta and Gamma Spectra	Quartz Filter	High-Volume Sampler Quartz Filter	EPA 900.0 (Modified) EPA 901.1 (Modified)

DAAMS – Depot Area Air Monitoring System
ECBC – Edgewood Chemical Biological Center
GC/ECD – Gas Chromatograph/Electron Capture Detector
GC/FID – Gas Chromatograph/Flame Ionization Detector
PCB – Polychlorinated Biphenyl
PUF – Polyurethane Foam
GC/MS – Gas Chromatograph/Mass Spectrometer
HPLC – High Performance Liquid Chromatography
ICP – Inductively Coupled Plasma
EPA –Environmental Protection Agency

The EPA Method TO-14 is designed for sampling and analysis of volatile organic compounds (VOCs) in ambient air as collected in summa canisters or other specially prepared canisters. A sample of ambient air is drawn through a sampling train, comprised of components that regulate the rate and duration of sampling, into a pre-evacuated, passivated canister. The VOCs are separated by gas chromatography and measured by a mass spectrometer or by multi-detector techniques. Analysis of VOCs included reporting of up to 10 tentatively identified compounds (TICs).

Method TO-4 is a procedure for detemination of a variety of organochlorine pesticides and polychlorinated biphenyls (PCBs) in ambient air. Method TO-4 utilizes a modified high volume sampler consisting of a glass fiber filter with a polyurethane foam (PUF) backup adsorbent cartridge used to sample ambient air at a rate of approximately 200 – 280 liters per minute. Flow rates for the high volume samplers are calculated during the calibration process prior to each sampling event. The high volume particulate sampler operates at an average flow rate of approximately 1.2 cubic meters per minute (m^3/min); the average flow rate for the high volume PUF sampler is approximately 0.2 m^3/min. The PCBs and pesticides are recovered by Soxhlet extraction and analyzed using gas chromatography with electron capture detection (GC/ECD). Samples collected using TO-4 (modified) are analyzed for explosives using high performance liquid chromatography (HPLC).

The EPA method 6010 utilizes Inductively Coupled Plasma (ICP) instrumentation with a high-temperature source for metals analysis. The samples are collected using a high-volume sampler and quartz filter media. The sample is prepared for ICP analysis by digesting the quartz filter in nitric acid.

The Depot Area Air Monitoring System (DAAMS) sampling method for chemical agents requires air flow through a solid sorbent tube at a controlled flow rate and a measured time period. The sampler flow rate is calibrated prior to the sampling event. The DAAMS tubes are analyzed by the

U.S. Army Edgewood Chemical Biological Center (ECBC) laboratory using thermal desorption techniques to strip the analytes into a gas chromatography/flame photometric detector (GC/FPD) analytical system.

For radioactivity, the analysis included gross alpha analysis for radionuclides that emit alpha particles, gross beta analysis for radionuclides that emit beta particles, and gamma ray spectroscopy for radionuclides that emit gamma rays. Of the methods employed, ony gamma spectroscopy is capable of identifying the specific radionuclides and the amount of radioactive material present (in pico-Curies (pCi)) from that radionuclide. Gross alpha and gross beta analyses provide only the amount of radioactivity (pCi).

The specific analytes included in each sampling and analysis method are provided for reference in Appendix C.

4.4 Quality Assurance

The ambient air sampling of these short-term events (the controlled burns conducted at APG) is considered representative of fires in fields where these burns occurred. These events may not be representative of all fires, but can be considered "worst case" for evaluation of release of potential contaminants in vegetation at sites with soil contamination. The sampling efforts incorporated numerous quality assurance methods to provide the best possible results.

- Equipment calibration was performed prior to each sampling event to provide accuracy in field measurements. Field instruments were calibrated according to manufacturers' specifications, and the calibration results were recorded.

- Use of high-volume sampling equipment, as appropriate, reduced errors potentially associated with low sample volumes, and achieved lower detection limits.

- Filter or media blanks for each sampling method (except the summa canister) were sent to the laboratory for analysis to detect filter or media contamination unrelated to the range fire sampling. The summa canisters were cleaned and evacuated by the analytical laboratory.

- Generators providing power supply for the sampling equipment were placed downwind or cross-wind from the sampling points to prevent interferences.

- Vehicles used to transport personnel and sampling equipment were parked downwind of the sampling equipment or removed from the sampling location.

- Samples were collected at an upwind location during each range fire sampling event to allow evaluation of ambient concentrations of detected analytes.

Sampling locations were dictated by the availability of established roads and by explosive fragment hazard distances. No sampling points were selected in off-road locations due to UXO safety considerations.

5.0 CONTROLLED BURN EVENTS AND RESULTS

Three controlled burn events were conducted from April 1999 through April 2000. Burn events were conducted in the J-Field and New O-Field ranges of the Edgewood Area, and in the Main

Front range of the Aberdeen Area of APG. A second burn event in the Main Front area was attempted in April 2001.

5.1 Main Front Range Controlled Burn – April 1999

A controlled burn was conducted on 28 April 1999, at the Main Front range in the Aberdeen Area of APG (Figure 3). Samples were collected at three sites downwind of the fire, and at one upwind site to serve as a background location. Downwind sampling sites SP1, SP2, and SP3 were located southwest of the burn site at distances of approximately 1000, 2000, and 3000 meters, respectively.

With favorable meteorological conditions forecasted by the ATC Meteorological Office, the fire ignition by the APG Fire Department occurred at approximately 1500 hours. The sampling duration was approximately four hours.

Meteorological data collected during the controlled burn show that the wind direction shifted widely during the course of the burn. The forecasted wind direction was from the northeast (i.e., blowing toward the Edgewood Area and down the Chesapeake Bay); the average winds during the sampling event were from the southeast. The shifting wind direction resulted in a reduction of the burn area and intensity of the fire, causing less smoke to be produced. The variable wind direction resulted in exposure of the upwind sampling point (SP4) to smoke during a portion of the sampling period. Photographs taken during the Main Front burn event are presented in Appendix D-1.

Detections of several analytes were reported for the 1999 Main Front controlled burn event:

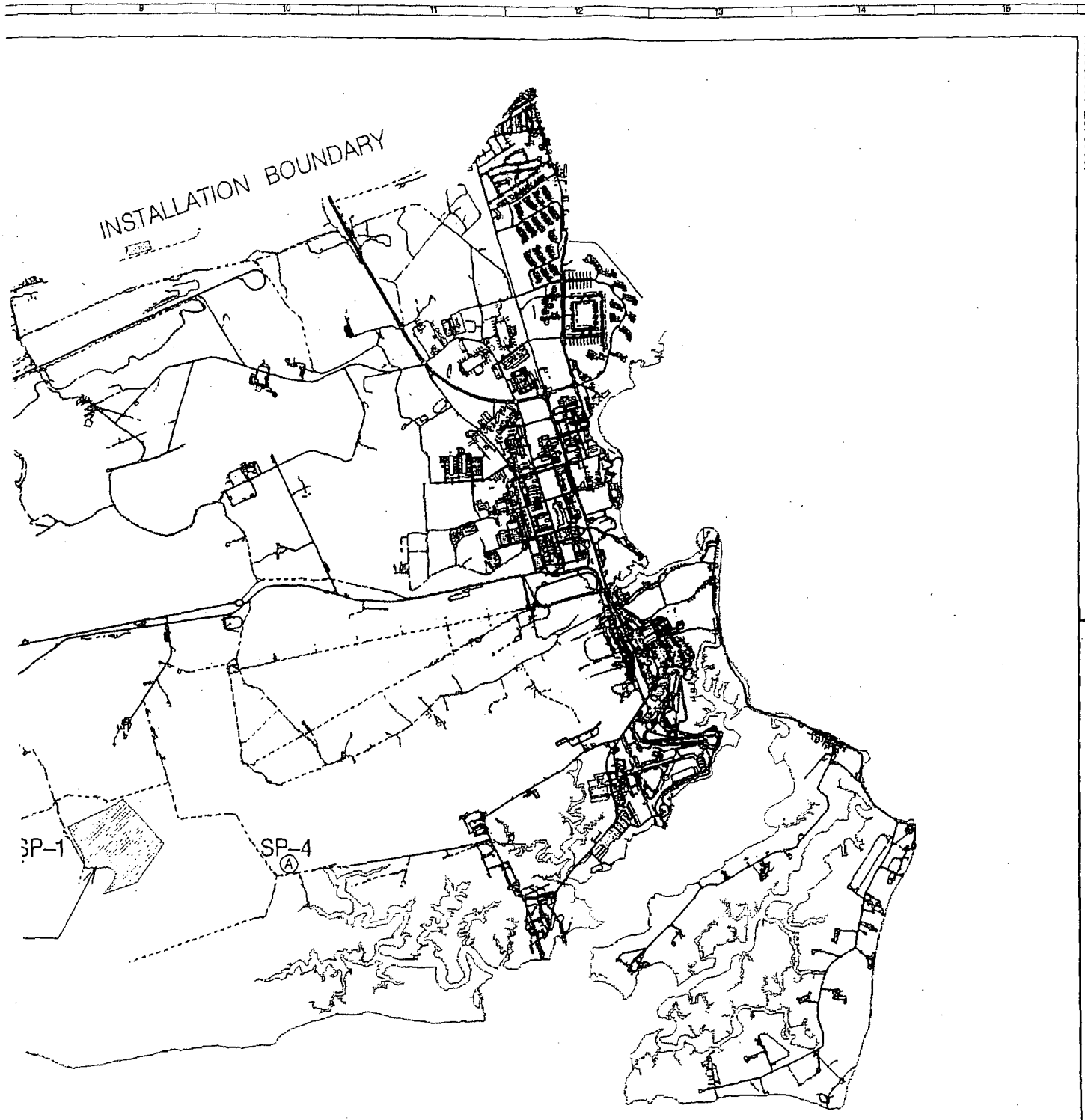
- Several VOCs were detected, including:
  - acetone
  - nonane
  - toluene
  - decane
  - methylene chloride
  - xylene.

- Analysis of the PUF media yielded detection of 2,2'3,4,5'-pentachlorobiphenyl and 2,4',5-trichlorobiphenyl in the SP3 sample, and 2,4',5-trichlorobiphenyl in the SP4 sample. These PCBs were detected at a concentration of approximately 1 ppb.

- One pesticide (dieldrin) was detected by the PUF samplers at all downwind sampling locations (SP-1, -2, and -3) in the parts per trillion range.

- Numerous metals were detected, but not at levels exceeding blank concentrations.

Chemical agents and explosives were not detected at the downwind or upwind sampling locations during the Main Front controlled burn. Additionally, no specific radionuclides were detected above the minimum detection activity, the analytical error, or the blank radionuclide activity level. Appendix E-1: Tables E-1 through E-10 contain the results from the analysis of the air samples collected during the Main Front controlled burn.



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Universal Transverse Mercator Projection - Zone 18, Geodetic Datum: North American 1983, WGS84 Ellipsoid, Measured in Survey Feet

5000 10000

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1:60000

TITLE:

MAIN FRONT CONTROLLED BURN AREA AND SAMPLING LOCATIONS APRIL 1999

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M. BROOKS	K. THORPE
DATE: 11-07-00	FIGURE: 3

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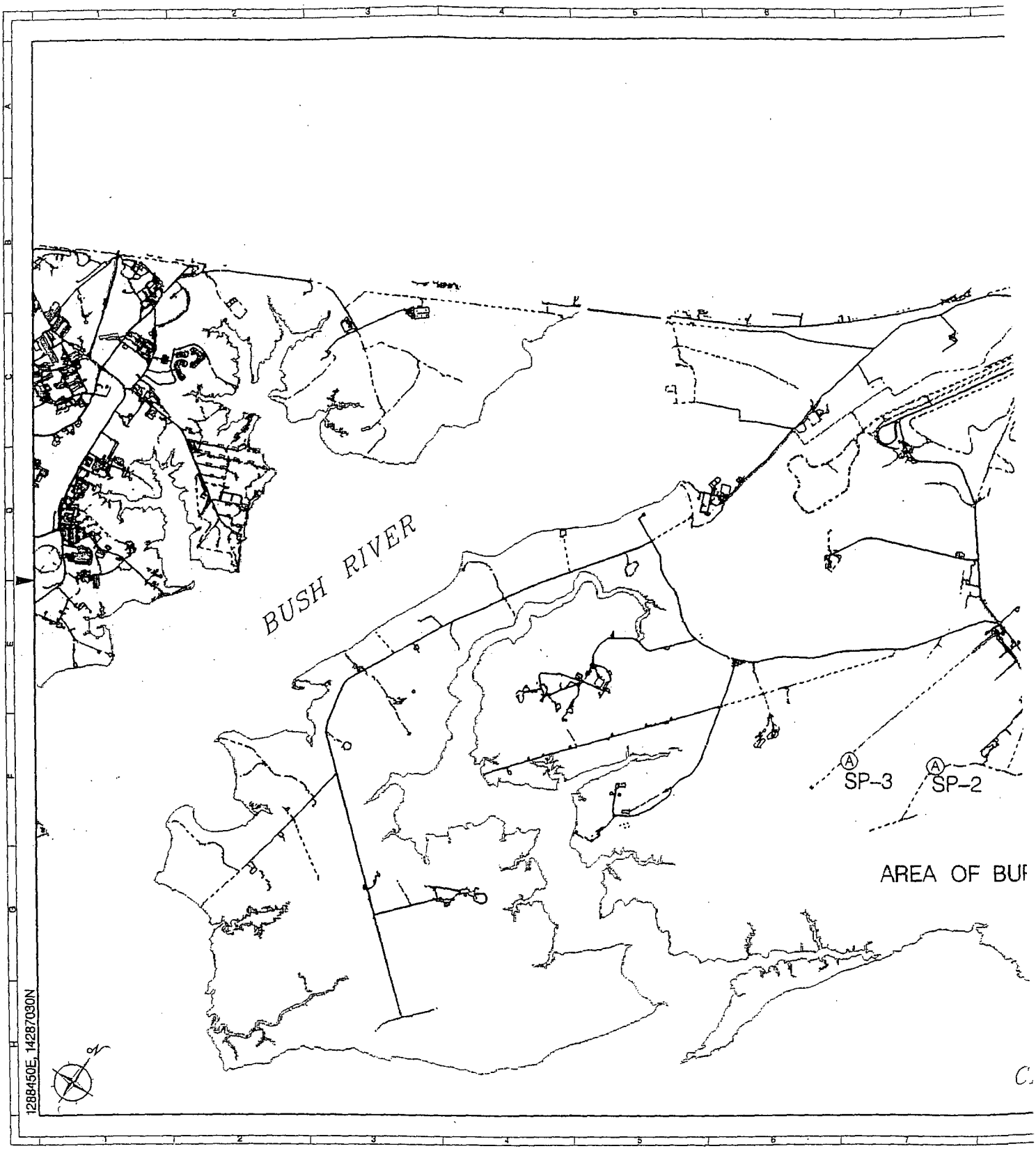


L E G E N D

Paved Roads
Unpaved Roads
Structures
Coastline
Controlled Burn Area
Sampling Location

5000 1000 0

5.2 New O-Field Controlled Burn – December 1999

The New O-Field controlled burn occurred on 3 December 1999 in the Edgewood Area of APG (Figures 4 and 5). Downwind sampling locations SP1, SP2, and SP3 were located 335, 1200, and 2300 meters, respectively, from the burn area. Sampling point SP1 was located at Watson Creek, SP2 at Ricketts Point Road, and SP3 at Briery Point on the Bush River shoreline. Due to a slight variation in wind direction during the burn (238° ± 20°), the SP2 sampling location was re-positioned within the smoke plume. The upwind sampling point SP4 was located on the Gunpowder River shoreline, approximately 500 meters from the burn location.

The meteorological forecast provided by the ATC Meteorological Office indicated winds speeds of less than 15 mph, a southwest wind direction, and Class D stability. Given the favorable forecast, the fire was ignited by the APG Fire Department at approximately 1530 hours. The sampling duration was approximately four hours.

The meteorological data collected during the controlled burn show that the wind direction generally remained from the southwest, with only slight variation during the course of the burn. However, reduced wind speeds, coupled with wet conditions in New O-Field, limited the size of the burn area during this event. Given that the area and the intensity of the burn were much less than anticipated, a reduced amount of smoke was produced from the fire for the air sampling event. Photographs of the area following the controlled burn are included in Appendix C-2.

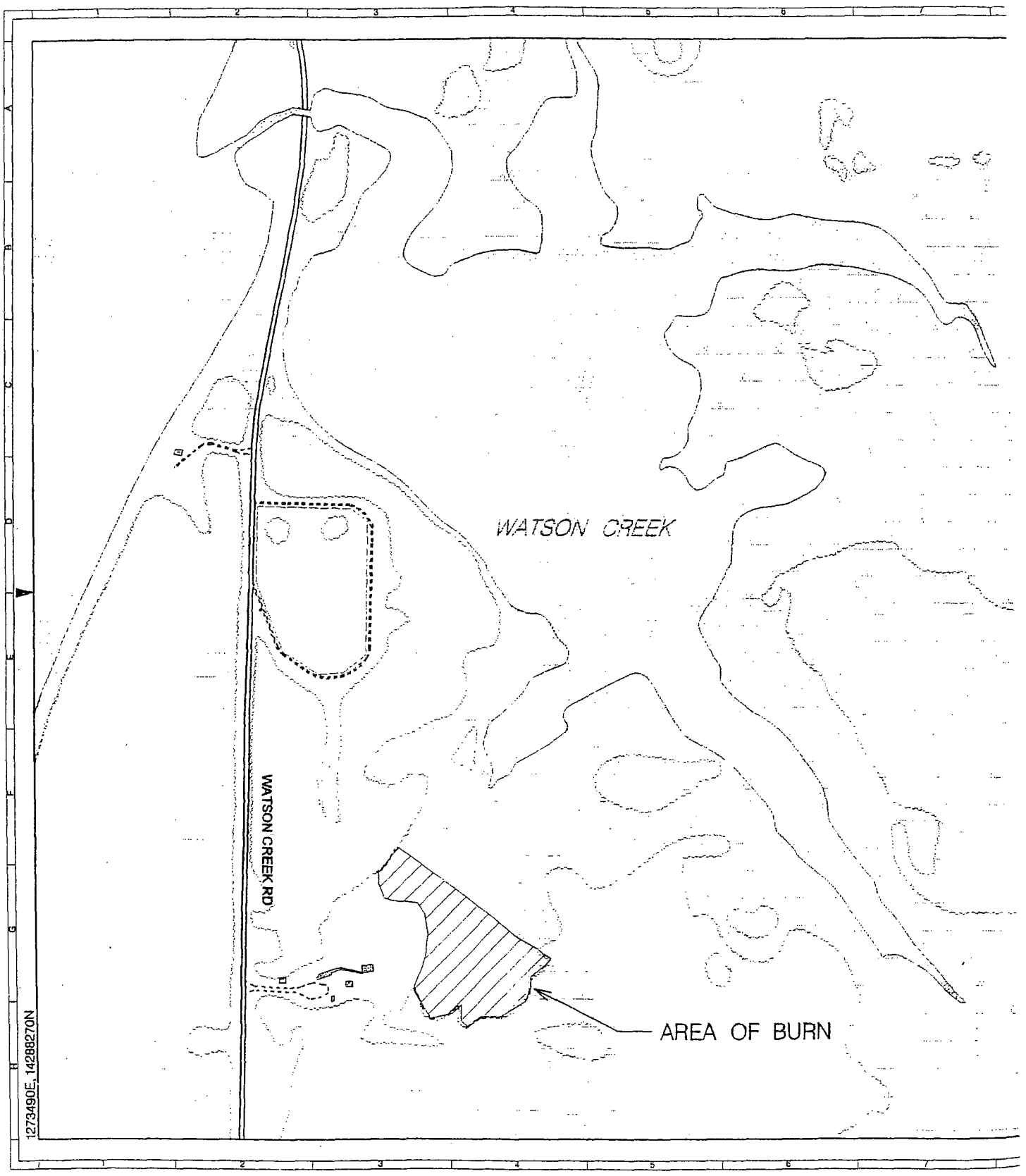
Samples collected were analyzed for chemical agents, explosives, VOCs, PCBs, pesticides, inorganics, and radionuclides; detections of several analytes were reported:

- Several VOCs were detected in the ppb range, including:
  - acetone
  - benzene
  - benzonitrile
  - carbon disulfide
  - dedecene
  - hexane
  - methylene chloride
  - toluene
  - xylene

- 2,2',3,4,5-pentachlorobiphenyl was detected at sampling locations SP1, SP2, and SP3 in concentrations ranging from 0.0004 to 0.0011 micrograms per cubic meter ($\mu g/m^3$). 2,2',3,4,4'-tetrachlorobiphenyl was detected in the SP4 (upwind) sampling location at a concentration of 0.0020 $\mu g/m^3$.

- Numerous metals were detected in the ppb range in samples collected both upwind and downwind of the burn area.

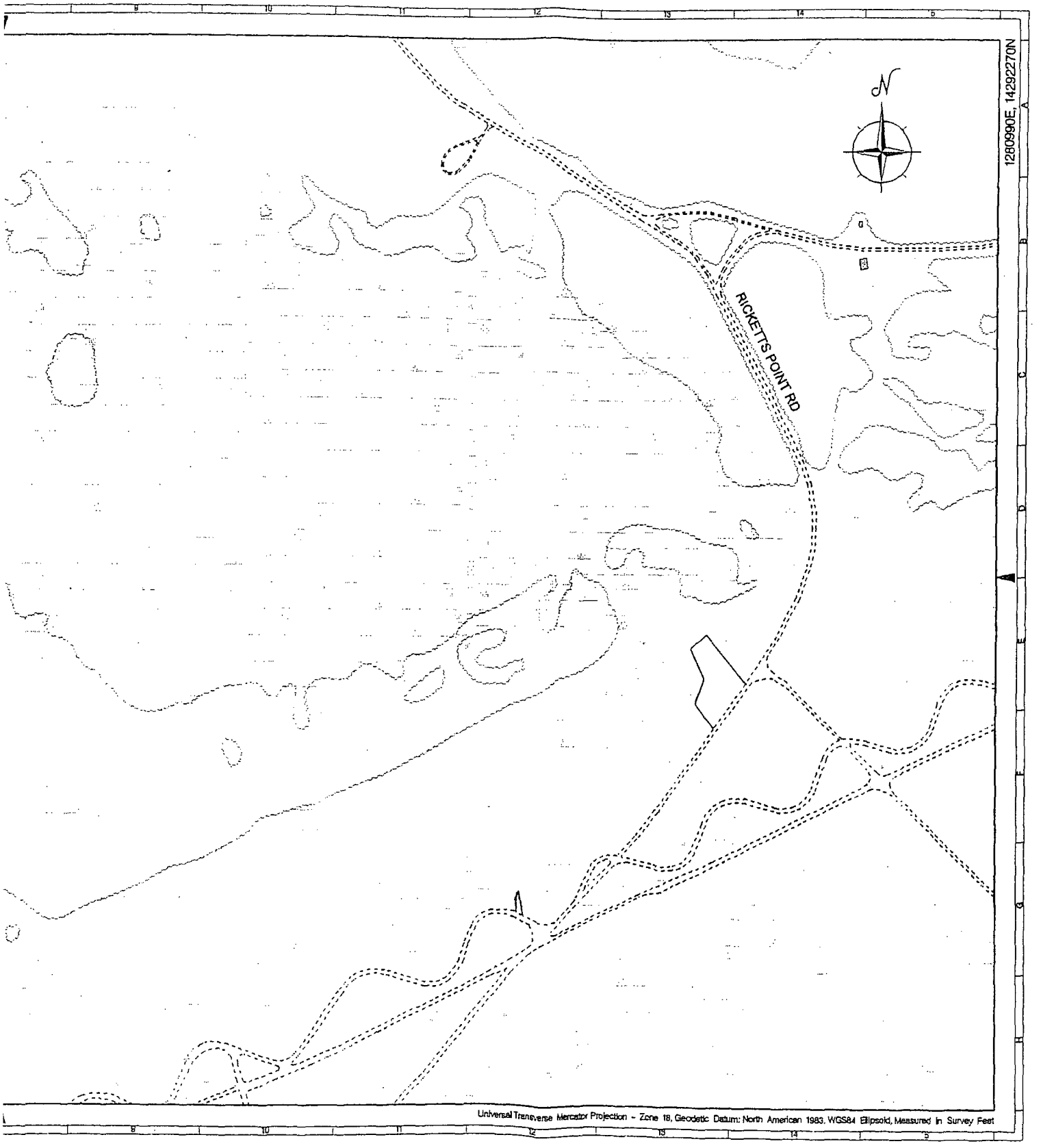
Chemical agents, explosive compounds, and pesticides were not detected at the downwind or upwind sampling locations during the New O-Field burn. Appendix E-2: Tables E-11 through E-17 contain the results from the analysis of the air samples collected during the controlled burn at New O-Field.



L E G E N D

Structure
Paved Road
Unpaved Road
Treeline
Wetland
Water
Fence
Controlled Burn Area

500 400 300 200 100



250 500 1000

HICAL SCALE
EET (1" = 500') 1:6000

TITLE:

NEW O-FIELD CONTROLLED BURN AREA
DECEMBER 1999

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CARTOGRAPHER:	APPROVED BY:
M. BROOKS	K. THORPE
DATE:	FIGURE:
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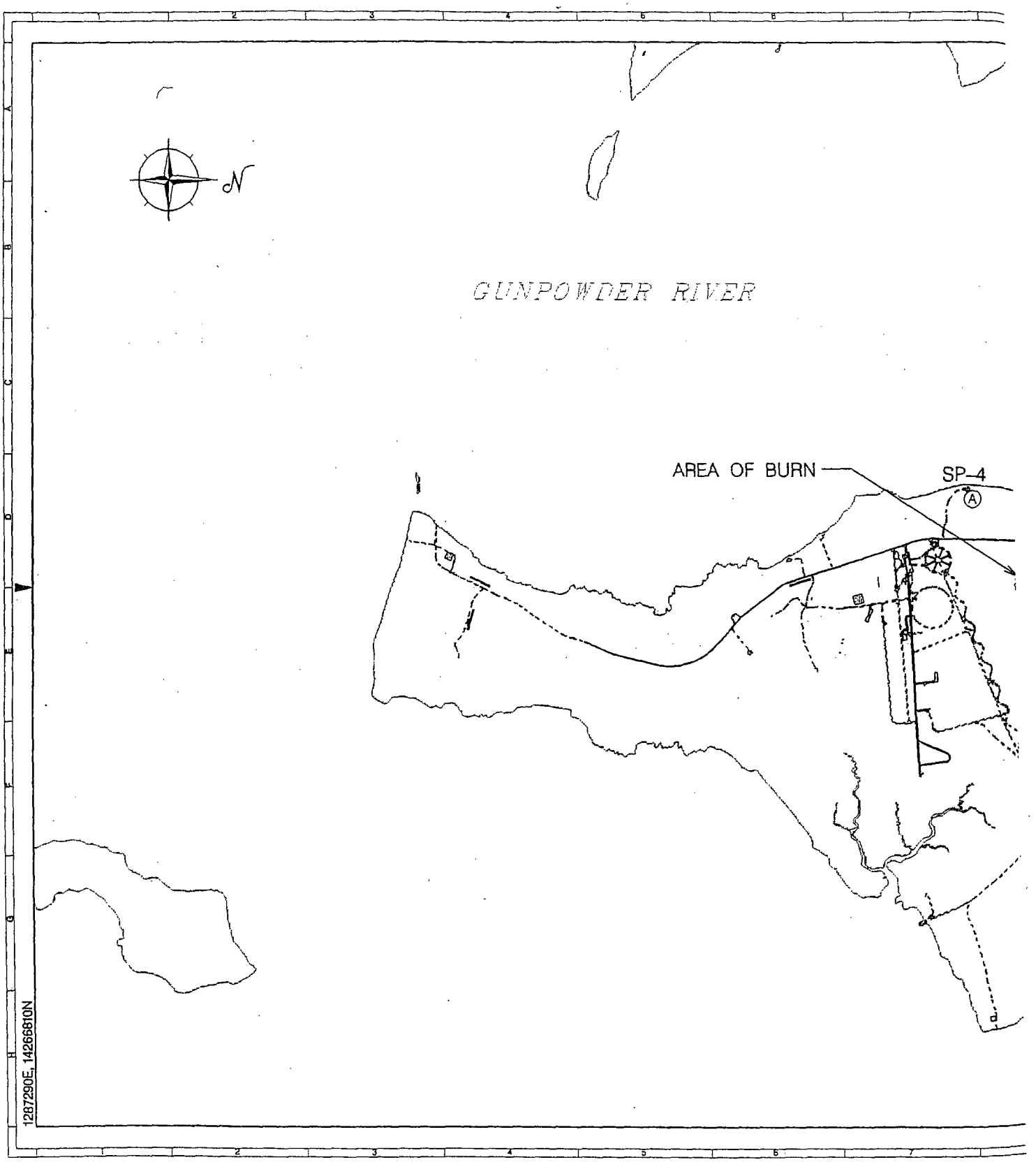
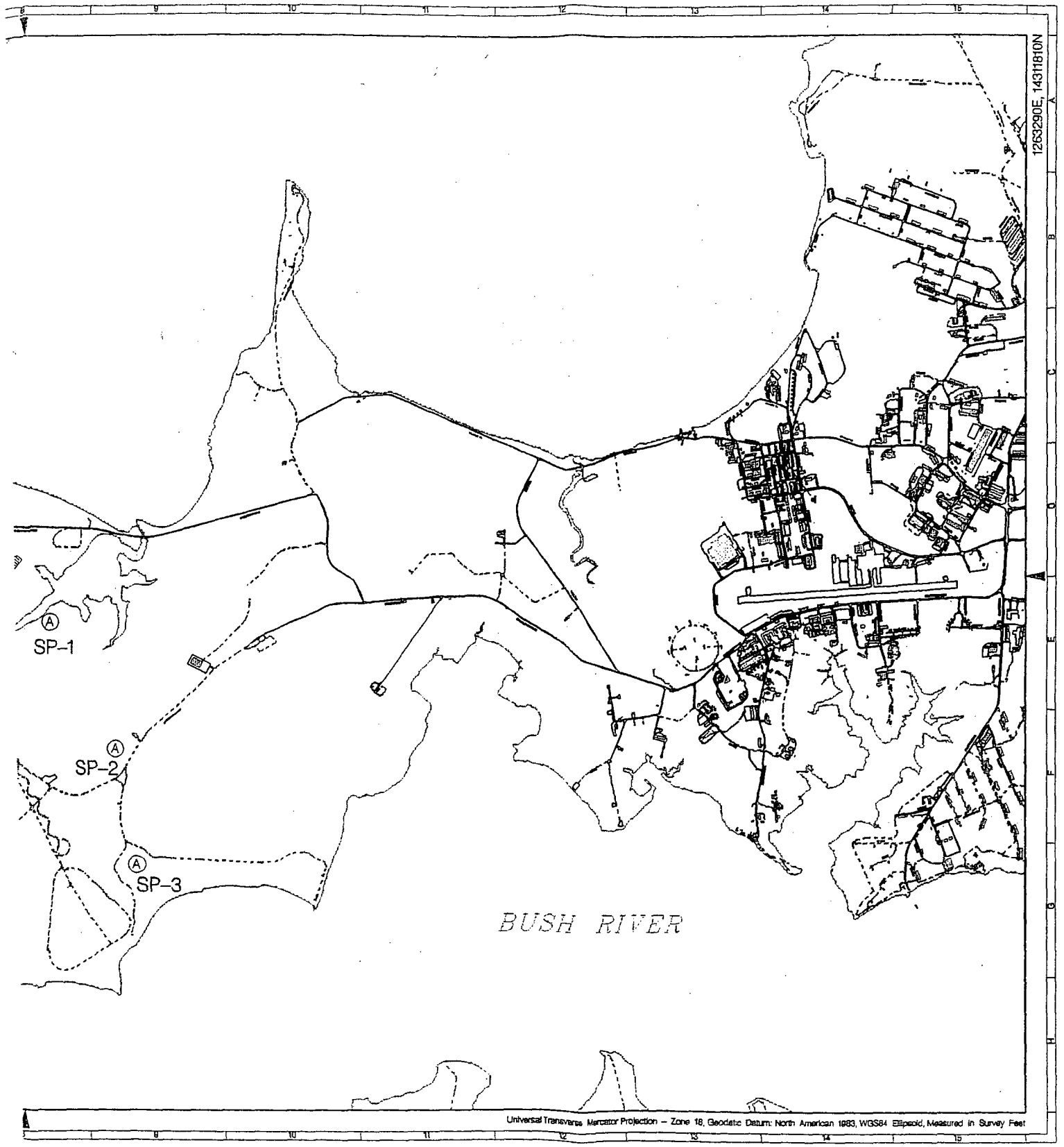


L E G E N D

Paved Road ------ Unpaved Road Structure —— Coastline (A) Sampling Location

Controlled Burn Area

3000 2000 1000 0



1500 3000 6000

HICAL SCALE
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TITLE:

NEW O-FIELD CONTROLLED BURN SAMPLING LOCATIONS DECEMBER 1999

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DATE: 11-07-00	FIGURE: 5

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5.3 J-Field Controlled Burn – April 2000

The J-Field controlled burn occurred on 6 April 2000 in the Edgewood Area of APG (Figure 6). The burn area extended over the southeast portion of J-Field, covering both marsh and forest environments. Robbins Point Road and the Bush River served respectively as the northern and eastern firebreaks.

Air samples were collected at two monitoring locations during the J-Field controlled burn: one located downwind of the fire to capture smoke constituents (SP1), and one located upwind of the fire (SP4). The downwind sampling location was northeast of the burn area, along the end of Robbins Point Road on the shore of the Bush River. The SP1 sampling location was approximately 10 meters from the northernmost edge of the burned area. The upwind sampling location (SP4) was located on the Gunpowder River shoreline at the end of Ricketts Point Road, approximately 500 meters from the fire location. Collection of additional downwind samples did not occur due to the logistics of staging samplers at offshore locations in the Bush River.

The ATC Meteorological Office provided a favorable forecast for wind speeds of less than 15 mph from the southwest, and atmospheric stability Class D conditions. The APG Fire Department

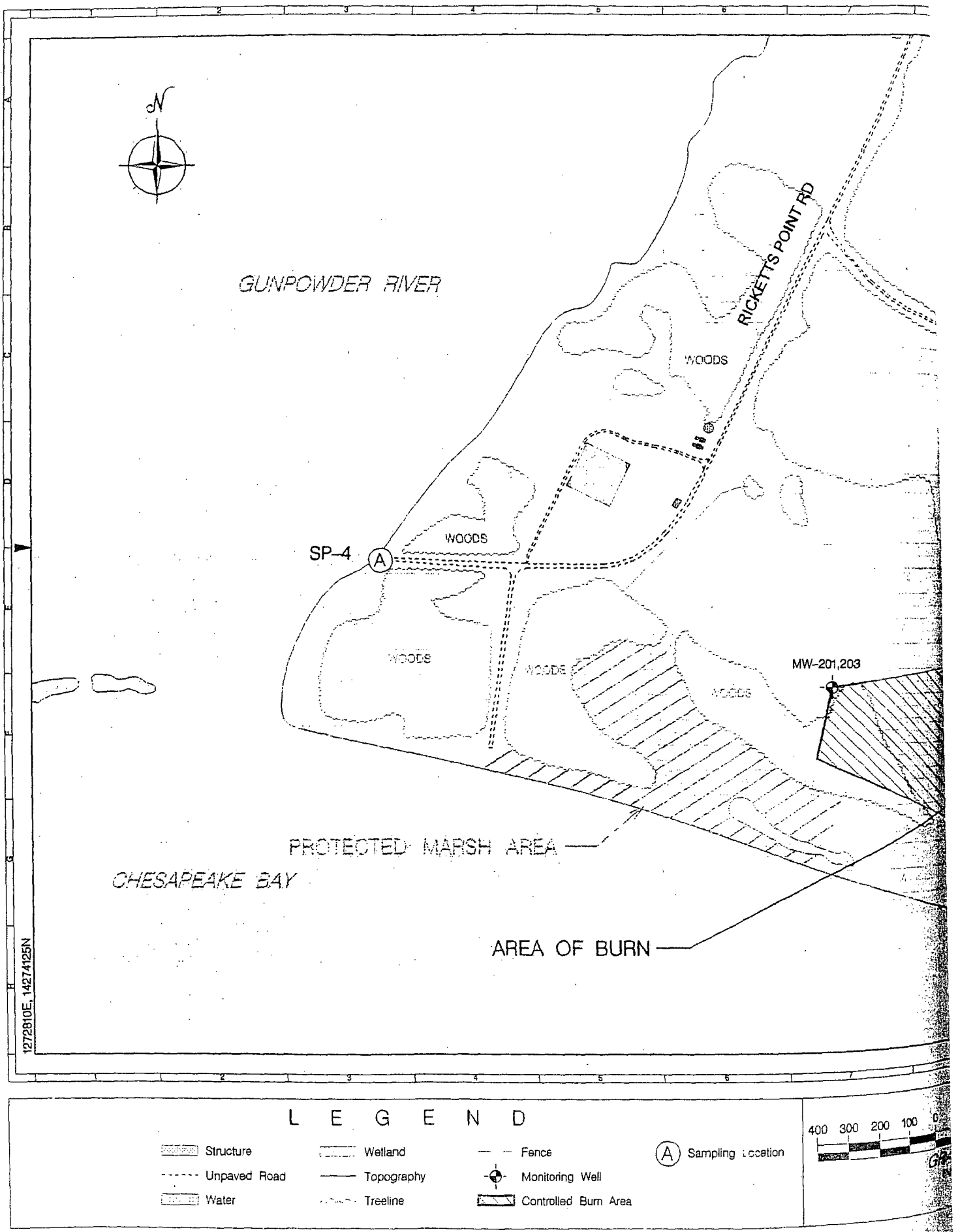
initiated the controlled burn at approximately 1725 hours. The sampling duration was approximately three hours.

Meteorological data collected during the controlled burn period indicated stable wind directions from the southwest, with only slight variations. Wind gusts of up to 15 mph were recorded by an on-site weather station. Wind speeds, coupled with dry conditions and adequate vegetative fuel, sustained the fire during the J-Field controlled burn. A visible smoke plume extended from the burn area in a northeasterly direction.

Photographs taken during and following the J-Field controlled burn are presented in Appendix D-3. The J-Field controlled burn revealed a significant amount of surface waste and debris throughout the burned area, indicating disposal had previously occurred in the area. A separate removal action was conducted in May 2000 to remove the surface debris, including ordnance-related items.

Sampling was performed for chemical agents, explosives, VOCs, PCBs, pesticides, inorganics, and radionuclides; detections of several analytes were reported:

- Several VOCs were detected in the ppb range at the upwind location (SP4):
  - acetic acid
  - acetone
  - hydrocarbon compound (no identification from the TIC library)


N
GUNPOWDER RIVER
RICKETTS POINT RD
WOODS
WOODS
SP-4
A
WOODS
WOODS
WOODS
MW-201,203
PROTECTED MARSH AREA
CHESAPEAKE BAY
AREA OF BURN
1272810E, 14274125N
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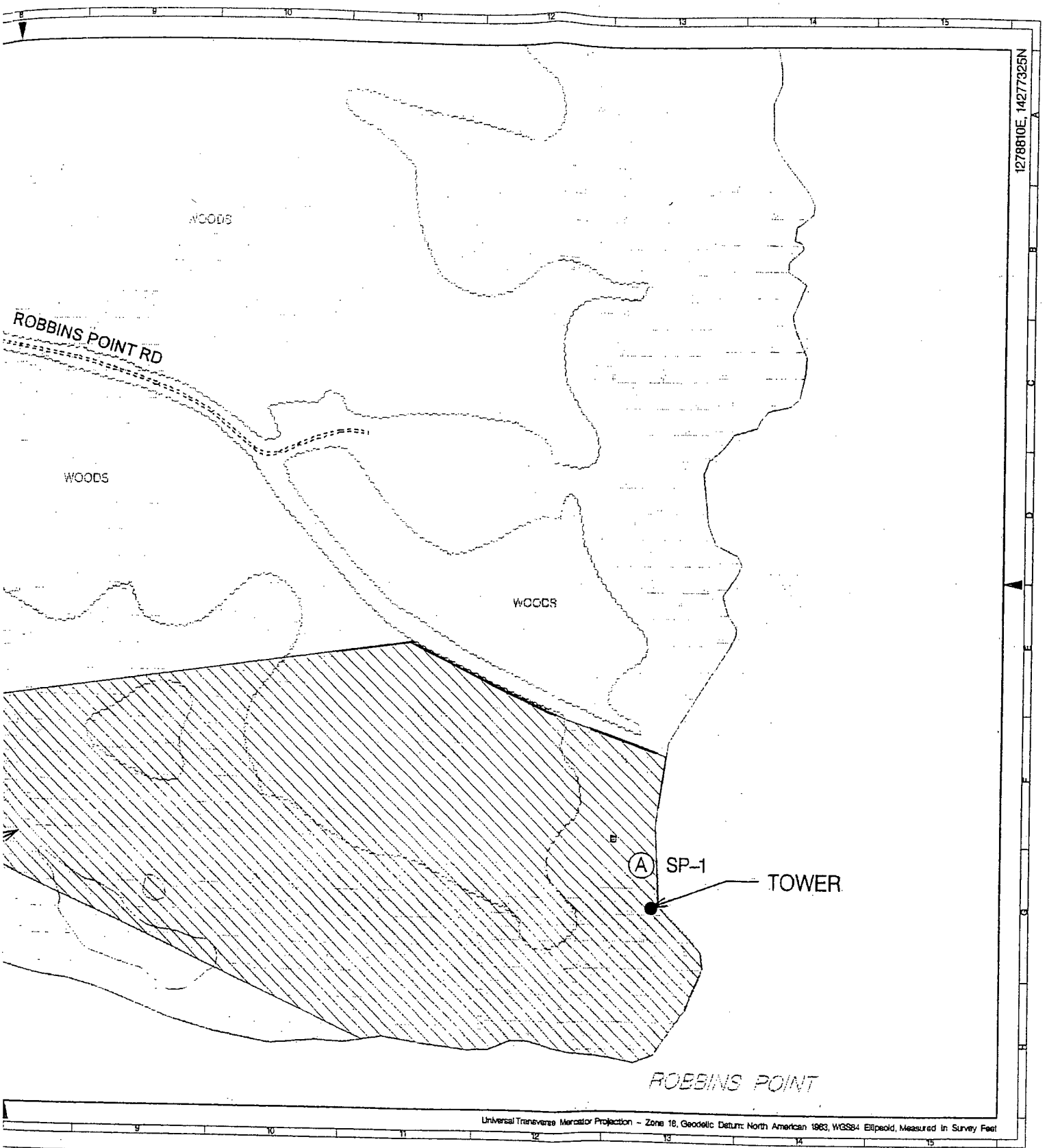
L E G E N D
Structure
Unpaved Road
Water
Wetland
Topography
Treeline
Fence
Monitoring Well
Controlled Burn Area
A Sampling Location
400 300 200 100



Universal Transverse Mercator Projection – Zone 18, Geodetic Datum: North American 1983, WGS84 Ellipsoid, Measured in Survey Feet

200 400 800

4ICAL SCALE
EET (1" = 400') 1:4800

TITLE:

J–FIELD CONTROLLED BURN AREA AND SAMPLING LOCATIONS APRIL 2000

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DATE: 11–07–00	FIGURE: 6

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- Several VOCs were also detected in the ppb range at the downwind sampling location (SP1):
  - acetaldehyde
  - acetone
  - acetonitrile
  - ethylhexanol
  - furan
  - furfural
  - methylester acetic acid
  - methylfuran
  - methylpropene
  - hydrocarbon compound (no identification from the TIC library)

- An isolated pesticide detection (heptachlor) was reported in the ppb range at the upwind sampling location (SP4). No pesticides were detected at the downwind sampling location (SP1).

- Two explosive-related compounds (2-amino-4,6-dinitrotoluene and 4,-amino-2,6-dinitrotoluene) were detected in the ppb range at the downwind sampling location. No explosive-related compounds were detected at the upwind sampling location.

- Numerous metals were detected in the ppb range in samples collected both upwind and downwind of the burn area.

- U-235 was reported as detected in the downwind sampling location.

No chemical agents or PCBs were detected in samples collected either upwind or downwind of the burn area. Appendix E-3: Tables E-18 through E-24 contain the results from the analysis of the air samples collected during the J-Field controlled burn.

5.4 Main Front Controlled Burn Attempt – April 2001

A second controlled burn in the Main Front Range was planned in an area where testing of DU weapons has occurred. Immediately following the successful completion of the April 2000 J-Field controlled burn, coordination resumed for the seond Main Front controlled burn. Wind directions under which the controlled burn could be conducted were northeast or southwest. However, given the active testing schedule and other limitations (wind direction and greening vegetation), the controlled burn could not be accomplished in the spring, and was delayed until fall.

Coordination resumed in late fall when the vegetation was determined by the APG Fire Department officials to be sufficiently dried to provide adequate fuel and a successful burn. Once again, the active testing schedule and unfavorable meteorological conditions prevented successful completion of the controlled burn. Coordination again resumed in spring of 2001 Under favorable wind conditions, the controlled burn was attempted in the Main Front Range on 6 April 2001. However, light precipitation and the wet condition of the underlying vegetative fuel prevented successful ignition of the burn area.

Evaluation of the selected burn area by Fire Department personnel indicated that a successful controlled burn was unlikely, given the wet conditions and reduced available fuel volume as a result of previous unplanned burns. Active test schedules were projected by ATC for the selected area. Given these limitations, completion of a second burn in the Main Front Range is not feasible.

6.0 RISK ANALYSIS

The evaluation of risk involves comparison of air sampling data collected from the controlled burn events to available human health screening criteria, and calculations to evaluate potential risk associated with exposure to range fire smoke via the inhalation pathway.

6.1 Risk-Based Screening Criteria

To provide a screening level evaluation of potential human health impacts from range fire smoke, concentrations of contaminants detected above quantitation limits are compared to the Maryland Toxic Air Pollutant (TAP) Screening Levels and EPA Region III Risk-Based Concentrations (RBCs). The TAP Screening Levels and RBCs for inhalation are more conservative than other screening criteria such as the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). The PELs establish workplace exposure limits for inhalation by healthy workers, generally based on an 8- or 10-hour workday in a 40-hour workweek. The available TAP Screening Levels and RBCs used in this evaluation are lower values than the PELs for a given chemical. The TAP Screening Levels and RBCs provide consideration of the general population in evaluating exposure and associated risk.

6.1.1 Maryland Toxic Air Pollutant Screening Levels

The Maryland TAP regulations were promulgated in September 1988 to protect the public from TAP emissions from stationary sources of air pollution. The Maryland Department of the Environment (MDE) maintains a list of screening levels for over 1700 compounds. These TAP Screening Levels are tools used to predict whether emissions from a source will unreasonably endanger public health. Emissions from a pollutant source are compared to benchmark concentrations known as "screening levels" which are considered safe or sufficiently conservative that no one would be endangered by that level of exposure. The TAP Screening Levels are included in Appendix E, Tables E-1 through E-24, for the compounds detected in range fire samples collected as part of the controlled burn project.

6.1.2 EPA Region III Ambient Air Risk-Based Concentrations

The RBCs were developed originally for use in the EPA Region III Superfund Program. The primary use of RBCs is for chemical screening during baseline risk assessments. The RBCs combine toxicity factors with "standard" exposure scenarios to provide a numerical estimation of the concentration that relates to a specified risk level. The inhalation RBCs for ambient air presented in Tables E-1 through E-24 (Appendix E) are based on an increased lifetime cancer risk of $1x10^{-6}$ for carcinogens (i.e., one in one million), or a hazard quotient of 0.1 for non-carcinogens. The exposure factors used in the calculation of the ambient air RBCs are conservative, and are based on residential exposure to contaminants (i.e, 350 days per year).

Noncarcinogenic effects are evaluated by calculating the ratio of a site-specific exposure level for a specified time period to a reference dose (RfD). The RfD for a specific chemical is an estimate of the daily exposure level, with consideration of sensitive populations, that is not expected to cause adverse health effects over the course of a lifetime. The calculated ratio is known as the hazard quotient (HQ). Unlike cancer risk estimates, HQs are not expressed as a probability. An HQ of less than one indicates that exposures are not likely to be associated with adverse noncarcinogenic effects. As the hazard quotient approaches or exceeds 10, the likelihood of adverse effects is increased to the point where action to reduce human exposure should be considered (although the

magnitude of the uncertainty factors used to derive the RfD should also be considered). Because of the uncertainties involved with these estimates, values between one and 10 may be of concern, particularly when additional significant risk factors are present. Since RfDs do not have equal accuracy or precision and they are not based on the same severity of toxic effects, evaluation of hazard indices (i.e., the sum of two or more HQ values for multiple substances and/or multiple exposure pathways) should take into account the uncertainties associated with chemical-specific RfDs. Using this approach, contaminants can then be excluded when they contribute an HQ of less than 0.1 (for noncarcinogens).

6.1.3 Radiological Parameters

Air samples collected were analyzed for gross alpha and gross beta activity, and specific radionuclides by gamma spectroscopy. Results were evaluated against upwind (background) concentrations as well as blank analysis results. Further evaluation was on the basis of Title 10 Code of Federal Regulations (CFR), Part 20, *Standards for Protection Against Radiation*, Appendix B – Table 2, *Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Effluent Concentrations.* Table 2 of Appendix B of 10 CFR Part 20 provides concentration limits for radionuclides in airborne effluents released to the general public.

Main Front
Gross alpha and beta radioactivity were detected in the blank and samples. Gross alpha results were not statistically different between the blank and samples. Gross beta results for SP3 and SP4 were also not statistically different from the blank result.

Although gross beta activity was detected in the SP1 and SP2 samples at levels statistically different from the blank, the concentrations of radioactivity are less than 30 times the most restrictive limit for radioactivity per 10 CFR Part 20, Appendix B, Table 2 for unidentified radionuclides. Gamma ray spectroscopy identified the presence of only Potassium-40 (K-40), Lead-212 (Pb-212), Radium-223 (Ra-223), and Uranium-235 (U-235). All of these radionuclides are naturally occurring and were detected with amounts so small that they could not be quantified as statistically significant above the background for the detector used by the gamma ray spectroscopy system. These radionuclides were detected in the background spectrum for the instrument and are therefore considered as not detected.

The levels of airborne radioactivity detected during the Main Front controlled burn sampling event could not be distinguished from ambient concentrations, and do not pose an increased health risk.

New O-Field
Gross alpha and beta radioactivity were detected in the blank and the samples. Gross alpha results were not statistically different between the blank and sample results. Gross beta results were not significant between SP1 and the blank. The gross beta results for SP2, SP3, and SP4, although statistically different from the blank, are present at concentrations less than 10 times the most restrictive limit for radioactivity in air per 10 CFR Part 20, Appendix B, Table 2, for unidentified radionuclides.

Gamma spectroscopy identified the presence of only K-40, Pb-212, Radium-224 (Ra-224), and U-235. All of these radionuclides are naturally occurring, were detected in the blank, and were detected at levels too low to be quantified as statistically significant above background for the detector utilized for the analysis. The levels of radioactivity measured in air samples collected during the New O-Field controlled burn could not be distinguished from ambient concentrations and do not pose an increased health risk.

J-Field
Gross alpha and beta activity detected was not statistically different between the blank and sample results, and could not be distinguished from ambient concentrations.

Gamma spectroscopy identified the presence of the naturally occurring radionuclides K-40, Pb-212, and U-235 at levels too low to be quantified as statistically different from background for the detector used. Thus, these radionuclides were considered not detected. Uranium-235 was reported as detected in the downwind sampling location (SP1) at 0.0005 pico-Curies per cubic meter (pCi/m^3), less than one percent of the most restrictive limit for U-235 in air as per 10 CFR Part 20, Appendix B, Table 2 (i.e., 0.06 pCi/m^3). On this basis, the detected levels of U-235 are not considered to pose a health risk.

6.2 Results of Risk-Based Screening

Several analytes detected in the controlled burn sampling events conducted at APG occurred at levels exceeding either the Maryland TAP Screening Levels or the EPA Region III ambient air RBCs. The analytes exceeding these criteria are highlighted in the data tables (Appendix E, Tables E-1 through E-24) and included in Table 2. Analytes for which screening levels are not available are not further evaluated.

Table 2. Calculated Range Fire RBCs

Analyte	Noncarcinogenic RF-RBC ($\mu g/m^3$)	Carcinogenic RF-RBC ($\mu g/m^3$)	Maximum Reported Concentration ($\mu g/m^3$)[a]
VOLATILE ORGANICS			
Acetaldehyde	---	170.1	3.98
Benzene	---	46.2	19.9
Furan	777	---	8.58
Methylene Chloride	N/A	798	25.25
Trimethylbenzene	1302	---	12.54 (Upwind)
PCBs			
2,4',5-Trichlorobiphenyl	---	0.651	0.0110
PESTICIDES			
Dieldrin	---	0.0819	0.0030
Heptachlor	---	0.294	0.0020 (Upwind)
EXPLOSIVES			
2-Amino-4,6-dinitrotoluene	46.2	---	0.4570
INORGANICS			
Aluminum	777	---	51.19
Arsenic	---	0.0861	0.0147
Cadmium	---	0.208	0.0036
Manganese	10.92	---	0.5476

[a] Maximum reported concentration is the maximum concentration detected based on three burn events.

6.3 Risk Calculations

Risk calculations were performed to further assess potential human health impacts from airborne range fire contaminant concentrations that exceeded the screening levels. The Maryland TAP Screening Levels assume emissions from a stationary source, indicating frequent emissions and associated exposure. The assumptions used in determining the EPA Region III RBCs for evaluating a residential exposure to contaminants in ambient air are overly conservative for evaluating potential human health impacts due to infrequent exposure to range fire smoke. Therefore, the default exposure parameters used in the RBC calculations are modified to reflect a more realistic scenario for exposure to smoke from infrequent range fires (Table 2). The revised exposure parameters are then employed in back-calculating a revised risk-based concentration for the chemicals detected during range fire smoke sampling at concentrations in excess of the risk-based screening criteria. The calculated concentration represents the upper bound of the risk levels established by EPA as acceptable: for carcinogens, increased lifetime cancer risk of 1 in 1,000,000 (1×10^{-6}); for non-carcinogens, a hazard quotient of 0.1.

Data evaluated by ANL in preparation of the "Potential Human Health Impacts from Range Fires at Aberdeen Proving Ground, Maryland" report indicate that, from the period of 1992 – 1997, an average of 80 fires occurred per year at APG. Of those fires, 84 percent involved areas less than 5 acres in size. Fires that burned 25 acres or more constituted only 2 percent of the fires during that period, although some fire reports did not include an estimate of the area burned. ANL used the assumption that five 25-acre or larger fires occurred per year. The ANL report also indicated that the average duration of range fires at APG is approximately one hour. The use of a helicopter with "Bambi bucket" to drop water directly onto the burning areas allows the fires to be extinguished in a short time. These factors were used to develop conservative exposure duration and frequency parameters for calculating revised risk-based concentrations.

The approach used in this report for determining the range fire RBCs (RF-RBCs) is based on modification of the EPA Region III RBCs to reflect a conservative frequency for the exposure of the general population to range fire smoke. The EPA Region III RBCs used for screening purposes assume a residential exposure to airborne contaminants from an ongoing source, with a frequency of 350 days per year. The RF-RBCs are derived on the basis of exposure to 10 range fires per year, with the assumption that wind direction would control exposure. The residential EPA Region III RBCs assume an exposure basis of 24 hours per day. For range fires, that basis is reduced to 4 hours per event. The conservative exposure duration assumes that the receptor would be exposed to smoke from 10 of 80 range fires occurring per year for a maximum duration of 4 hours per fire. The calculated RF-RBCs (presented in $\mu g/m^3$) are compared (Table 2) to maximum concentrations detected (also presented in $\mu g/m^3$) in the controlled burn sampling events.

7.0 CONCLUSIONS

Air emissions sampling was conducted during the course of three controlled burns at APG. To assess the potential impacts to human health resulting from exposure to smoke from range fires at APG, the analytical results obtained from the sampling events were compared against EPA Region III RBCs and Maryland TAP Screening Levels. Thirteen analytes were reported at concentrations exceeding at least one of the two screening criteria. To further screen the data, revised RF-RBCs were calculated using parameters conservatively considered representative of exposure of residential receptors to range fire smoke at APG. The conservative RF-RBCs were calculated based on the assumption that a receptor is exposed to smoke from 10 range fires per year at APG, for a

duration of four hours each. The resulting RF-RBCs were then compared to the maximum reported concentrations for the 13 analytes in any of the controlled burn sampling events.

The risk analysis presented in this report does not indicate significant impacts to human health resulting from range fires at APG. The risk analysis assumes that the data collected during the controlled burn events are representative of "typical" range fires occurring at APG.

8.0 REFERENCES

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APPENDIX A

LOCKHEED MARTIN RANGE FIRE SAMPLING TRIP REPORTS

APPENDIX A-1

O-FIELD TRIP REPORT
(JULY 2000)

'heed Martin Technology Services Group
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LOCKHEED MARTIN

DATE: July 5, 2000

TO: David Mickunas, U.S. EPA/ERTC Work Assignment Manager

THROUGH: Jeff Bradstreet, REAC Air Group Leader

FROM: Amy DuBois, REAC Task Leader

SUBJECT: AIR MONITORING AND SAMPLING AT THE AIR MONITORING SAMPLING, ANALYSIS, AND MODELING SUPPORT, AND UNDERWATER SURVEY ACTIVITIES SITE, ABERDEEN PROVING GROUND, ABERDEEN, MD, WORK ASSIGNMENT #0-110 - TRIP REPORT - O-FIELD

BACKGROUND

The United States Environmental Protection Agency/Environmental Response Team Center (U.S. EPA/ERTC) issued Work Assignment Number 0-110 to Lockheed Martin under the Response, Engineering, and Analytical Contract (REAC) to provide air monitoring and air sampling during two controlled burns in the Edgewood Area of Aberdeen Proving Ground (APG). One burn was to be conducted at O-Field and one at J-Field.

Ordnance firing, ongoing test activities, and lightning strikes occasionally cause accidental fires in the test range areas at APG. Because of APG's long history of weapons testing and disposal practices, there is concern that contaminants have accumulated in the surface soils and vegetation at these locations and could be transported in the smoke plumes produced by such fires, posing a health risk to exposed individuals on and off the installation.

The scope of work for this work assignment included air sampling for dioxins, metals, polynuclear aromatic hydrocarbons (PAHs), inorganic acids, volatile organic compounds (VOCs) and chemical warfare agents (CWAs). Particulate monitoring was conducted utilizing an MIE DataRAM at each location.

OBSERVATIONS AND ACTIVITIES

REAC personnel mobilized to APG on December 3, 1999. Air sampling and monitoring were conducted at 5 downwind and 2 upwind locations (Figure 1).

VOC sampling and analysis was conducted following EPA Method TO-14A: *Determination of Volatile Organic Compounds in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Mass Spectrometric (GC/MS) Analysis*. A sampling orifice was connected to each SUMMA canister to control the flow at 15 cubic centimeters per minute (cc/min). A solenoid valve was then connected to the SUMMA orifice. A trip wire was attached to each solenoid valve to trigger the solenoid to open just before personnel exited the downwind area.

PAH sampling and analysis was conducted following National Institute for Occupational Safety and Health (NIOSH) Method # 5515: *Polynuclear Aromatic Hydrocarbons*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (2 Liters per minute (L/min)) through a sampling train containing a teflon

prefilter cassette and an XAD-2 sorbent tube. The pumps were programmed for a delayed start with a 4-hour sampling period.

Sampling and analysis for inorganic acids was conducted following NIOSH Method # 7903: *Acids, Inorganic*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (250 cc/min) through a sampling train containing a silica gel sorbent tube. The pumps were programmed for a delayed start with a 4-hour sampling period.

Sampling and analysis for dioxins was conducted following modified U.S. EPA Method TO9A. *Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air.* Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a polyurethane foam (PUF) plug and quartz filter. The pumps were programmed for a delayed start with a 4-hour sampling period. PUF glassware, plugs, and quartz filters were cleaned and certified by Southwest Research Institute in San Antonio, Texas prior to use.

Sampling and analysis for metals was conducted following modified NIOSH Method # 7300: *Elements (ICP)*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a mixed cellulose ester filter cassette. The pumps were programmed for a delayed start with a 4-hour sampling period.

Samples were collected for CWAs utilizing a personal sampling pump (SKC) to draw a measured volume of air (100 cc/min) through a sampling train containing two Depot Area Air Monitoring System (DAAMS) sorbent tubes in a dual-sampling manifold. The CWAs analyzed for included: Sarin (GB), Soman (GD), Mustard (HD), and VX. The pumps were programmed for a delayed start with a 4-hour sampling period. Tubes and analysis were provided by Soldiers Biological and Chemical Command (SBC COM).

Air monitoring for total particulates was performed utilizing an MIE DataRAM portable real-time aerosol monitor. Concentration data was logged every 10 seconds for the duration of the burn.

APG personnel positioned support poles, at each of the five downwind locations, prior to REAC's mobilization to the site. Due to the heavy equipment required to position the poles, and the potential for unexploded ordinance in the marsh/brush area downwind of the proposed burn area, the support poles were positioned on solid ground along the edge of the marsh off Ricketts Point Road. Two nights before the scheduled burn, a spontaneous fire burned the marsh area between Watsons Creek and Ricketts Point Road right up to the support poles. The support poles were used to hold the sampling devices 15 feet above the ground, this positioned the samplers in the plume but out of the potential burn path of the fire. The collection of sampling devices was hoisted up the support pole after setting the timers on the individual pumps. The trip wire for each SUMMA canister allowed the solenoid valve for each SUMMA to be triggered from ground level. Each SUMMA was triggered just before sampling personnel left the potential burn area for a safe zone upwind. When all personnel were out of the area, the APG Fire Department initiated the burn.

RESULTS

VOCs: Benzene and toluene were the only target VOCs detected in any of the samples. The detected concentrations of these two compounds were between 0.4 and 0.6 parts per billion volume (ppbv). These concentrations should be regarded as not detected because 0.6 ppbv each of benzene and toluene were detected in the trip blank. For complete analytical results for VOCs, see the Analytical Report in Appendix A.

PAHs: No PAHs were detected in any of the samples. For complete analytical results for PAHs see the Analytical Report in Appendix B.

Inorganic Acids: No inorganic acids were detected in any of the samples. For complete analytical results for inorganic acids see the Analytical Report in Appendix B.

Dioxins/Furans: A summary of dioxins/furans results can be found in Table 1. The method blank contained OCDD, 1234678-HpCDF, and OCDF; none of the sample results for these compounds were greater than five times the concentration detected in the method blank. The results for each of those compounds should be regarded as not detected. The trip blanks contained 123678-HxCDD, 1234678-HpCDD, OCDD, 12378-PeCDF, 1234678-HpCDF, and OCDF. None of the samples contained concentrations of 123678-HxCDD, 1234678-HpCDD, or 12378-PeCDF exceding five times the concentrations detected in the trip blank; the results for these compounds should be regarded as not detected. The field blank contained 12378-PeCDD. None of the samples contained 12378-PeCDD at concentrations greater than five times the detected field blank concentration The results for 12378-PeCDD should be regarded as not detected. The total dioxins/furans detected at each location after adjusting for the compounds regarded as not detected are as follows: O-2(not detected), O-3(not detected), O-4(0.0491 picograms per cubic meter (pg/m^3)), O-5(0.705 pg/m^3), O-UW1(not detected), and O-UW2(not detected). For complete analytical results for dioxins/furans, see the Analytical Report in Appendix B.

Metals: A summary of metals results can be found in Table 2. The tin concentration detected in sample 28050 should be regarded as estimated because the acceptable quality control (QC) limits for the percent recovery of the blank spike (BS) and blank spike duplicate (BSD) were exceeded. All other concentrations should be regarded an not detected because they were each less than 5 times the lot blank concentration. For complete analytical results for metals, see the Analytical Report in Appendix B.

CWAs: No chemical warfare agents were detected in any of the samples. CWA results are provided by SBC COM, see Appendix C.

Particulates: Particulates results are shown in Figures 2 through 8. The overall maximum concentration of 54.9 micrograms per cubic meter ($\mu g/m^3$) was detected at location O-UW1.

Meteorological data: Windroses representing local wind speed and wind direction during the burn period are provided in Appendix D. The data was collected at H-Field using a 10-meter tower, and at Poverty Island using a 5-meter tower. Winds at Poverty Island were predominantly out of the southwest, but were light and variable. H-Field recorded stronger winds at the 10-meter level, predominantly out of the south southwest.

Analysis for VOCs and PAHs were provided by REAC, Edison, NJ. Analysis for dioxins/furans, inorganic acids, and metals were provided by Southwest Research Institute, San Antonio, TX. Analysis for CWAs was provided by SBC COM, APG, MD.

FUTURE ACTIVITIES

Due to light winds and the wet marsh, the proposed burn area did not burn, only the area near the fire initiation line ignited. The sampling devices were too far away to capture the plume from the small burned area. A second controlled burn will be conducted at O-Field when the conditions are more favorable. After the O-Field burn is completed, the J-Field burn will be initiated. There are no eagle nesting restrictions affecting the J-Field burn.

Table 1
Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
Summary of Dioxins/Furans Sampling Results - O-Field Controlled Burn - December 3, 2000

Sample Number	28080	28081	28082	28083	28084	28085	28086	28088	28089
Sample Location	O-1(Field Blank)	O-2	O-3	O-4	O-5	O-UW1	O-UW2	Trip Blank	Trip Blank
Adjusted concentration[1]	pg	pg	pg	pg/m^3	pg/m^3	pg/m^3	pg/m^3	pg/m^3	pg/m^3
1,2,3,7,8-PeCDD[4]	4.35	U	U	6.9	U	7.85	5.85	U	U
1,2,3,6,7,8-HxCDD[3]	U	U	U	U	U	U	1.02	U	0.862
1,2,3,4,6,7,8-HpCDD[3]	U	U	0.192	U	U	0.277	U	U	0.0574
OCDD[2]	U	0.0381	0.0548	U	U	0.0918	0.0306	0.0172	0.019
2,3,7,8-TCDF	U	U	U	U	0.526	U	U	U	U
1,2,3,7,8-PeCDF[3]	U	0.3845	U	0.3895	0.351	U	0.52	0.374	0.209
1,2,3,4,7,8-HxCDF	U	U	U	U	0.179	U	U	U	U
1,2,3,7,8,9-HxCDF	U	U	U	0.0491	U	U	U	U	U
1,2,3,4,6,7,8-HpCDF[2]	U	U	U	U	U	U	0.146	0.0712	U
OCDF[2]	0.0115	0.0215	0.0263	0.0201	U	0.0511	0.0203	0.0113	U
Total	**4.3615**	**0.4441**	**0.2731**	**7.3587**	**1.056**	**8.2699**	**7.5869**	**0.4737**	**1.1474**

pg - picograms
pg/m^3 - picograms per cubic meter

[1] Adjusted concentration - detected concentration multiplied by the toxicity equivalency factor (TEF) for each compound.

[2]The OCDD results for samples 28081, 28082, 28085, 28086, 28088, and 28089; the 1,2,3,4,6,7,8-HpCDF results for samples 28086 and 28088; and the OCDF results for samples 28080, 28081, 28082, 28083, 28085, 28086, and 28088 should be regarded as not detected because the concentrations in the samples were less than 5 times the concentration in the method blank.

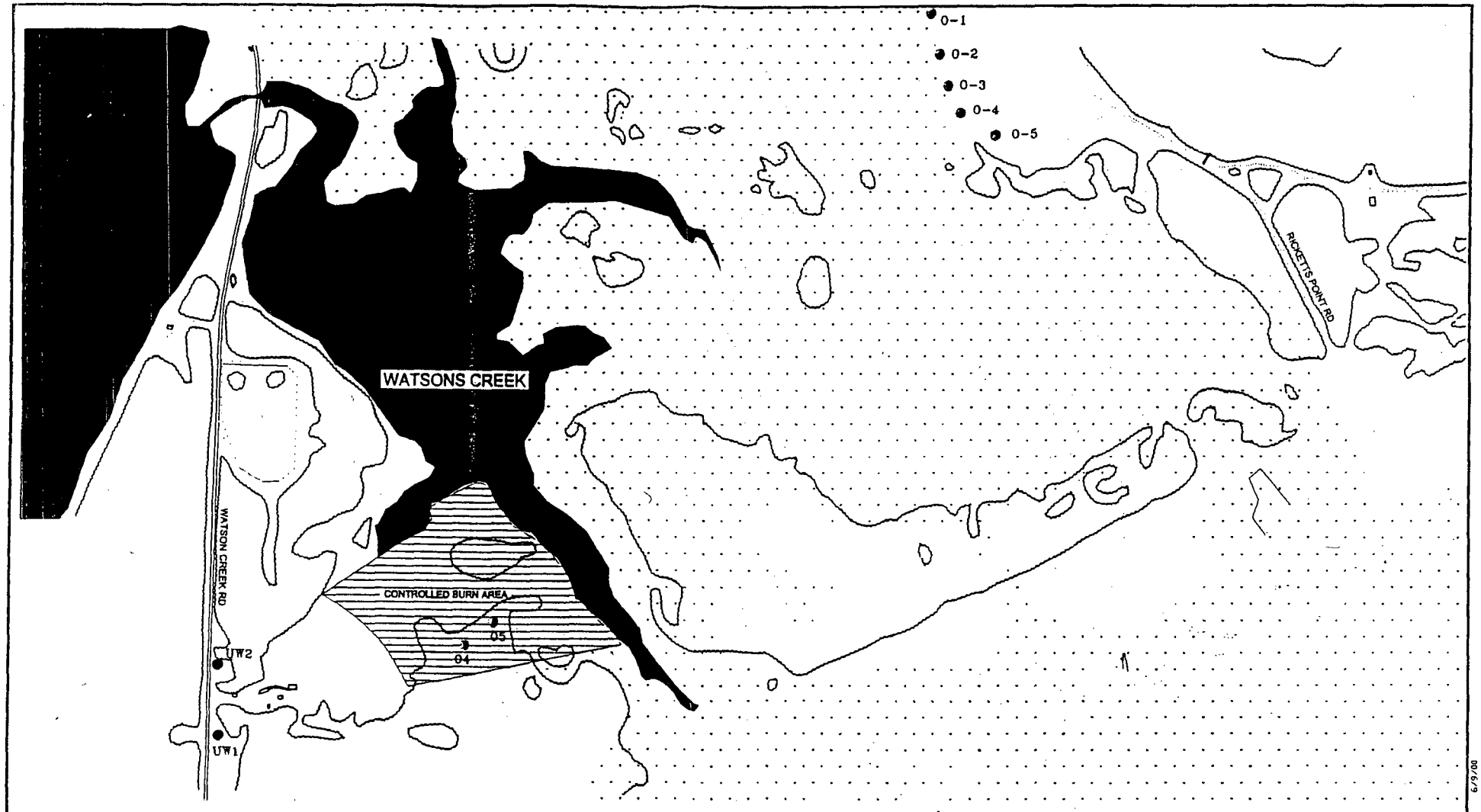
[3]The 1,2,3,6,7,8-HxCDD result for sample 28086; the 1,2,3,4,6,7,8-HpCDD result for samples 28082 and 28085; and the 1,2,3,7,8-PeCDF result for samples 28081, 28083, 28084, and 28086 should be regarded as not detected because the concentration in the sample is less than 5 times the concentration in the trip blank.

[4]The 1,2,3,7,8-PeCDD results for samples 28083, 28085, and 28086 should be regarded as not detected because the concentration in the samples were less than 5 times the concentration in the field blank.

Table 2
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites
Summary of Metals Sampling Results - O-Field Controlled Burn - December 3, 2000

Sample Number	28050	28051	28052	28053	28054	28055	28056	28057	28058	28059
Location	O-1	O-2	O-3	O-4	O-5	O-UW1	O-UW2	Field Blank	Trip Blank	Lot Blank
Parameter	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/filter	µg/filter	µg/filter
Aluminum	U	1.5	3.5	2.7	4.0	2.0	2.0	1.3	1.3	2.3
Calcium	8.8	8.3	9.0	9.0	9.7	10	9.0	5.4	5.5	5.5
Chromium	0.59	0.47	0.64	0.66	0.76	0.97	0.7	0.56	0.49	0.44
Iron	1.5	1.1	1.1	0.95	2.7	1.2	2.1	0.82	0.45	0.45
Phosphorus	U	U	U	U	U	U	U	U	U	U
Sodium	9.0	12.6	12.5	11.6	14	13.8	12	12.3	7.8	10
Tin	1.3 [1]	U	U	U	U	U	U	U	U	U
Zinc	0.21	U	0.25	0.23	0.33	0.31	0.16	0.11	U	0.12

[1]Regard concentration as estimated, acceptable QC limits for the %Recovery of the BS and the BSD were exceeded.
All detected concentrations for all compounds in this table should be regarded as not detected because they are each less than 5*(Lot Blank Concentration).
µg/m³ - micrograms per cubic meter
QC - Quality control
BS - Blank spike
BSD - Blank spike duplicate



U.S. EPA ENVIRONMENTAL RESPONSE TEAM CENTER
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-C99-223
V.O.# 01A00110

FIGURE 1
SAMPLING LOCATIONS O-FIELD CONTROLLED BURN AREA
AIR MONITORING, SAMPLING, ANALYSIS, AND
MODELING SUPPORT, AND UNDERWATER
SURVEY ACTIVITIES
ABERDEEN, MARYLAND
JUNE 2000

6/9/00
110/OFIELDBS.DWG

Figure 2
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-1

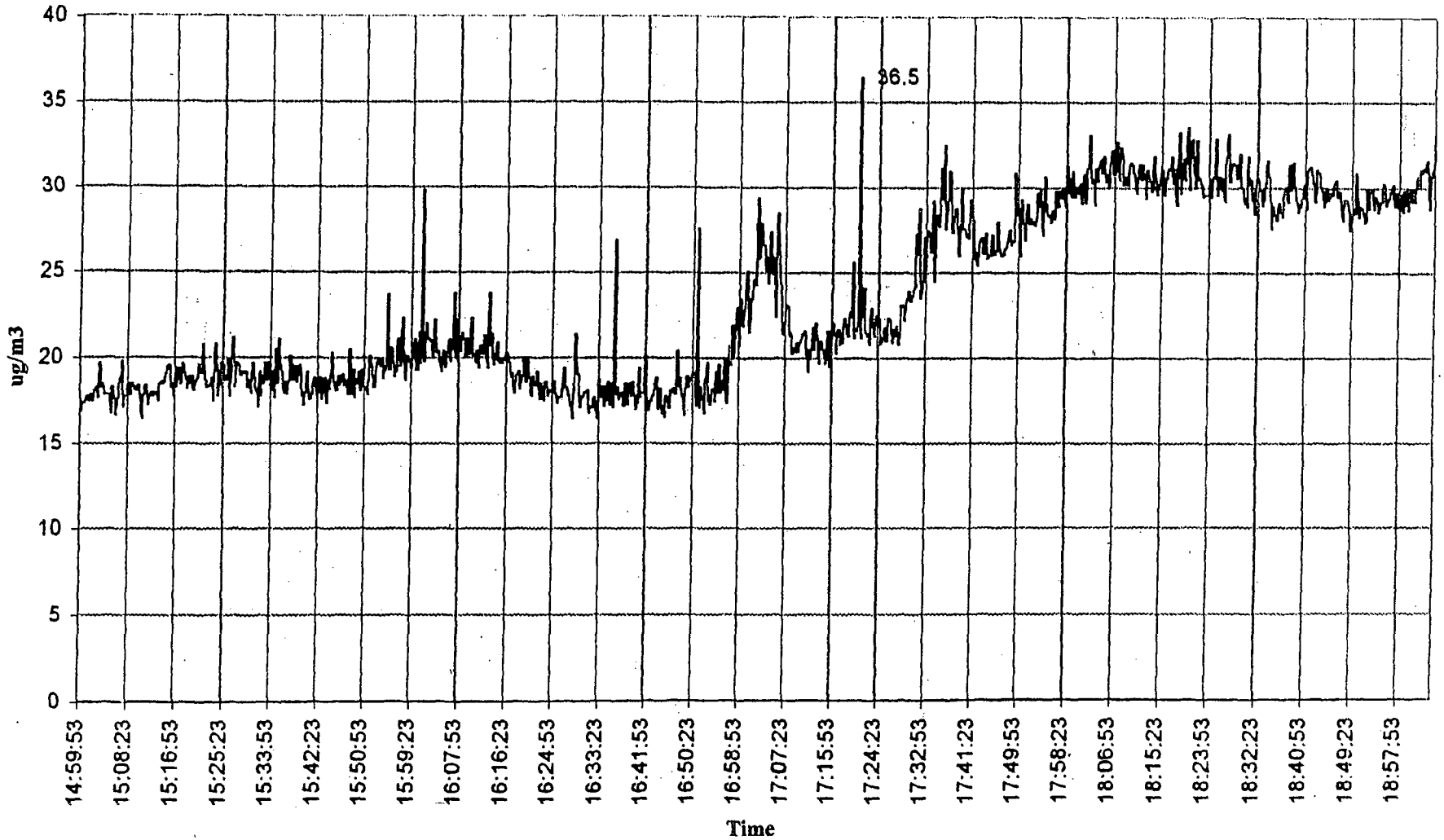


Figure 3
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-2

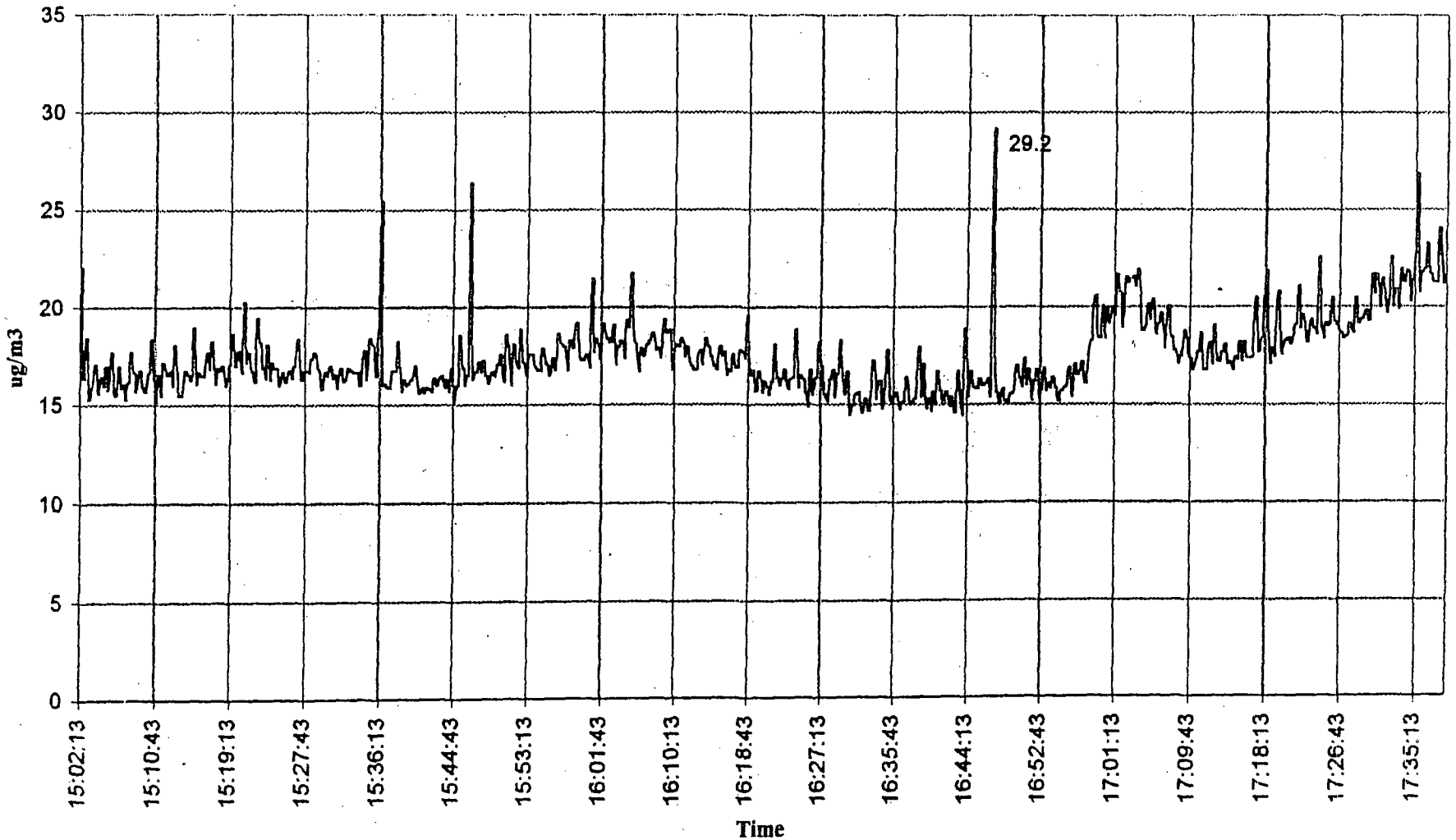


Figure 4
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-3

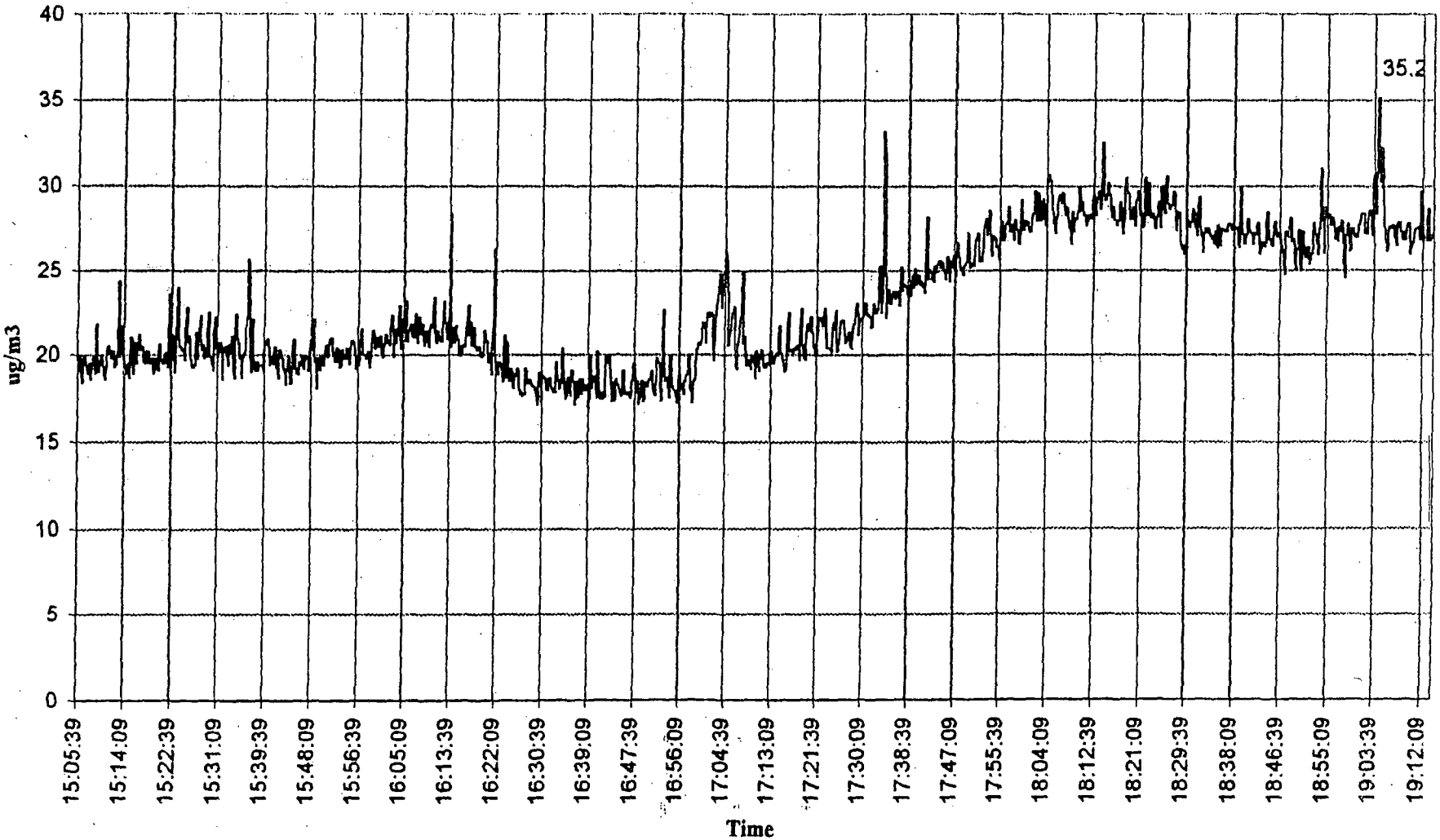


Figure 5
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-4

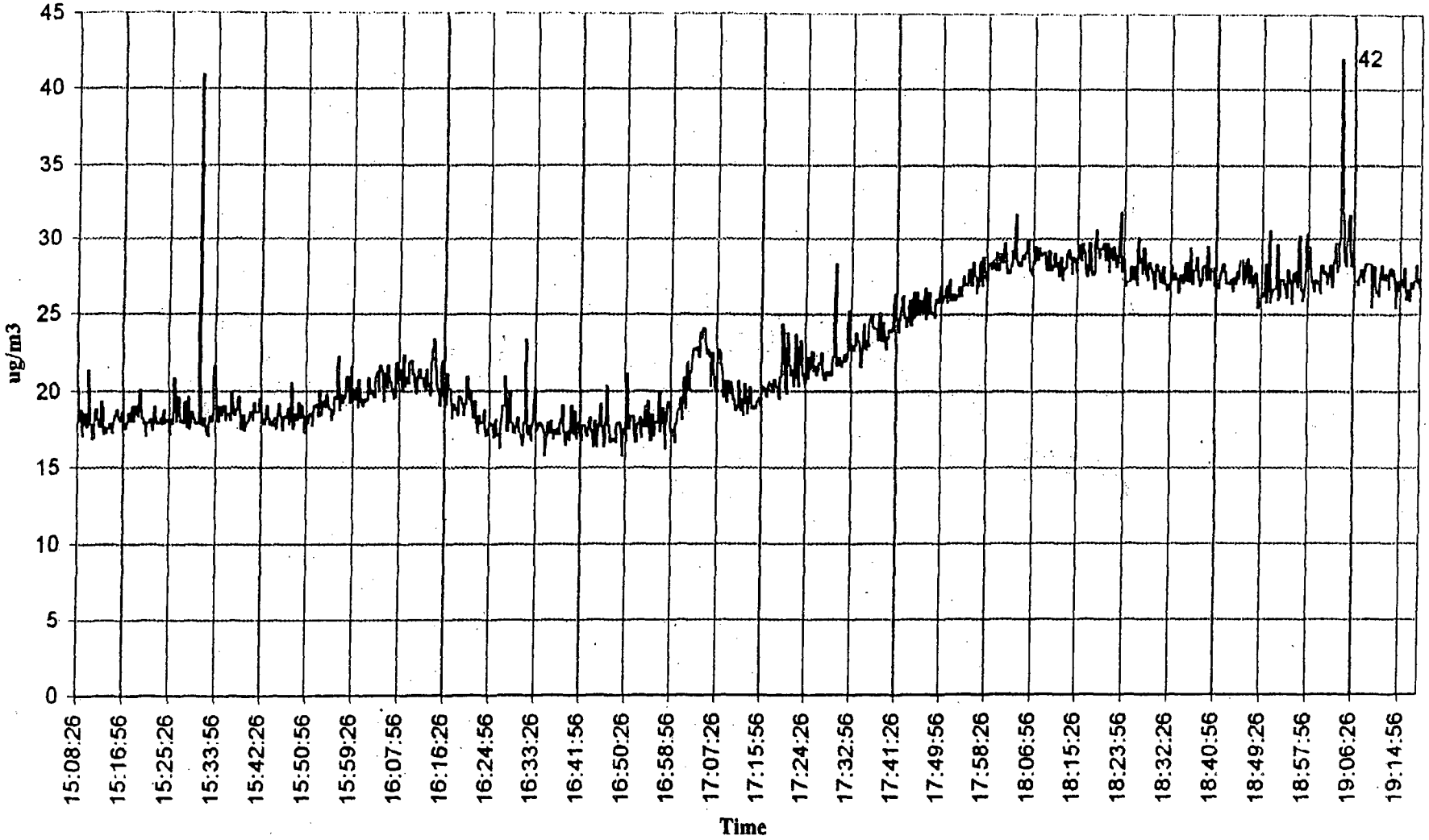


Figure 6
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-5

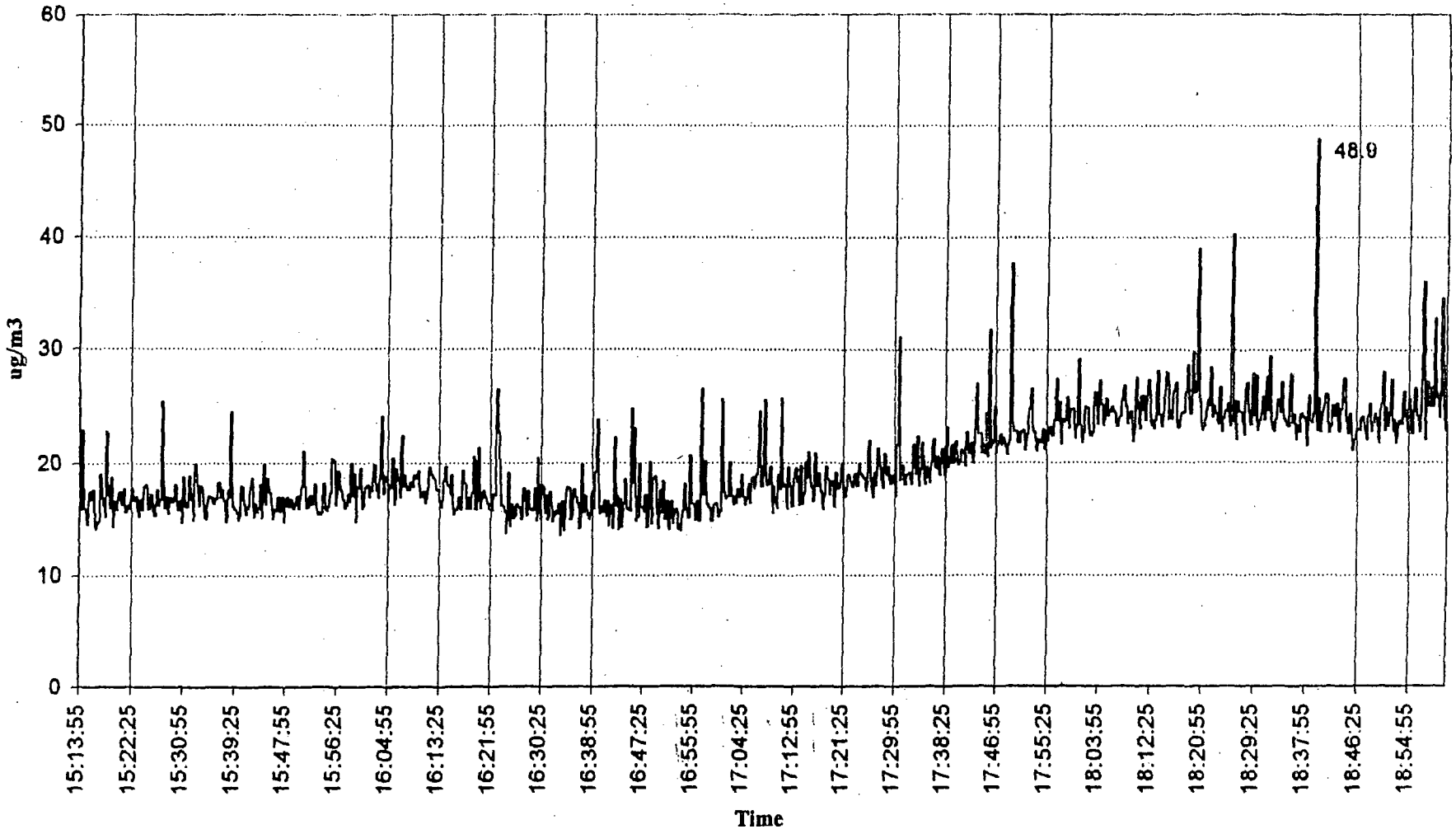


Figure 7
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-UW1

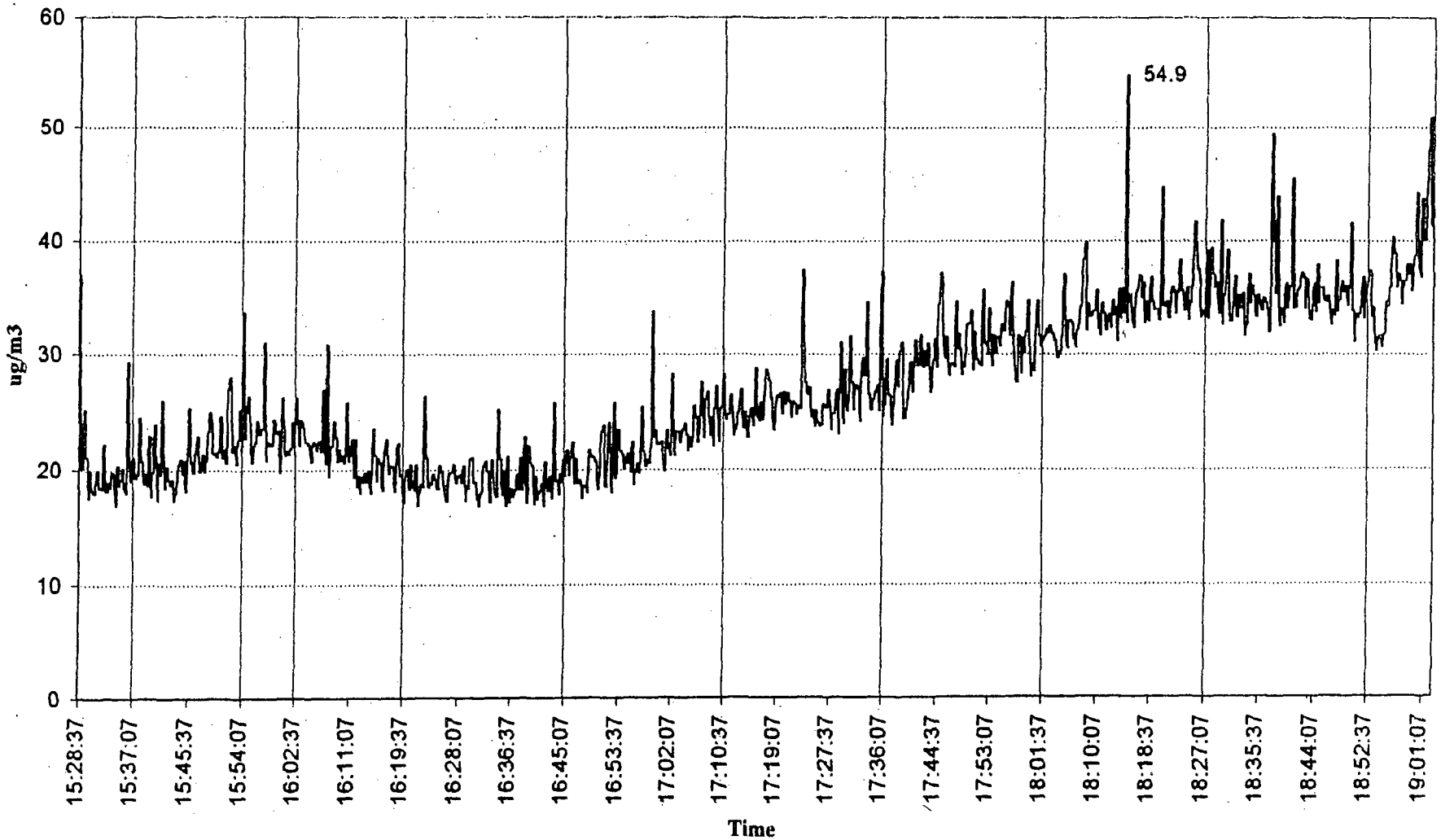
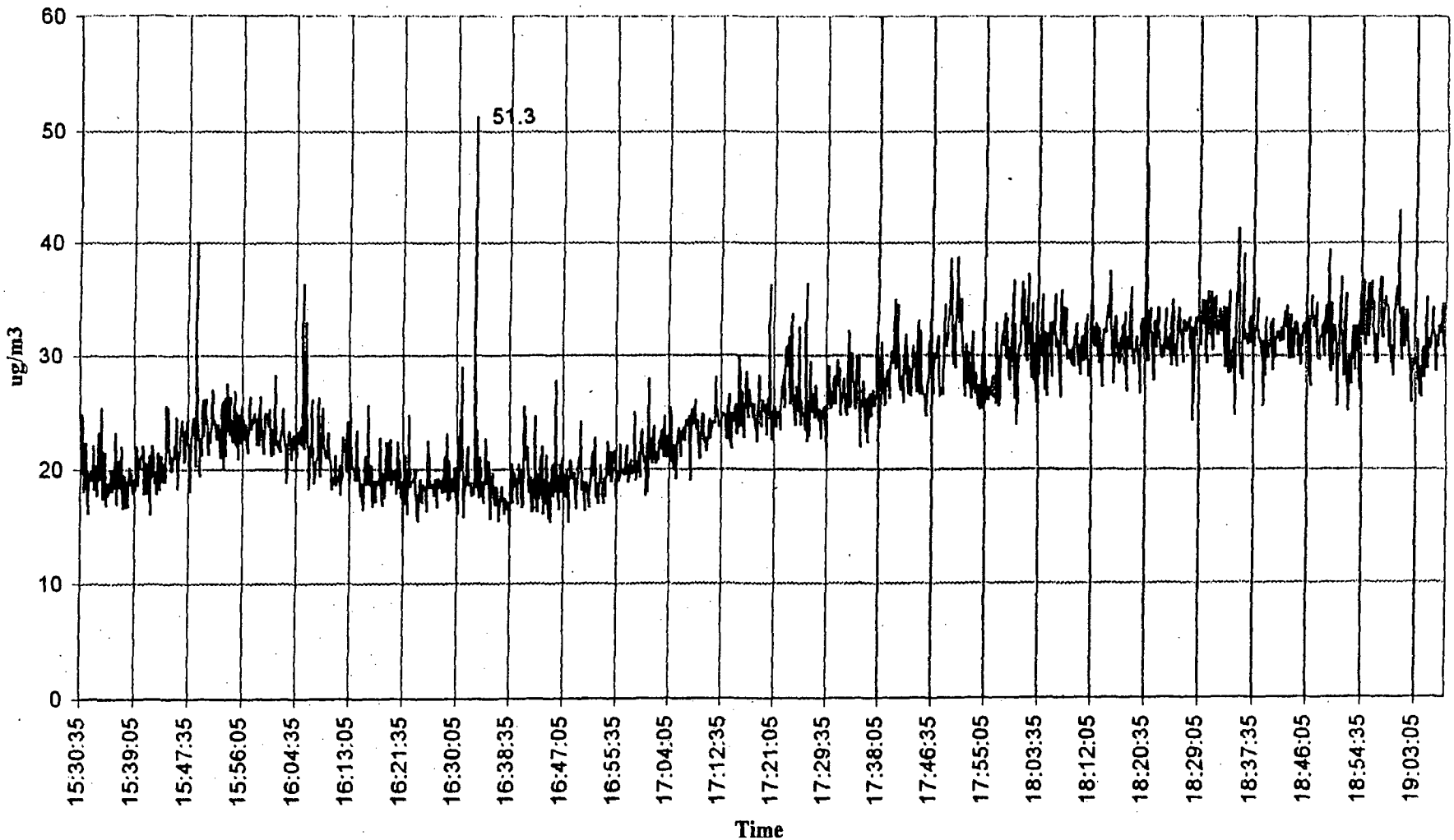


Figure 8
Aberdeen Proving Ground
O Field Burn Data - Particulates
December 3, 1999
Location: O-UW2



APPENDIX A
Analytical Report (VOCs)
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

ANALYTICAL REPORT

Prepared by
Lockheed Martin Technology Services Group

Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities
Aberdeen, MD

January 2000

EPA Work Assignment No:0-110
LOCKHEED MARTIN Work Order No. R1A00110
EPA Contract No. 68-C99-223

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0110/DEL/AR/0001/report

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1.0 INTRODUCTION

Summa canister samples were collected at the Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site in Aberdeen, MD on 03 December 1999. A total of eight (8) samples were collected in 6-liter passivated Summa canisters, the samples were transported back to the Environmental Response Team Center (ERTC) facility in Edison, New Jersey. These samples were analyzed by the Response Engineering and Analytical Contract (REAC) using gas chromatography/mass spectrometry (GC/MS) on 06, 07, and 08 December 1999.

2.0 GC/MS CANISTER PROCEDURES

2.1 Sample Pressurization

The Summa canisters used for sampling were cleaned by REAC using REAC Standard Operating Procedure (SOP) #1703 and were selected from batches certified clean by REAC. Before analysis, all canisters were pressurized. A pressurizing train was setup with a pressure gauge accurate to ± 0.1 pounds per square inch absolute (psia). The gauge and train were purged with nitrogen gas (Ultra High Pure grade)for 5 minutes. The train was then connected to the canister, an initial reading was taken. Nitrogen was added to all canister samples to bring the canister pressure to 3 times the initial reading, except 29007 trip blank.

Sample	Location	Initial Pressure (psia)	Final Pressure (psia)
29007	Trip Blank	0.7	20.0
29000	01	8.2	24.6
29001	02	10.2	30.6
29002	03	9.2	27.6
29003	04	8.5	25.5
29004	05	9.8	27.4
29005	UPW1	10.4	31.2
29006	UPW2	8.3	24.9

2.2 Summa Canister Analysis

Samples were analyzed by cryogenic trapping of aliquots from Summa canisters via a canister using a Hewlett-Packard 5890 gas chromatography (GC) and 5971A mass selective detector (MSD) running ChemStation software. Table 1 lists cryogenic trap and GC/MS conditions.

All canisters were attached to the Summa canister autosampler. Sample analysis began by cooling the first cryotrap, module -1 (M-1), to -160 degree Celsius (°C). Once M-1 was cooled, a specified aliquot of sample or standard was cryotrapped. This aliquot was transferred to a Tenax trap, M-2, to eliminate most of the water, and then cryofocussed at a third trap, M-3, before injection by direct heating.

2.3 Calibration and Sample Spiking

A twenty-five (25) compound standard was provided in compressed gas cylinder No ALM009519 by Scott Specialty Gases, Inc. This standard was diluted from 1 part per million volume (ppmv) to 20 parts per billion volume (ppbv) in a Silco canister. An initial calibration range was obtained by varying the volume of the 20 ppbv standard from 50 to 1250 milliliters (mL), equivalent to 1 nanoliter (nL) to 25 nL. Daily standards were obtained by analyzing the 20 ppbv standard at 500 mL (equivalent to 10 nL).

Bromochloromethane (BCM) and p-bromofluorobenzene (BFB) were added to both samples and standards. Both standards were provided in compressed gas cylinder No. ALM046281 by Scott Specialty Gases. BCM was used as an internal standard and BFB was used as a surrogate standard. This standard was diluted from 1 ppmv to 100 ppbv in a Silco canister. An aliquot of 100 mL (equivalent to 10 nL) was added to all standards and samples. To validate the mass spectrometer tuning, an aliquot of 70 mL (equivalent to 50 nanograms of BFB) was analyzed alone. Standard cylinder I.D. numbers, concentrations, and their quantitation ions are listed in Table 2.

2.4 Compound Identification/Quantitation

Contaminants in samples were identified and quantitated by the ChemStation software. This software was designed in order to tentatively identify and quantitate target compounds, using reconstructed and extracted ion chromatogram which were matched with retention time windows. The report format prints the identified compound mass spectra (both raw and background subtracted), quantitation, and qualifier ion chromatogram.

Target compound results are originally reported in nL. The limit of quantitation (LOQ) for all the target compounds is estimated to be 1 nL, being the lowest volume of standard on the calibration curve. The target compound results are calculated in ppbv using the following equation:

$$Concentration(ppbv) = \frac{Quant\ Result\ (nL)\ x\ 1000}{Undiluted\ Sample\ Volume(mL)}$$

The quantitation limit was 4 ppbv.

Non-target compounds were identified by a library search of all peaks in a chromatogram. The library search report prints out the sample spectrum along with the ten best library matches and the three best library match spectra. These matches were used along with mass spectral interpretation techniques to tentatively identify the unknowns. Concentrations were calculated based on the total ion response of bromochloromethane in the daily standard. All compounds appearing in the method blank as well as other background compounds commonly found in Summa canister GC/MS analyses (siloxanes, carbon dioxide, etc.) were deleted from the sample results to provide a true listing of the compounds in the samples.

2.5 QA/QC

The following QA/QC procedures were performed for this analysis:

- The HP 5971A was tuned daily for perfluorotributylamine (PFTBA) to meet abundance criteria for p-bromofluorobenzene as listed in EPA Method 624. Tuning results are included in the QA/QC data section (Appendix B). The tune was adjusted when necessary.

- An initial calibration by automated injection from a Silco canister standard at 20 ppbv was performed on 25 September 1999. All compounds met the acceptance criteria of having relative standard deviations (RSD) of less than 25%, except chloroethane (29.03 %), 1,1,1-trichloroethane (25.71 %) and carbon tetrachloride (26.97 %).

- Continuing calibrations were performed on 06, 07, and 08 December 1999 to satisfy the 12 hour requirement. All compounds met the acceptance criteria of having relative percent difference (RPD) less than 25%.

- A surrogate standard of BFB was added to all standards and samples. Percent recoveries were calculated against daily standards, and are listed in Table 3. Recoveries should be within 70% to 130% for BFB.

- Method blanks were analyzed after continuing calibrations to ensure that the system was clean.
- A duplicate was analyzed on sample 29000 (01).
- One set of matrix spike and matrix spike duplicates (MS/MSD) was analyzed on sample 29006 (UPW2) by spiking the samples with 500 mL of the 20 ppbv standard. There is no specific recovery range established according to SOP # 1705.

3.0 RESULTS

Summa canister target and non-target results are listed in Tables 3 and 4, respectively. The recoveries for the MS/MSD are presented in Table 5. All results are reported in ppbv for Summa canister samples and blanks. The chain-of-custody is in Appendix A. The Summa canister data is in Appendix B.

In Appendix B, the Analysis Log is followed by the calibration package for each day of analysis. The calibration package includes the daily analysis log, canister pressurization log, BFB tune, and initial or continuing calibration quant report. The quant report lists the retention time, quantitation ion, peak area, and concentration in nL. Concentrations listed on this quant report are generated by using the average response factors of the initial calibration and the response factors of the continuing calibrations.

The following is a list of the QA/QC flags used in qualifying the results:

A - Assumed volume for method blank.
B - Concentration less than 3 times method blank value.
C - Compound calibration relative standard deviation (RSD) >25% (concentrations calculated by average response factor only).
E - Exceeds calibration range.
J - Below 1.0 nL quantitation limit.
U -Not detected.

4.0 DATA ASSESSMENT

The following summarizes the data validation performed on the air toxic analysis of 8 Summa canister air samples received at REAC on 12/6/99, chain of custody 03218, collected on 12/3/99 for the Air Monitoring, Sampling, Analysis and Modeling Support, and Underwater Survey Activities project, WA# 0-110.

The data in this report have been validated to two significant figures. Any other representation of the data is the responsibility of the user.

The samples were treated with procedures consistent with those specified in SOP #1008.

The method blank of 12/7/99 contained 0.4 ppbv of benzene. The concentrations of benzene in samples 29004, 29005 and 29006 should be regarded as not detected.

The trip blank, sample 29007, contained 0.7 ppbv of trichlorofluoromethane, 0.6 ppbv of 1,1-dichloroethene, 0.8 ppbv methylene chloride, 0.6 ppbv trans 1.2-dichloroethylene, 0.6 ppbv 1,1-dichloroethane, 0.7 ppbv trichloroethane, 0.5 ppbv 1,2-dichloroethane, 0.6 ppbv benzene, 0.7 ppbv carbon tetrachloride, 0.6 ppbv trichloroethylene, 0.6 ppbv dibromomethane, 0.5 ppbv bromochloromethane, 0.6 ppbv of toluene and 0.6 ppbv tetrachloroethylene. The data are affected as follows:

The concentrations of benzene and toluene in samples 29000, 29001, 29003, 29004, 29005 and 29006 should be regarded as not detected.

The concentration of toluene in sample 29002 should be regarded as not detected.

The remainder of the data are not affected as the other analytes detected in the trip blank were not detected in the samples.

In the initial calibration of 9/25/99 the acceptable QC limits were exceeded for the percent relative standard deviation for 1,1,1-trichloroethane (26%) and carbon tetrachloride (27%). The data are not affected because these analytes were not detected in the associated samples.

TABLE 1 - GC/MS Instrument Conditions

A. Single Tube Desorber Conditions

Cool Desorb Temperature	: 20°C
Cool Desorb Time	: 1 minute
Cool Desorb Flow	: 50 mL/min
Hot Desorb Temperature	: 240°C
Hot Desorb Time	: 10.0 minute
Hot Desorb Flow	: 50 mL/min

(2) Preconcentrator Conditions:

M-1 Cryotrap Temperature	: -160°C
Internal Standard Trap Time	: 1.0 minute
Sample flow	: 150 mL/min
M-1 Cryotrap Desorb Temperature	: 20°C
M-2 Cryotrap Temperature	: -10°C
Transfer (M-1 to M-2) Time	: 4.5 minutes
M-2 Cryotrap Desorb Temperature	: 240°C
M-3 Cryotrap Temperature	: -160°C
Transfer (M-2 to M-3) Time	: 3.5 minutes
Injection Time	: 2.0 minutes

C. GC/MS Conditions, Sample Analysis:

Initial Temperature	: 40.0°C
Initial Time	: 6.0 minutes
Ramp Rate	: 8.0°C/min
Final Temperature	: 185.0°C
Final Time	: 11.4 minutes
Run Time	: 35.5 minutes
Mass Scan Range:	: 35 to 250 AMU

Column: 0.32 mm x 60 meter Restek RTx-5, 1.50 um film thickness (Restek Corporation)

TABLE 2 - Air Toxic Standards (Concentrations and Quantitation Ions)

Compound	Cylinder	Conc. (ppmv)	Quant. Ion
chloromethane	ALM009519	0.98	50
vinyl chloride	ALM009519	0.97	62
chloroethane	ALM009519	1.00	64
trichlorofluoromethane	ALM009519	1.04	101
1,1-dichloroethene	ALM009519	1.02	61
dichloromethane	ALM009519	1.00	49
trans-1,2-dichloroethene	ALM009519	1.00	61
1,1-dichloroethane	ALM009519	1.02	63
trichloromethane	ALM009519	1.02	83
1,1,1-trichloroethane	ALM009519	1.01	97
1,2-dichloroethane	ALM009519	1.02	62
benzene	ALM009519	1.00	78
carbon tetrachloride	ALM009519	0.98	117
trichloroethene	ALM009519	1.00	130
dibromomethane	ALM009519	0.98	174
bromodichloromethane	ALM009519	1.01	83
toluene	ALM009519	1.01	91
1,1,2-trichloroethane	ALM009519	0.98	97
tetrachloroethene	ALM009519	1.00	166
ethylbenzene	ALM009519	1.01	91
meta-xylene	ALM009519	1.02	91
styrene	ALM009519	1.04	104
ortho-xylene	ALM009519	1.04	91
1,1,2,2-tetrachloroethane	ALM009519	1.00	83
1,3,5-trimethylbenzene	ALM009519	1.05	120
Surrogate Standards			
bromochloromethane	ALM046281	1.06	49
p-bromofluorobenzene	ALM046281	1.06	95

Table 3 Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites
(concentrations in ppbv)

Sample Number	Method	29007	29000	29000 Rep	29001
Sample Location	Blank	Trip Blank	01	01	02
Date Sampled	N/A	12/03/99	12/03/99	12/03/99	12/03/99
Date Analyzed	12/07/99	12/06/99	12/06/99	12/06/99	12/06/99
Data File	CET016	ABS001	ABS002	ABS013	ABS003
Chloromethane	4 U	4 U	4 U	4 U	4 U
Vinyl Chloride	4 U	4 U	4 U	4 U	4 U
Chloroethane	4 U	4 U	4 U	4 U	4 U
Trichlorofluoromethane	4 U	0.7 J	4 U	4 U	4 U
1,1-Dichloroethene	4 U	0.6 J	4 U	4 U	4 U
Methylene Chloride	4 U	0.8 J	4 U	4 U	4 U
trans-1,2-Dichloroethylene	4 U	0.6 J	4 U	4 U	4 U
1,1-Dichloroethane	4 U	0.6 J	4 U	4 U	4 U
Trichloromethane	4 U	4.0 U	4 U	4 U	4 U
1,1,1-Trichloroethane	4 U	0.7 J	4 U	4 U	4 U
1,2-Dichloroethane	4 U	0.5 J	4 U	4 U	4 U
Benzene	4 U	0.6 J	0.4 J	0.4 J	0.4 J
Carbon Tetrachloride	4 U	0.7 J	4 U	4 U	4 U
Trichloroethylene	4 U	0.6 J	4 U	4 U	4 U
Dibromomethane	4 U	0.6 J	4 U	4 U	4 U
Bromodichloromethane	4 U	0.5 J	4 U	4 U	4 U
Toluene	4 U	0.6 J	0.6 J	0.6 J	0.5 J
1,1,2-Trichloroethane	4 U	4 U	4 U	4 U	4 U
Tetrachloroethylene	4 U	0.6 J	4 U	4 U	4 U
Ethylbenzene	4 U	4 U	4 U	4 U	4 U
m & p-Xylenes	4 U	4 U	4 U	4 U	4 U
Styrene	4 U	4 U	4 U	4 U	4 U
o-Xylene	4 U	4 U	4 U	4 U	4 U
1,1,2,2-Tetrachloroethane	4 U	4 U	4 U	4 U	4 U
1,3,5-Trimethylbenzene	4 U	4 U	4 U	4 U	4 U
p-Bromofluorobenzene (% Rec)	117	116	123	125	125
Pressurized Sample Volume (mL)	250	250	750	750	750
Initial Pressure (psia)	N/A	N/A	8.2	10.4	10.2
Final Pressure (psia)	N/A	N/A	24.6	31.2	30.6
Quantitation Limit (ppbv)	4	4	4	4	4

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected
N/A - Not Applicable

Table 3 (cont.) Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites
(concentrations in ppbv)

Sample Number	29002	29003	Method	29004	29005
Sample Location	03	04	Blank	05	UPW1
Date Sampled	12/03/99	12/03/99	N/A	12/03/99	12/03/99
Date Analyzed	12/06/99	12/06/99	12/07/99	12/07/99	12/07/99
Data File	ABS004	ABS005	ABS007	ABS011	ABS012
Chloromethane	4 U	4 U	4 U	4 U	4 U
Vinyl Chloride	4 U	4 U	4 U	4 U	4 U
Chloroethane	4 U	4 U	4 U	4 U	4 U
Trichlorofluoromethane	4 U	4 U	4 U	4 U	4 U
1,1-Dichloroethene	4 U	4 U	4 U	4 U	4 U
Methylene Chloride	4 U	4 U	4 U	4 U	4 U
trans-1,2-Dichloroethylene	4 U	4 U	4 U	4 U	4 U
1,1-Dichloroethane	4 U	4 U	4 U	4 U	4 U
Trichloromethane	4 U	4 U	4 U	4 U	4 U
1,1,1-Trichloroethane	4 U	4 U	4 U	4 U	4 U
1,2-Dichloroethane	4 U	4 U	4 U	4 U	4 U
Benzene	4 U	0.4 J	0.4 J	0.4 J	0.4 J
Carbon Tetrachloride	4 U	4 U	4 U	4 U	4 U
Trichloroethylene	4 U	4 U	4 U	4 U	4 U
Dibromomethane	4 U	4 U	4 U	4 U	4 U
Bromodichloromethane	4 U	4 U	4 U	4 U	4 U
Toluene	0.6 J	0.5 J	4 U	0.6 J	0.5 J
1,1,2-Trichloroethane	4 U	4 U	4 U	4 U	4 U
Tetrachloroethylene	4 U	4 U	4 U	4 U	4 U
Ethylbenzene	4 U	4 U	4 U	4 U	4 U
m & p-Xylenes	4 U	4 U	4 U	4 U	4 U
Styrene	4 U	4 U	4 U	4 U	4 U
o-Xylene	4 U	4 U	4 U	4 U	4 U
1,1,2,2-Tetrachloroethane	4 U	4 U	4 U	4 U	4 U
1,3,5-Trimethylbenzene	4 U	4 U	4 U	4 U	4 U
p-Bromofluorobenzene (% Rec)	130	128	117	126	129
Pressurized Sample Volume (mL)	750	750	250	750	750
Initial Pressure (psia)	9.2	8.5	N/A	9.8	10.4
Final Pressure (psia)	27.6	25.5	N/A	27.4	31.2
Quantitation Limit (ppbv)	4	4	4	4	4

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected
N/A - Not Applicable

Table 3 (cont.) Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites
(concentrations in ppbv)

Sample Number	29006
Sample Location	UPW2
Date Sampled	12/03/99
Date Analyzed	12/07/99
Data File	ABS014

Chloromethane	4	U
Vinyl Chloride	4	U
Chloroethane	4	U
Trichlorofluoromethane	4	U
1,1-Dichloroethene	4	U
Methylene Chloride	4	U
trans-1,2-Dichloroethylene	4	U
1,1-Dichloroethane	4	U
Trichloromethane	4	U
1,1,1-Trichloroethane	4	U
1,2-Dichloroethane	4	U
Benzene	0.4	J
Carbon Tetrachloride	4	U
Trichloroethylene	4	U
Dibromomethane	4	U
Bromodichloromethane	4	U
Toluene	0.5	J
1,1,2-Trichloroethane	4	U
Tetrachloroethylene	4	U
Ethylbenzene	4	U
m & p-Xylenes	4	U
Styrene	4	U
o-Xylene	4	U
1,1,2,2-Tetrachloroethane	4	U
1,3,5-Trimethylbenzene	4	U
p-Bromofluorobenzene (% Rec)	126	
Pressurized Sample Volume (mL)	750	
Initial Pressure (psia)	8.3	
Final Pressure (psia)	24.9	
Quantitation Limit (ppbv)	4	

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected
N/A - Not Applicable

Table 4 Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	Method	Reference Standard:	Bromochloromethane
Sample Location:	Blank	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	N/A	Reference Std Area:	11910887
Date Analyzed:	12/07/99	Initial Pressure (psig):	N/A
Data File:	CET016	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)	
dichlorodifluoro-methane	6.114	589021	2	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29007	Reference Standard:	Bromochloromethane
Sample Location:	Trip Blank	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	11910887
Date Analyzed:	12/06/99	Initial Pressure (psig):	N/A
Data File:	ABS001	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)	
dichlorodifluoro-methane	6.114	605224	2	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29000	Reference Standard:	Bromochloromethane
Sample Location:	01	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	11910887
Date Analyzed:	12/06/99	Initial Pressure (psig):	8.2
Data File:	ABS002	Final Pressure (psig):	24.6

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.098	689263	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29001	Reference Standard:	Bromochloromethane
Sample Location:	02	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	11910887
Date Analyzed:	12/06/99	Initial Pressure (psig):	10.2
Data File:	ABS003	Final Pressure (psig):	30.6

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.098	664275	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29002	Reference Standard:	Bromochloromethane
Sample Location:	03	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	11910887
Date Analyzed:	12/06/99	Initial Pressure (psig):	9.2
Data File:	ABS004	Final Pressure (psig):	27.6

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.114	636487	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29003	Reference Standard:	Bromochloromethane
Sample Location:	04	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	11910887
Date Analyzed:	12/06/99	Initial Pressure (psig):	8.5
Data File:	ABS005	Final Pressure (psig):	25.5

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.122	629600	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	Method	Reference Standard:	Bromochloromethane
Sample Location:	Blank	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	N/A	Reference Std Area:	10549361
Date Analyzed:	12/07/99	Initial Pressure (psig):	N/A
Data File:	ABS007	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.066	555849	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29004	Reference Standard:	Bromochloromethane
Sample Location:	05	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	10549361
Date Analyzed:	12/07/99	Initial Pressure (psig):	9.8
Data File:	ABS011	Final Pressure (psig):	27.4

Compound Name	Retention Time	Area	Concentration (ppbv)
dichlorodifluoro-methane	6.082	615240	2 *

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29005	Reference Standard:	Bromochloromethane
Sample Location:	UPW1	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	10549361
Date Analyzed:	12/07/99	Initial Pressure (psig):	10.4
Data File:	ABS012	Final Pressure (psig):	31.2

Compound Name	Retention Time	Area	Concentration (ppbv)	
dichlorodifluoro-methane	6.075	599625	2	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 (cont.) Air Toxic Non-target Compounds
Summa Canister Sample Results
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample Number:	29006	Reference Standard:	Bromochloromethane
Sample Location:	UPW2	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	750	Reference Std Volume (mL):	500
Date Sampled:	12/03/99	Reference Std Area:	10549361
Date Analyzed:	12/07/99	Initial Pressure (psig):	8.3
Data File:	ABS014	Final Pressure (psig):	24.9

Compound Name	Retention Time	Area	Concentration (ppbv)	
dichlorodifluoro-methane	6.066	638029	3	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 5 Air Toxic MS/MSD Recovery Summary for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample Number		29006	29006 MS		29006 MSD		
Sample Location		UPW2	UPW2		UPW2		
Date Sampled		12/03/99	12/03/99		12/03/99		
Date Analyzed	Spike	12/07/99	12/08/99	%	12/08/99	%	
Data File	Amount	ABS014	ABS018	Recovery	ABS019	Recovery	RPD
Chloromethane	9.8	U	10.13	103	10.03	102	1
Vinyl Chloride	9.7	U	10.05	104	9.87	102	2
Chloroethane	10.0	U	10.59	106	10.54	105	0.5
Trichlorofluoromethane	10.4	U	9.93	95	9.85	95	1
1,1-Dichloroethene	10.2	U	10.27	101	10.15	100	1
Methylene Chloride	10.0	U	10.14	101	10.01	100	1
trans-1,2-Dichloroethene	10.0	U	10.18	102	10.08	101	1
1,1-Dichloroethane	10.2	U	10.09	99	9.87	97	2
Trichloromethane	10.2	U	10.22	100	9.98	98	2
1,1,1-Trichloroethane	10.1	U	9.67	96	9.25	92	4
1,2-Dichloroethane	10.2	U	10.04	98	9.76	96	3
Benzene	10.0	0.11	10.02	99	9.79	97	2
Carbon Tetrachloride	9.8	U	9.49	97	9.40	96	1
Trichloroethylene	10.0	U	10.05	101	9.84	98	2
Dibromomethane	9.8	U	10.13	103	9.96	102	2
Bromodichloromethane	10.1	U	10.36	103	10.08	100	3
Toluene	10.1	0.13	10.33	101	10.34	101	0.1
1,1,2-Trichloroethane	9.8	U	10.77	110	10.67	109	1
Tetrachloroethylene	10.0	U	10.09	101	9.81	98	3
Ethylbenzene	10.1	U	11.20	111	11.06	110	1
meta & para-Xylenes	10.2	U	11.01	108	11.05	108	0.4
Styrene	10.4	U	10.63	102	10.75	103	1
ortho-Xylene	10.4	U	11.15	107	11.04	106	1
1,1,2,2-Tetrachloroethane	10.0	U	10.33	103	10.24	102	1
1,3,5-trimethlybenzene	10.5	U	9.69	92	9.51	91	2
p-Bromofluorobenzene (% Rec.)	N/A	126	104	N/A	103	N/A	N/A

N/A - Not Applicable

APPENDIX A

CHAIN-OF-CUSTODY

Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities, Aberdeen, MD

Sampled on 3 December 1999

WA #: 0-110

REAC, Ed , NJ
(908) 321- J
EPA Contract 68-~~01-0022~~ AR
0699-283

CHAIN OF CUSTODY RECORD

Project Name: ARS Burn support
Project Number: 1A00110
RPW Contact: John Johnson Phone: 321-4248
LM

No: 03218
SHEET NO. 1 OF 1

12699-

Sample Identification

VOCs

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of ~~Bottles~~ Summa	Container/Preservative	Volume (L)	VOCs
643	29000	01	A	12/3/99	1	summa/none	3.6	✓
644	29001	02					3.6	✓
645	29002	03					3.6	✓
646	29003	04					3.6	✓
647	29004	05					3.6	✓
648	29005	UPW1					3.6	✓
649	29006	UPW2					3.6	✓
650	29007	Trip blank	↓	↓	↓	↓	0	✓

AR

0022

Matrix:

SD -	Sediment	PW -	Potable Water	S -	Soil
DS -	Drum Solids	GW -	Groundwater	W -	Water
DL -	Drum Liquids	SW -	Surface Water	O -	Oil
X -	Other	SL -	Sludge	A -	Air

Special Instructions:

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
Standard		12/6/99		12/6/99	9:50am	All Analyses		12/6/99			10:30

FORM #4

APPENDIX B

Analytical Report (PAH, Inorganic Acids, Metals, and Dioxins/Furans)

Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site

July 2000

ANALYTICAL REPORT

Prepared by
Lockheed Martin

Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
Aberdeen Proving Ground, Aberdeen, MD

February 2000

EPA Work Assignment No. 0-110
LOCKHEED MARTIN Work Order No. R1A00110
EPA Contract No. 68-C99-223

Submitted to
D. Mickunas
EPA-ERTC

2/14/00
A. Dubois — Date
Task Leader

2/15/2000
D. Miller — Date
Analytical Section Leader

2/15/2000
S. Clapp — Date
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Analysis by:
REAC
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Prepared by:
G. Karustis

Reviewed by:
D. Killeen

Table of Contents

Appendices will be furnished on request.

Introduction

REAC in response to WA # 0-110, provided analytical support for environmental samples collected from Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities, located in Aberdeen Proving Ground, Aberdeen, MD as described in the following table. The support also included QA/QC, data review, and preparation of an analytical report containing a summary of the analytical methods, the results, and the QA/QC results.

The samples were treated with procedures consistent with those described in SOP # 1008 and are summarized in the following table:

COC #	Number of Samples	Sampling Date	Date Received	Matrix	Analysis	Laboratory
03215	9	12/3/99	12/6/99	Air	Dioxin	SWRI*
03217	10	12/3/99	12/6/99	Air	NIOSH 5515	REAC
03132	10	12/3/99	12/6/99	Air	Inorganic Acids	SWRI*
03133	10	12/3/99	12/6/99	Air	Metals	SWRI*

* SWRI denotes Southwest Research Institute

Case Narrative

The data in this report have been validated to two significant figures. Any other representation of the data is the responsibility of the user.

PAH in Air Package J 475

The data were examined and were found to be satisfactory.

Metals in Air Package J 012

The lot blank contained 2.3 µg/ filter aluminum, 5.5 µg/ filter calcium, 0.44 µg/ filter chromium, 0.45 µg/ filter iron, 10.0 µg/ filter sodium and 0.12 µg/ filter zinc. The data are affected as follows:

The results for calcium, chromium, iron, sodium and zinc in sample 28050 should be regarded as not detected because the concentration of analyte was less than five times that of the lot blank.

The results for aluminum, calcium, chromium, iron and sodium in samples 28051 and 28058 (the trip blank) should be regarded as not detected because the concentration of analyte was less than five times that of the lot blank.

The results for aluminum, calcium, chromium, iron, sodium and zinc in samples 28052, 28053, 28054, 28055, 28056 and 28057 (field blank) should be regarded as not detected because the concentration of analyte was less than five times that of the lot blank.

The acceptable QC limits for the percent recovery were exceeded in the laboratory control sample for phosphorous (73%), tin (63%) and zirconium (62%). The concentrations of these metals in samples 28050, 28051, 28052, 28053, 28054, 28055, 28056, 28057, 28058 and 28059 should be regarded as estimated.

The acceptable QC limits for the percent recovery were exceeded in the blank spike for phosphorous (52%), tin (36%) and zirconium (37%) and in the blank spike duplicate for the same metals (51%, 34% and 35%, respectively). The concentrations of these metals in samples 28050, 28051, 28052, 28053, 28054, 28055, 28056, 28057, 28058 and 28059 should be regarded as estimated.

Dioxins in Air Package J 015

The samples were received at 12° C by the subcontract laboratory.

The method blank contained 38.2 pg OCDD, 12.4 pg 1234678-HpCDF and 24.3 pg OCDF. The data are affected as follows:

Sample ID	Analyte	The data should be regarded as
28080	OCDF	Not detected
28081	OCDD, OCDF	Not detected
28082	OCDD, OCDF	Not detected
28083	OCDF	Not detected
28085	OCDD, OCDF	Not detected
28086	OCDD, OCDF 1234678-HpCDF	Not detected
28088	OCDD, OCDF 1234678-HpCDF	Not detected
28089	OCDD	Not detected

The values in the above samples are regarded as not detected because they are less than five times the mass found in the method blank.

The trip blank, 28088, contained 17.2 pg OCDD, 7.48 pg 12378-PeCDF, 7.12 pg 1234678-HpCDF and 11.3 pg OCDF. The trip blank, 28089, contained 8.62 pg 123678-HxCDD, 5.74 pg 1234678-HpCDD, 19.0 pg OCDD and 4.18 pg 12378-PeCDF. The data are affected as follows:

Sample ID	Analyte	The data should be regarded as
28081	12378-PeCDF	Not detected
28082	1234678-HpCDD	Not detected
28083	12378-PeCDF	Not detected
28084	12378-PeCDF	Not detected

28085	1234678-HpCDD	Not detected
28086	12378-PeCDF, 123678-HxCDD	Not detected

The values in the above samples are regarded as not detected because they are less than five times the mass found in the trip blank.

Samples 28083, 28085 and 28086 had masses of 12378-PeCDD that were less than five times that found in the field blank. The values of 12378-PeCDD for these samples should be regarded as not detected.

In the ending calibration verification standard of 12/11/99 (9:06), the acceptable percent difference QC limits were exceeded for 12378-PeCDD (34%), 123478-HxCDD (20.7%), ^{13}C-12378-PeCDF (62%), ^{13}C-12378-PeCDD (64%) and ^{13}C-OCDD (87%). The subcontract laboratory used the average relative response factor calculated from the two continuing calibrations bracketing samples, method blank 12/7/99, 28080 and 28081. Only estimated values or EMPC values were reported in the samples. The data are not affected.

The acceptable QC limits were exceeded for the percent recoveries of several internal standards. The internal standards in question and the samples and analytes involved are summarized as follows:

Sample ID	Internal standard	Effect
28086	^{13}C-2378-TCDF	The data are not affected
28088	^{13}C-2378-TCDF	The data are not affected
	^{13}C-1234678-HpCDF	The data for 1234678-HpCDF should be regarded as estimated.
28089	^{13}C-2378-TCDF	The data are not affected
	^{13}C-1234678-HpCDF	The data are not affected
Blank Spike	^{13}C-2378-TCDF	The data for 2378-TCDF should be regarded as estimated

Inorganic Acids in Air Package J 013

The data were examined and were found to be satisfactory.

Summary of Abbreviations

AA	Atomic Absorption
B	The analyte was found in the blank
BFB	Bromofluorobenzene
C	Centigrade
D	(Surrogate Table) this value is from a diluted sample and was not calculated (Result Table) this result was obtained from a diluted sample
Dioxin	denotes Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans and/or PCDD and PCDF
CLP	Contract Laboratory Protocol
COC	Chain of Custody
CONC	Concentration
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
DFTPP	Decafluorotriphenylphosphine
DL	Detection Limit
E	The value is greater than the highest linear standard and is estimated
EMPC	Estimated maximum possible concentration
ICAP	Inductively Coupled Argon Plasma
ISTD	Internal Standard
J	The value is below the method detection limit and is estimated
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDL	Method Detection Limit
MI	Matrix Interference
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Molecular Weight
NA	either Not Applicable or Not Available
NC	Not Calculated
NR	Not Requested
NS	Not Spiked
% D	Percent Difference
% REC	Percent Recovery
PPB	Parts per billion
PPBV	Parts per billion by volume
PPMV	Parts per million by volume
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QL	Quantitation Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SIM	Selected Ion Monitoring
TCLP	Toxic Characteristics Leaching Procedure
U	Denotes not detected
W	Weathered analyte; the results should be regarded as estimated

m^3	cubic meter	kg	kilogram	μg	microgram
L	liter	g	gram	pg	picogram
mL	milliliter	mg	milligram	ng	nanogram
μL	microliter				

*	denotes a value that exceeds the acceptable QC limit
	Abbreviations that are specific to a particular table are explained in footnotes on that table

Revision 1/5/00

Analytical Procedure for PAH in Air (XAD-2 Tubes)

XAD-2 Tube Preparation

The XAD-2 tubes were analyzed for polycyclic aromatic hydrocarbons (PAH) using modified NIOSH Method 5515. The front, back and filter portions of the tubes were analyzed separately by extracting them with 2.0 mL methylene chloride. A preweighed filter was also collected with these tubes and this filter was extracted with 4.0 mL methylene chloride. One mL of extract was spiked with 20 µL of a 2000 ppm XAD internal standards solution consisting of naphthalene-d_8, acenaphthene-d_{10}, phenanthrene-d_{10}, chrysene-d_{12}, and perylene-d_{12}, resulting in a 40.0 ppm concentration and analyzed.

GC/MS Analysis

An HP 6890 MSD, equipped with a 6890 autosampler and controlled by a personal computer equipped with HP-Enviroquant software was used to analyze the samples.

The instrument conditions were:

Column	Restek Rtx-5 (cross bonded SE-54) 30 meter x 0.25 mm ID, 0.50 µm film thickness.
Flow Rate	1 mL/min, EPC enabled
Injection Temperature	280° C
Transfer Temperature	280° C
Source Temperature & Analyzer Temperature	Controlled by thermal transfer of heat from Transfer Line
Temperature	280° C
Temperature Program	70° C for 0.5 min 30° C/min to 295° C hold for 8 minutes 30° C/min to 315° C; hold for 7 min
Pulsed Splitless Injection	Pressure Pulse = 16 psi for 1.0 min, then normal flow 8:1 Split Ratio
Injection Volume	1µL
	Must use 4 mm ID single gooseneck liners packed with 10 mm plug of silanized and conditioned glass wool

The GC/MS was calibrated using 6 PAH standards at 10, 25, 50, 75, 100 and 150 ppm. Before analysis each day the system was tuned with 50-ng decafluorotriphenylphosphine (DFTPP) and passed a continuing calibration check by analyzing a 50µg/mL daily standard. The QC limit for the initial calibration is %RSD less than 30 and %D less than 25 for the daily check. Sample quantification is based on the average response factor of the calibration curve or the response factor of the daily calibration check.

The XAD-2 tube PAH results are listed in Table 1.1. Tentatively identified compounds are listed in Table 1.2. The following equations were used to calculate the analyte - total µg/sample:

$$\mu g/sample = C_u x V x DE = \frac{A_u x C_{is} x V x DE}{A_{is} x RF}$$

where

C_u = Concentration of the analyte (µg/mL)
V = Extraction Volume (mL)
DE = Desorption Efficiency = 100/(% Recovery)
A_u = Area of the analyte
C_{is} = Concentration of the internal standard (µg/mL)
A_{is} = Area of the internal standard

The Relative Response Factor, RRF, is calculated from the calibration standard mixture using

$$RRF = \frac{A_u x C_{is}}{A_{is} x C_u}$$

where

RRF = Relative Response Factor (unitless)
A_u = Area of Analyte in the standard mixture
C_{is} = Concentration of Internal Standard in the standard mixture (µg/mL)
A_{is} = Area of Internal Standard in the standard mixture
C_u = Concentration of Analyte in the standard mixture (µg/mL)

The concentration of the analyte in mg/m^3 and ppbv (parts per billion by volume) is calculated using the following:

$$mg/m^3 = \frac{(Total\ \mu g\ front + Total\ \mu g\ back)}{Liters\ Sampled}$$

$$ppbv = \frac{mg/m^3 x 24.45 x 1000}{MW}$$

where MW is the molecular weight of the analyte

Revision of 5/5/98

LINEAR SCAN COMPOUND AND ION LIST FOR PAH/XAD TUBES

Compound	Quant Ion	Secondary Ions
Naphthalene-d_8 (IS)	136	108
Naphthalene	128	127, 129
2-Methylnaphthalene	142	141, 115
1-Methylnaphthalene	142	141, 115
Biphenyl	154	153, 152
2,6-Dimethylnaphthalene	156	141, 128
2-Fluorobiphenyl (SURR)	172	171, 173
Acenaphthene-d_8 (IS)	164	162
Acenaphthylene	152	151, 153
Acenaphthene	153	152, 151
Dibenzofuran	168	139
Fluorene	166	167, 165
Phenanthrene-d_{10} (IS)	188	189
Phenanthrene	178	179, 176
Anthracene	178	179, 176
Carbazole	167	166, 168
Fluoranthene	202	101, 200
Pyrene	202	101, 200
Terphenyl-d_{14} (SURR)	244	243
Chrysene-d_{12} (IS)	240	236
Benzo(a)anthracene	228	226, 229
Chrysene	228	226, 229
Perylene-d_{12} (IS)	264	260
Benzo(b)fluoranthene	252	250, 126
Benzo(k)fluoranthene	252	250, 126
Benzo(e)pyrene	252	250, 126
Benzo(a)pyrene	252	250, 126
Indeno(1,2,3-cd)pyrene	276	138, 277
Dibenzo(a,h)anthracene	278	139, 278
Benzo(g,h,i)perylene	276	277, 138

Analytical Procedure for Metals in Air

The subcontract laboratory determined the metal concentration in the samples by analyzing them according to NIOSH method 7300. The results of the analysis are listed in Table 1.3.

Analytical Procedure for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

The subcontract laboratory determined the concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in the samples by analyzing them according to USEPA Method 8290. The results of the analysis are listed in Table 1.4.

Analytical Procedure for Inorganic Acids in Air

The subcontract laboratory determined the concentration of inorganic acids in the samples by analyzing them according to NIOSH Method 7903. The results of the analysis for the soil samples are listed in Table 1.5.

Table 1.1 Results of the Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample No.	28079		28070		28071		28072		28073	
Sampling Location	Lot Blank		0-1		0-2		0-3		0-4	
Volume (L)	0		474.6		458		462		460	
Compound Name	Conc. µg	MDL µg	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv
Naphthalene	U	8.6	U	3.5	U	3.6	U	3.6	U	3.6
2-Methylnaphthalene	U	9.1	U	3.3	U	3.4	U	3.4	U	3.4
1-Methylnaphthalene	U	9.0	U	3.2	U	3.4	U	3.3	U	3.4
Biphenyl	U	9.2	U	3.1	U	3.2	U	3.2	U	3.2
2,6-Dimethylnaphthalene	U	9.3	U	3.1	U	3.2	U	3.1	U	3.2
Acenaphthylene	U	9.2	U	3.1	U	3.2	U	3.2	U	3.2
Acenaphthene	U	9.0	U	3.0	U	3.1	U	3.1	U	3.1
Dibenzofuran	U	9.0	U	2.7	U	2.8	U	2.8	U	2.8
Fluorene	U	9.1	U	2.8	U	2.9	U	2.9	U	2.9
Phenanthrene	U	9.2	U	2.7	U	2.8	U	2.7	U	2.8
Anthracene	U	8.9	U	2.6	U	2.7	U	2.6	U	2.7
Carbazole	U	9.7	U	3.0	U	3.1	U	3.1	U	3.1
Fluoranthene	U	9.2	U	2.4	U	2.4	U	2.4	U	2.4
Pyrene	U	9.2	U	2.3	U	2.4	U	2.4	U	2.4
Benzo(a)anthracene	U	9.2	U	2.1	U	2.2	U	2.1	U	2.2
Chrysene	U	8.9	U	2.0	U	2.1	U	2.1	U	2.1
Benzo(b)fluoranthene	U	9.6	U	2.0	U	2.0	U	2.0	U	2.0
Benzo(k)fluoranthene	U	9.3	U	1.9	U	2.0	U	1.9	U	2.0
Benzo(e)pyrene	U	9.5	U	1.9	U	2.0	U	2.0	U	2.0
Benzo(a)pyrene	U	9.6	U	2.0	U	2.0	U	2.0	U	2.0
Indeno(1,2,3-cd)pyrene	U	10	U	1.9	U	1.9	U	1.9	U	1.9
Dibenzo(a,h)anthracene	U	10	U	1.9	U	1.9	U	1.9	U	1.9
Benzo(g,h,i)perylene	U	10	U	1.9	U	2.0	U	2.0	U	2.0

Table 1.1 (cont.) Results of the Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample No.	28074		28075		28076		28077		28078	
Sampling Location	0-5		0-UW1		0-UW2		Field Blank		Trip Blank	
Volume (L)	462		424		419.3		0		0	
Compound Name	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. µg	MDL µg	Conc. µg	MDL µg
Naphthalene	U	3.6	U	3.9	U	3.9	U	8.6	U	8.6
2-Methylnaphthalene	U	3.4	U	3.7	U	3.7	U	9.1	U	9.1
1-Methylnaphthalene	U	3.3	U	3.6	U	3.7	U	9.0	U	9.0
Biphenyl	U	3.2	U	3.4	U	3.5	U	9.2	U	9.2
2,6-Dimethylnaphthalene	U	3.1	U	3.4	U	3.5	U	9.3	U	9.3
Acenaphthylene	U	3.2	U	3.5	U	3.5	U	9.2	U	9.2
Acenaphthene	U	3.1	U	3.4	U	3.4	U	9.0	U	9.0
Dibenzofuran	U	2.8	U	3.1	U	3.1	U	9.0	U	9.0
Fluorene	U	2.9	U	3.2	U	3.2	U	9.1	U	9.1
Phenanthrene	U	2.7	U	3.0	U	3.0	U	9.2	U	9.2
Anthracene	U	2.6	U	2.9	U	2.9	U	8.9	U	8.9
Carbazole	U	3.1	U	3.3	U	3.4	U	9.7	U	9.7
Fluoranthene	U	2.4	U	2.6	U	2.7	U	9.2	U	9.2
Pyrene	U	2.4	U	2.6	U	2.6	U	9.2	U	9.2
Benzo(a)anthracene	U	2.1	U	2.3	U	2.4	U	9.2	U	9.2
Chrysene	U	2.1	U	2.3	U	2.3	U	8.9	U	8.9
Benzo(b)fluoranthene	U	2.0	U	2.2	U	2.2	U	9.6	U	9.6
Benzo(k)fluoranthene	U	1.9	U	2.1	U	2.1	U	9.3	U	9.3
Benzo(e)pyrene	U	2.0	U	2.2	U	2.2	U	9.5	U	9.5
Benzo(a)pyrene	U	2.0	U	2.2	U	2.2	U	9.6	U	9.6
Indeno(1,2,3-cd)pyrene	U	1.9	U	2.1	U	2.1	U	10	U	10
Dibenzo(a,h)anthracene	U	1.9	U	2.1	U	2.1	U	10	U	10
Benzo(g,h,i)perylene	U	2.0	U	2.1	U	2.2	U	10	U	10

Table 1.2 Results of the TIC for PAHs in Air
WA # 0-110 Air Monitoring, Sampling,
Analysis, and Modeling Support,
and Underwater Survey Activites

Sample ID	Compound Identification
28079 Lot Blank	No TICs were found
28070	No TICs were found
28071	No TICs were found
28072	No TICs were found
28073	No TICs were found
28074	No TICs were found
28075	No TICs were found
28076	No TICs were found
28077 Field Blank	No TICs were found
28078 Trip Blank	No TICs were found

Table 1.3 Results of the Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Client ID	PBW		28050		28051		28052		28053		28054	
Location	-		0-1		0-2		0-3		0-4		0-5	
Air Volume (L)	0		678		698.5		713		669.9		693	
Parameter	Conc µg	MDL µg	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³
Aluminum	U	1.0	U	1.5	1.5	1.4	3.5	1.4	2.7	1.5	4.0	1.4
Arsenic	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Beryllium	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Cadmium	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Calcium	U	1.0	8.8	1.5	8.3	1.4	9.0	1.4	9.0	1.5	9.7	1.4
Chromium	U	0.1	0.59	0.15	0.47	0.14	0.64	0.14	0.66	0.15	0.76	0.14
Cobalt	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Copper	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Iron	U	0.4	1.5	0.59	1.1	0.57	1.1	0.56	0.95	0.60	2.7	0.56
Lead	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Lithium	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Magnesium	U	1.0	U	1.5	U	1.4	U	1.4	U	1.5	U	1.4
Manganese	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Molybdenum	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Nickel	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Phosphorus	U	0.4	U	0.59	U	0.57	U	0.56	U	0.60	U	0.56
Platinum	U	1.0	U	1.5	U	1.4	U	1.4	U	1.5	U	1.4
Selenium	U	0.2	U	0.29	U	0.29	U	0.28	U	0.30	U	0.29
Silver	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Sodium	U	6.0	9.0	8.8	12.6	8.6	12.5	8.4	11.6	9.0	14	8.7
Tellurium	U	1.0	U	1.5	U	1.4	U	1.4	U	1.5	U	1.4
Thallium	U	0.4	U	0.59	U	0.57	U	0.56	U	0.60	U	0.56
Tin	U	0.2	1.3	0.29	U	0.29	U	0.28	U	0.30	U	0.29
Titanium	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Vanadium	U	0.1	U	0.15	U	0.14	U	0.14	U	0.15	U	0.14
Yttrium	U	0.2	U	0.29	U	0.29	U	0.28	U	0.30	U	0.29
Zinc	U	0.1	0.21	0.15	U	0.14	0.25	0.14	0.23	0.15	0.33	0.14
Zirconium	U	0.2	U	0.29	U	0.29	U	0.28	U	0.30	U	0.29

Table 1.3 (cont.) Results of the Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Client ID	28055		28056		28057		28058		28059	
Location	0-UW1		0-UW2		Field Blank		Trip Blank		Lot Blank	
Air Volume (L)	636		648		0		0		0	
Parameter	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/filter	MDL µg/filter	Conc µg/filter	MDL µg/filter	Conc µg/filter	MDL µg/filter
Aluminum	2.0	1.6	2.0	1.5	1.3	1.0	1.3	1.0	2.3	1.0
Arsenic	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Beryllium	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Cadmium	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Calcium	10	1.6	9.0	1.5	5.4	1.0	5.5	1.0	5.5	1.0
Chromium	0.97	0.16	0.7	0.15	0.56	0.10	0.49	0.10	0.44	0.10
Cobalt	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Copper	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Iron	1.2	0.63	2.1	0.62	0.82	0.4	0.45	0.4	0.45	0.4
Lead	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Lithium	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Magnesium	U	1.6	U	1.5	U	1.0	U	1.0	U	1.0
Manganese	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Nickel	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Phosphorus	U	0.63	U	0.62	U	0.4	U	0.4	U	0.4
Platinum	U	1.6	U	1.5	U	1.0	U	1.0	U	1.0
Selenium	U	0.31	U	0.31	U	0.20	U	0.20	U	0.20
Silver	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Sodium	13.8	9.4	12	9.3	12.3	6.0	7.8	6.0	10	6.0
Tellurium	U	1.6	U	1.5	U	1.0	U	1.0	U	1.0
Thallium	U	0.63	U	0.62	U	0.4	U	0.4	U	0.4
Tin	U	0.31	U	0.31	U	0.20	U	0.20	U	0.20
Titanium	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Vanadium	U	0.16	U	0.15	U	0.10	U	0.10	U	0.10
Yttrium	U	0.31	U	0.31	U	0.20	U	0.20	U	0.20
Zinc	0.31	0.16	0.16	0.15	0.11	0.10	U	0.10	0.12	0.10
Zirconium	U	0.31	U	0.31	U	0.20	U	0.20	U	0.20

Table 1.4 Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID	Blank				28081				
Location	12/07/99				0-2				
Matrix	Air				Air				
Volume of Air (L)	0				687				
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg/m^3	EMPC pg/m^3	MDL pg/m^3	Adjusted Conc (pg/m^3)	TEF
2,3,7,8-TCDD	U	3.34	10.0	0	U	2.85	14.6	0	1
1,2,3,7,8-PeCDD	U	8.20	10.0	0	U	13.0	14.6	0	0.5
1,2,3,4,7,8-HxCDD	U	3.36	25.0	0	U	1.40	36.4	0	0.1
1,2,3,6,7,8-HxCDD	U	10.2	25.0	0	U	7.39	36.4	0	0.1
1,2,3,7,8,9-HxCDD	U	2.34	25.0	0	U	4.60	36.4	0	0.1
1,2,3,4,6,7,8-HpCDD	U	6.82	25.0	0	U	9.26	36.4	0	0.01
OCDD	38.2 J		50.0	0.0382	38.1 J		72.8	0.0381	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	U				U				
Total Hexa-Dioxins	U				U				
Total Hepta-Dioxins	U				U				
2,3,7,8-TCDF	U	5.34	10.0	0	U	5.68	14.6	0	0.1
1,2,3,7,8-PeCDF	U	5.96	10.0	0	7.69 J		14.6	0.3845	0.05
2,3,4,7,8-PeCDF	U	2.82	10.0	0	U	1.80	14.6	0	0.5
1,2,3,4,7,8-HxCDF	U	1.74	25.0	0	U	2.91	36.4	0	0.1
1,2,3,6,7,8-HxCDF	U	6.98	25.0	0	U	6.35	36.4	0	0.1
1,2,3,7,8,9-HxCDF	U	1.40	25.0	0	U	1.05	36.4	0	0.1
2,3,4,6,7,8-HxCDF	U	2.76	25.0	0	U	1.02	36.4	0	0.1
1,2,3,4,6,7,8-HpCDF	12.4 J		25.0	0.124	U	17.5	36.4	0	0.01
1,2,3,4,7,8,9-HpCDF	U	3.38	25.0	0	U	4.1	36.4	0	0.01
OCDF	24.3 J		50.0	0.0243	21.5 J		72.8	0.0215	0.001
Total Tetra-Furans	U				U				
Total Penta-Furans	U				13.9				
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				U				
Total				0.1865				0.4441	

Table 1.4 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		28080				28082			
Location		0-1 (Field Blank)				0-3			
Matrix		Air				Air			
Volume of Air (L)		0				513.3			
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	TEF
2,3,7,8-TCDD	U	1.44	10.0	0	U	5.73	19.5	0	1
1,2,3,7,8-PeCDD	8.7 J		10.0	4.35	U	16.3	19.5	0	0.5
1,2,3,4,7,8-HxCDD	U	0.740	25.0	0	U	1.68	48.7	0	0.1
1,2,3,6,7,8-HxCDD	U	5.46	25.0	0	U	15.2	48.7	0	0.1
1,2,3,7,8,9-HxCDD	U	2.18	25.0	0	U	1.40	48.7	0	0.1
1,2,3,4,6,7,8-HpCDD	U	4.20	25.0	0	19.2 J		48.7	0.192	0.01
OCDD	U	20.3	50.0	0	54.8 J		97.4	0.0548	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	8.70				U				
Total Hexa-Dioxins	U				U				
Total Hepta-Dioxins	U				19.2				
2,3,7,8-TCDF	U	2.16	10.0	0	U	7.75	19.5	0	0.1
1,2,3,7,8-PeCDF	U	7.46	10.0	0	U	11.8	19.5	0	0.05
2,3,4,7,8-PeCDF	U	1.16	10.0	0	U	4.32	19.5	0	0.5
1,2,3,4,7,8-HxCDF	U	1.54	25.0	0	U	3.00	48.7	0	0.1
1,2,3,6,7,8-HxCDF	U	3.00	25.0	0	U	5.65	48.7	0	0.1
1,2,3,7,8,9-HxCDF	U	0.640	25.0	0	U	1.36	48.7	0	0.1
2,3,4,6,7,8-HxCDF	U	0.920	25.0	0	U	3.27	48.7	0	0.1
1,2,3,4,6,7,8-HpCDF	U	8.80	25.0	0	U	19.1	48.7	0	0.01
1,2,3,4,7,8,9-HpCDF	U	1.14	25.0	0	U	2.18	48.7	0	0.01
OCDF	11.5 J		50.0	0.0115	26.3 J		97.4	0.0263	0.001
Total Tetra-Furans									
Total Penta-Furans	U				U				
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				U				
	U				U				
Total				4.3615				0.2731	

Table 1.4 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		28083				28084			
Location		0-4				0-5			
Matrix		Air				Air			
Volume of Air (L)		693				646.8			
Analyte	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	TEF
2,3,7,8-TCDD	U	3.46	14.4	0	U	4.76	15.5	0	1
1,2,3,7,8-PeCDD	13.8 J		14.4	6.9	U	9.89	15.5	0	0.5
1,2,3,4,7,8-HxCDD	U	0.895	36.1	0	U	2.10	38.7	0	0.1
1,2,3,6,7,8-HxCDD	U	8.63	36.1	0	U	7.17	38.7	0	0.1
1,2,3,7,8,9-HxCDD	U	2.51	36.1	0	U	1.42	38.7	0	0.1
1,2,3,4,6,7,8-HpCDD	U	14.9	36.1	0	U	6.00	38.7	0	0.01
OCDD	U	32.6	72.2	0	U	23.0	77.3	0	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	13.8				U				
Total Hexa-Dioxins	U				U				
Total Hepta-Dioxins	U				U				
2,3,7,8-TCDF	U	7.33	14.4	0	5.26 J		15.5	0.526	0.1
1,2,3,7,8-PeCDF	7.79 J		14.4	0.3895	7.02 J		15.5	0.351	0.05
2,3,4,7,8-PeCDF	U	1.41	14.4	0	U	3.31	15.5	0	0.5
1,2,3,4,7,8-HxCDF	U	2.48	36.1	0	1.79 J		38.7	0.179	0.1
1,2,3,6,7,8-HxCDF	U	8.20	36.1	0	U	6.71	38.7	0	0.1
1,2,3,7,8,9-HxCDF	0.491 J		36.1	0.0491	U	0.866	38.7	0	0.1
2,3,4,6,7,8-HxCDF	U	1.70	36.1	0	U	1.08	38.7	0	0.1
1,2,3,4,6,7,8-HpCDF	U	16.1	36.1	0	U	15.2	38.7	0	0.01
1,2,3,4,7,8,9-HpCDF	U	2.77	36.1	0	U	1.08	38.7	0	0.01
OCDF	20.1 J		72.2	0.0201	U	28.0	77.3	0	0.001
Total Tetra-Furans	U				7.64				
Total Penta-Furans	7.79				7.02				
Total Hexa-Furans	0.491				1.79				
Total Hepta-Furans	U				U				
Total				7.3587				1.056	

Table 1.4 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		28085				28086				
Location		10-UW1				10-UW2				
Matrix		Air				Air				
Volume of Air (L)		406				612				
Analyte	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	TEF
2,3,7,8-TCDD	U	6.06	24.6	0	U	2.45	16.3	0	1
1,2,3,7,8-PeCDD	15.7 J		24.6	7.85	11.7 J		16.3	5.85	0.5
1,2,3,4,7,8-HxCDD	U	3.74	61.6	0	U	1.37	40.8	0	0.1
1,2,3,6,7,8-HxCDD	U	13.0	61.6	0	10.2 J		40.8	1.02	0.1
1,2,3,7,8,9-HxCDD	U	4.04	61.6	0	U	1.14	40.8	0	0.1
1,2,3,4,6,7,8-HpCDD	27.7 J		61.6	0.277	U	14.5	40.8	0	0.01
OCDD	91.8 J		123.0	0.0918	30.6 J		81.7	0.0306	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	15.7				11.7				
Total Hexa-Dioxins	U				10.2				
Total Hepta-Dioxins	39.6				4.05				
2,3,7,8-TCDF	U	7.59	24.6	0	U	2.88	16.3	0	0.1
1,2,3,7,8-PeCDF	U	15.0	24.6	0	10.4 J		16.3	0.52	0.05
2,3,4,7,8-PeCDF	U	1.48	24.6	0	U	3.40	16.3	0	0.5
1,2,3,4,7,8-HxCDF	U	2.96	61.6	0	U	1.08	40.8	0	0.1
1,2,3,6,7,8-HxCDF	U	18.2	61.6	0	U	9.05	40.8	0	0.1
1,2,3,7,8,9-HxCDF	U	2.81	61.6	0	U	0.882	40.8	0	0.1
2,3,4,6,7,8-HxCDF	U	3.15	61.6	0	U	1.05	40.8	0	0.1
1,2,3,4,6,7,8-HpCDF	U	28.6	61.6	0	14.6 J		40.8	0.146	0.01
1,2,3,4,7,8,9-HpCDF	U	6.45	61.6	0	U	0.784	40.8	0	0.01
OCDF	51.1 J		123.0	0.0511	20.3 J		81.7	0.0203	0.001
Total Tetra-Furans	U				U				
Total Penta-Furans	U				10.4				
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				14.6				
Total				8.2699				7.5869	

Table 1.4 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		28088				28089			
Location		Trip Blank				Trip Blank			
Matrix		Air				Air			
Volume of Air (L)		0				0			
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	TEF
2,3,7,8-TCDD	U	3.24	10.0	0	U	2.72	10.0	0	1
1,2,3,7,8-PeCDD	U	7.86	10.0	0	U	6.78	10.0	0	0.5
1,2,3,4,7,8-HxCDD	U	0.880	25.0	0	U	1.16	25.0	0	0.1
1,2,3,6,7,8-HxCDD	U	5.90	25.0	0	8.62 J		25.0	0.862	0.1
1,2,3,7,8,9-HxCDD	U	0.920	25.0	0	U	1.18	25.0	0	0.1
1,2,3,4,6,7,8-HpCDD	U	6.26	25.0	0	5.74 J		25.0	0.0574	0.01
OCDD	17.2 J		50.0	0.0172	19.0 J		50.0	0.019	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	U				U				
Total Hexa-Dioxins	U				8.62				
Total Hepta-Dioxins	U				5.74				
2,3,7,8-TCDF	U	1.72	10.0	0	U	2.90	10.0	0	0.1
1,2,3,7,8-PeCDF	7.48 J		10.0	0.374	4.18 J		10.0	0.209	0.05
2,3,4,7,8-PeCDF	U	0.960	10.0	0	U	0.620	10.0	0	0.5
1,2,3,4,7,8-HxCDF	U	1.04	25.0	0	U	0.900	25.0	0	0.1
1,2,3,6,7,8-HxCDF	U	4.46	25.0	0	U	4.78	25.0	0	0.1
1,2,3,7,8,9-HxCDF	U	0.420	25.0	0	U	0.540	25.0	0	0.1
2,3,4,6,7,8-HxCDF	U	0.220	25.0	0	U	0.940	25.0	0	0.1
1,2,3,4,6,7,8-HpCDF	7.12 J		25.0	0.0712	U	8.96	25.0	0	0.01
1,2,3,4,7,8,9-HpCDF	U	0.740	25.0	0	U	1.72	25.0	0	0.01
OCDF	11.3 J		50.0	0.0113	U	15.3	50.0	0	0.001
Total Tetra-Furans	U				1.28				
Total Penta-Furans	11.1				4.18				
Total Hexa-Furans	U				U				
Total Hepta-Furans	7.12				U				
Total				0.4737				1.1474	

Table 1.5 Results of the Analysis for Inorganic Acids in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID	28090		28091		28092		28060		28061	
Location	Field Blank		Trip blank		Lot Blank		0-1		0-2	
Air Volume (L):	0		0		0		59.2		41.2	
Analyte	Conc mg	MDL mg	Conc mg	MDL mg	Conc mg	MDL mg	Conc mg/m³	MDL mg/m³	Conc mg/m³	MDL mg/m³
Hydrobromic acid	U	0.0011	U	0.0011	U	0.0011	U	0.0171	U	0.0246
Hydrochloric acid	U	0.001	U	0.001	U	0.001	U	0.0174	U	0.0250
Hydrofluoric acid	U	0.001	U	0.001	U	0.001	U	0.0178	U	0.0256
Nitric acid	U	0.0045	U	0.0045	U	0.0045	U	0.0760	U	0.1092
Phosphoric acid	U	0.0032	U	0.0032	U	0.0032	U	0.0523	U	0.0752
Sulfuric acid	U	0.001	U	0.001	U	0.001	U	0.0172	U	0.0248

Sample ID	28062		28063		28064		28065		28066	
Location	0-3		0-4		0-5		0-UW1		0-UW2	
Air Volume (L):	57.8		52.0		58.0		53.0		43.2	
Analyte	Conc mg/m³	MDL mg/m³	Conc mg/m³	MDL mg/m³	Conc mg/m³	MDL mg/m³	Conc mg/m³	MDL mg/m³	Conc mg/m³	MDL mg/m³
Hydrobromic acid	U	0.0175	U	0.0195	U	0.0174	U	0.0191	U	0.0234
Hydrochloric acid	U	0.0178	U	0.0198	U	0.0177	U	0.0194	U	0.0238
Hydrofluoric acid	U	0.0182	U	0.0203	U	0.0182	U	0.0199	U	0.0244
Nitric acid	U	0.0779	U	0.0865	U	0.0776	U	0.0849	U	0.1042
Phosphoric acid	U	0.0536	U	0.0596	U	0.0534	U	0.0584	U	0.0717
Sulfuric acid	U	0.0177	U	0.0196	U	0.0176	U	0.0193	U	0.0236

Results of the BS/BSD Analysis for PAH in Air

A lot blank and a lot blank filter were chosen for the blank spike/blank spike duplicate (BS/BSD) analyses. The percent recoveries, for the lot blank, ranging from 78 to 97, are listed in Table 2.1. The relative percent differences, also listed in Table 2.1, ranged from 3 to 8. The percent recoveries, for the lot blank filter, ranging from 41 to 101, are also listed in Table 2.1. The relative percent differences, also listed in Table 2.1, ranged from 7 to 70. QC limits are not available for either the percent recoveries or the relative percent differences for this analysis.

Table 2.1 Results of BS/BSD Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample ID: Lot Blank

Compound	Spike Added µg	BS Rec. µg	% Rec.	BSD Rec. µg	% Rec.	RPD
Naphthalene	50	48.18	96	46.27	93	4
2-Methylnaphthalene	50	47.78	96	45.73	91	5
1-Methylnaphthalene	50	48.27	97	44.76	90	8
Biphenyl	50	47.72	95	45.26	91	5
2,6-Dimethylnaphthalene	50	47.60	95	45.11	90	5
Acenaphthylene	50	47.86	96	46.05	92	4
Acenaphthene	50	48.20	96	46.41	93	4
Dibenzofuran	50	47.16	94	45.51	91	4
Fluorene	50	47.86	96	45.90	92	4
Phenanthrene	50	47.98	96	45.95	92	5
Anthracene	50	47.68	95	46.43	93	3
Carbazole	50	48.49	97	46.04	92	5
Fluoranthene	50	48.13	96	46.26	93	4
Pyrene	50	48.69	97	46.62	93	4
Benzo(a)anthracene	50	48.19	96	45.25	91	6
Chrysene	50	37.28	75	38.75	78	4
Benzo(b)fluoranthene	50	48.09	96	44.67	89	7
Benzo(k)fluoranthene	50	46.43	93	44.84	90	4
Benzo(e)pyrene	50	47.46	95	45.32	91	5
Benzo(a)pyrene	50	47.14	94	44.61	89	6
Indeno(1,2,3-cd)pyrene	50	48.18	96	45.77	92	5
Dibenzo(a,h)anthracene	50	48.08	96	45.39	91	6
Benzo(g,h,i)perylene	50	48.06	96	45.69	91	5

Table 2.1 (cont.) Results of BS/BSD Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support,
and Underwater Survey Activites

Sample ID: Lot Blank filter

Compound	Spike Added µg	BS Rec. µg	% Rec.	BSD Rec. µg	% Rec.	RPD
Naphthalene	50	42.80	86	20.62	41	70
2-Methylnaphthalene	50	46.56	93	33.82	68	32
1-Methylnaphthalene	50	47.38	95	36.54	73	26
Biphenyl	50	48.02	96	39.62	79	19
2,6-Dimethylnaphthalene	50	47.60	95	39.74	79	18
Acenaphthylene	50	48.36	97	41.68	83	15
Acenaphthene	50	49.52	99	43.70	87	12
Dibenzofuran	50	49.68	99	44.26	89	11
Fluorene	50	49.36	99	44.44	89	11
Phenanthrene	50	48.38	97	42.82	86	12
Anthracene	50	50.60	101	46.20	92	9
Carbazole	50	48.48	97	43.24	86	12
Fluoranthene	50	50.52	101	45.06	90	11
Pyrene	50	50.02	100	44.44	89	12
Benzo(a)anthracene	50	48.50	97	42.82	86	12
Chrysene	50	50.08	100	46.74	93	7
Benzo(b)fluoranthene	50	47.16	94	40.98	82	14
Benzo(k)fluoranthene	50	45.04	90	40.14	80	12
Benzo(e)pyrene	50	47.02	94	41.60	83	12
Benzo(a)pyrene	50	44.00	88	39.32	79	11
Indeno(1,2,3-cd)pyrene	50	44.26	89	39.74	79	11
Dibenzo(a,h)anthracene	50	43.44	87	40.00	80	8
Benzo(g,h,i)perylene	50	43.82	88	40.08	80	9

Results of the BS/BSD Analysis for Metals in Air

A blank spike/blank spike duplicate analysis (BS/BSD) was run. The percent recoveries, listed in Table 2.2, ranged from 34 to 125. Fifty out of fifty-six values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.2, ranged from 0 (zero) to 7. QC limits are not available for this criterion.

Results of the Analysis of the Laboratory Control Sample for Metals in Air

Laboratory control samples were also analyzed. The percent recoveries ranged from 62 to 116 and are listed in Table 2.3. Twenty-five out of twenty-eight concentrations were within the acceptable QC limits.

Table 2.2 Results of the BS/BSD Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Metal	Sample Conc µg/filter	Original Conc Spike µg/filter	Original Conc Dup µg/filter	Recovered Conc Spike µg/filter	Recovered Conc Dup µg/filter	% Recovery Spike	% Recovery Dup	RPD	Recommended QC Limit % Rec
Aluminum	2.3292	40.00	40.00	52.26	48.966	125	117	7	75-125
Arsenic	U	40.00	40.00	40.839	40.458	102	101	1	75-125
Beryllium	U	1.00	1.00	1.0592	1.046	106	105	1	75-125
Cadmium	U	1.00	1.00	1.0498	1.0388	105	104	1	75-125
Calcium	5.5364	1000	1000	1085.9	1074.6	108	107	1	75-125
Chromium	0.4428	4.00	4.00	4.9778	5.2212	113	120	6	75-125
Cobalt	U	10.00	10.00	10.184	10.04	102	100	1	75-125
Copper	U	5.00	5.00	5.47	5.41	109	108	1	75-125
Iron	0.4518	20.00	20.00	21.624	21.132	106	103	2	75-125
Lead	U	10.00	10.00	10.885	10.719	109	107	2	75-125
Lithium	U	40.00	40.00	46.163	46.319	115	116	0	75-125
Magnesium	U	1000	1000	1088.4	1078.6	109	108	1	75-125
Manganese	U	10.00	10.00	10.385	10.242	104	102	1	75-125
Molybdenum	U	40.00	40.00	42.838	42.729	107	107	0	75-125
Nickel	U	10.00	10.00	10.473	10.37	105	104	1	75-125
Phosphorus	U	40.00	40.00	20.931	20.372	52 *	51 *	3	75-125
Platinum	U	40.00	40.00	40.866	39.58	102	99	3	75-125
Selenium	U	40.00	40.00	40.464	39.955	101	100	1	75-125
Silver	U	1.00	1.00	1.0042	0.9952	100	100	1	75-125
Sodium	9.9974	1000	1000	1050.3	1039.6	104	103	1	75-125
Tellurium	U	40.00	40.00	39.822	38.988	100	97	2	75-125
Thallium	U	40.00	40.00	45.497	44.952	114	112	1	75-125
Tin	U	40.00	40.00	14.508	13.513	36 *	34 *	7	75-125
Titanium	U	40.00	40.00	41.055	40.774	103	102	1	75-125
Vanadium	U	10.00	10.00	10.586	10.46	106	105	1	75-125
Yttrium	U	40.00	40.00	42.336	41.878	106	105	1	75-125
Zinc	0.1208	10.00	10.00	10.784	10.535	107	104	2	75-125
Zirconium	U	40.00	40.00	14.671	14.075	37 *	35 *	4	75-125

Table 2.3 Results of the Analysis of the
Laboratory Control Sample for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis,
and Modeling Support, and Underwater Survey Activites

Metal	Analyzed Value µg/L	Accepted Value µg/L	% Rec		QC Limits % Rec
Aluminum	4617.55	4000	115		80-120
Arsenic	4116.9	4000	103		80-120
Beryllium	107.5	100	107		80-120
Cadmium	103.18	100	103		80-120
Calcium	53193	50000	106		80-120
Chromium	439.2	400	110		80-120
Cobalt	1006.11	1000	101		80-120
Copper	541.74	500	108		80-120
Iron	2144.08	2000	107		80-120
Lead	1061.38	1000	106		80-120
Lithium	2319.62	2000	116		80-120
Magnesium	53566.16	50000	107		80-120
Manganese	1018.99	1000	102		80-120
Molybdenum	2127.76	2000	106		80-120
Nickel	1032.58	1000	103		80-120
Phosphorus	1451.11	2000	73	*	80-120
Platinum	2068.2	2000	103		80-120
Selenium	4062.26	4000	102		80-120
Silver	100.04	100	100		80-120
Sodium	50626.04	50000	101		80-120
Tellurium	1994.5	2000	100		80-120
Thallium	4513.77	4000	113		80-120
Tin	1250.53	2000	63	*	80-120
Titanium	2044.16	2000	102		80-120
Vanadium	1040.05	1000	104		80-120
Yttrium	2113.37	2000	106		80-120
Zinc	1028.63	1000	103		80-120
Zirconium	1244.98	2000	62	*	80-120

Results of the Internal Standard Recoveries for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

The results of the internal standard recoveries, listed in Table 2.4, ranged from 62 to 146, One hundred and two out of one hundred and eight values were within the acceptable QC limits.

Results of the BS/BSD Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

A blank was spiked in duplicate and analyzed. The percent recoveries ranged from 81 to 122 and are listed in Table 2.5. All thirty-four values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.5, ranged from 0 (zero) to 14. QC limits are not available for this analysis.

Table 2.4 Results of the Internal Standard Recoveries for Polychlorinated Dibenzodioxin and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support and Underwater Survey Activites

Sample ID	Method Blank	28080	28081	28082	28083	28084	QC Limits
Location		0-1	0-2	0-3	0-4	O-5	
Matrix	Air	Air	Air	Air	Air	Air	Percent
Units	%	%	%	%	%	%	
Internal Standard							
13C-2,3,7,8-TCDD	79	100	79	86	94	84	40-135
13C-1,2,3,6,7,8-HxCDD	85	96	80	113	113	111	40-135
13C-2,3,7,8-TCDF	79	103	80	108	109	109	40-135
13C-1,2,3,4,7,8-HxCDF	81	91	77	119	112	110	40-135
13C-1,2,3,7,8-PeCDD	123	130	126	100	95	93	40-135
13C-1,2,3,4,6,7,8-HpCDD	80	86	68	85	107	72	40-135
13C-1,2,3,7,8-PeCDF	117	127	122	98	104	97	40-135
13C-1,2,3,4,6,7,8-HpCDF	86	99	83	115	107	106	40-135
13C-OCDD	115	122	107	80	89	76	40-135

Sample ID	28085	28086	28088	28089	Blank Spike	Blank Spike Duplicate	QC Limits
Location	10-UW1	10-UW2	Trip Blank	Trip Blank			
Matrix	Air	Air	Air	Air	Air	Air	Percent
Units	%	%	%	%	%	%	
Internal Standard							
13C-2,3,7,8-TCDD	63	85	83	88	75	79	40-135
13C-1,2,3,6,7,8-HxCDD	94	109	110	113	111	110	40-135
13C-2,3,7,8-TCDF	114	146 *	138 *	143 *	142 *	128	40-135
13C-1,2,3,4,7,8-HxCDF	98	119	128	129	124	124	40-135
13C-1,2,3,7,8-PeCDD	81	85	77	83	75	70	40-135
13C-1,2,3,4,6,7,8-HpCDD	110	103	112	113	100	103	40-135
13C-1,2,3,7,8-PeCDF	91	106	91	102	91	88	40-135
13C-1,2,3,4,6,7,8-HpCDF	119	126	139 *	141 *	132	127	40-135
13C-OCDD	62	85	91	95	75	82	40-135

Table 2.5 Results of the BS/BSD Analysis
for Polychlorinated Dibenzodioxin and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support
and Underwater Survey Activites

Sample ID Blank

Parameter	Spike Added pg	Sample Conc pg	BS Conc pg	% Rec	BSD Conc pg	% Rec	RPD	QC Limits (% Rec)
2378-TCDD	200	U	239	120	244	122	2	60-140
12378-PeCDD	200	U	214	107	230	115	7	60-140
123478-HxCDD	500	U	550	110	507	101	8	60-140
123678-HxCDD	500	U	473	95	493	99	4	60-140
123789-HxCDD	500	U	429	86	418	84	3	60-140
1234678-HpCDD	500	U	494	99	525	105	6	60-140
OCDD	1000	38.2	969	93	1040	100	7	60-140
2378-TCDF	200	U	165	83	189	95	14	60-140
12378-PeCDF	200	U	218	109	239	120	9	60-140
23478-PeCDF	200	U	232	116	233	116	0	60-140
123478-HxCDF	500	U	455	91	461	92	1	60-140
123678-HxCDF	500	U	466	93	469	94	1	60-140
123789-HxCDF	500	U	435	87	421	84	3	60-140
234678-HxCDF	500	U	513	103	498	100	3	60-140
1234678-HpCDF	500	12.4	418	81	461	90	10	60-140
1234789-HpCDF	500	U	407	81	434	87	6	60-140
OCDF	1000	24.3	1090	107	1090	107	0	60-140

Results of the BS/BSD Analysis for Inorganic Acids in Air

A blank spike/blank spike duplicate analysis (BS/BSD) was run. The percent recoveries, listed in Table 2.6, ranged from 93 to 100. All twelve values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.6, ranged from 0 (zero) to 1. QC limits are not available for this criterion.

Table 2.6 Results of the BS/BSD Analysis for Inorganic Acids in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Analyte	Original Conc		Recovered Conc		% Recovery		RPD	Recommended QC Limits % Rec
	Spike mg	Dup mg	Spike mg	Dup mg	Spike	Dup		
Hydrobromic acid	0.1053	0.1053	0.0983	0.0983	93	93	0	75-125
Hydrochloric acid	0.2054	0.2054	0.2042	0.2042	99	99	0	75-125
Hydrofluoric acid	0.4049	0.4049	0.3925	0.3937	97	97	0	75-125
Nitric acid	0.4067	0.4067	0.3901	0.3919	96	96	0	75-125
Phosphoric acid	0.5914	0.5914	0.5884	0.592	99	100	1	75-125
Sulfuric acid	0.4085	0.4085	0.3949	0.3937	97	96	0	75-125

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LOCKHEED MARTIN

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PO Box 28510, 6220 Culebra Road
San Antonio, TX 78228-0510

Attn: Jo Ann Boyd

19 November 1999

Project # RIA-00011 APG Burn Support

As per Lockheed Martin / REAC Purchase Order GA91969J73, please analyze samples according to the following parameters:

Analysis/Method	Matrix	# of samples
Dioxin/ Furans / Modified TO9	Air	20
Inorganic Acids / NIOSH 7903	Air	20
Metals/ NIOSH 7300	Air	20
Data package: Package with Diskette Deliverable		

Samples are expected to arrive at your laboratory between November 23-December 31, 1999. **All applicable QA/QC (BS/BSD) analysis as per method, will be performed on our sample matrix.** Preliminary sample and QC result tables plus a signed copy of our Chain of Custody must be faxed to REAC 10 business days after receipt of the last samples. The complete data package is due 21 business days after receipt of the last samples. The complete data package must include all items on the deliverables checklist. **Expect all samples to be difficult matrix and all raw data must be included in final analytical report.**

All sample and QC results(ie: BS/BSD, LCS, Duplicates, and Blanks) must be summarized in a ExCel diskette deliverable.

Please submit all reports and technical questions concerning this project to **John Johnson at (732) 321-4248 or fax to (732) 494-4020.**

Sincerely,

Deborah Killeen
Data Validation and Report Writing Group Leader
Lockheed Martin / REAC Project

DK:jj Attachments

cc. R. Singhvi
D. Michunas
0011\non\nem\9911\sub\0011Con
D. Miller
Subcontracting File
D. Angwenyi
C. Lentini
A. DuBois
D. Killeen

732 (908) 321-4200
EPA Contract 68-~~C4-0022~~ C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG Burn Support
Project Number: RIA00110
LM REW Contact: John Johnson Phone: 732-321-4248

No: 03215

SHEET NO. 1 OF 1

Sample Identification DIOXINS

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles (Puf filter)	Container/Preservative	Volume (L)	Dioxins		
	28080	O-1 ①	A	12/3/99	1	AMBER JAR/ICE	Ø L	✓		
	28081	O-2	↓	↓	1	↓	687 L	✓		
	28082	O-3			1		513.3	✓		
	28083	O-4			1		693	✓		
	28084	O-5			1		646.8	✓		
	28085	O-UW1			1		406	✓		
	28086	O-UW2			1		612	✓		
	28089	TRIP Blank			1		Ø	✓		
	28088	TRIP BLANK			1		Ø	✓		
	—	BS/BSD	↓	↓	2	↓	Ø	✓		

Matrix:
SD - Sediment; DS - Drum Solids; DL - Drum Liquids; X - Other
PW - Potable Water; GW - Groundwater; SW - Surface Water; SL - Sludge
S - Soil; W - Water; O - Oil; A - Air

Special Instructions:
Puf plugs + Quartz filters certified clean by Southwest Research Institute

Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78228

① will use as FB - no flow through plug + filter

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
All/Analysis	[signature]	12/4/99	[signature]	12/6/99	0935						

FORM #4 8/94

000032

REAC, Edison, NJ
732 ~~(908)~~ 321-4200
EPA Contract 68-~~C4-0022~~ C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG Burn Support
Project Number: RIA00110
LM ~~RPW~~ Contact: John Johnson Phone: 732-321-4248

No: 03132

SHEET NO. 1 OF 1

Sample Identification Inorganic Acids **Analyses Requested**

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles / Tubes	Container/Preservative	Volume (L)	Inorganic Acids		
	28060	O-1	A	12/3/99	1	Silica gel / Ice	59.2	✓		
	28061	O-2	↓	↓	1	↓	41.2	✓		
	28062	O-3			1		57.8	✓		
	28063	O-4			1		52.0	✓		
	28064	O-5			1		58.0	✓		
	28065	O-UW1			1		53.0	✓		
	28066	O-UW2			1		43.2	✓		
	28090	Field Blank			1		0	✓		
	28091	Trip Blank			1		0	✓		
	28092	Lot Blank			1		0	✓		
	—	BS/BSD	↓	↓	2	↓	0	✓		

Cooler Temp. 12.6°C

Matrix:
SD - Sediment; PW - Potable Water; S - Soil
DS - Drum Solids; GW - Groundwater; W - Water
DL - Drum Liquids; SW - Surface Water; O - Oil
X - Other; SL - Sludge; A - Air

Special Instructions:
① Inorganic Acids by NIOSH 7903
All Inorganic acids samples used Lot #1038 silica tubes

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF

Southwest Research Institute
6220 Culebra Rd
San Antonio, TX 78228

Post-it® Fax Note 7671 | Date 1/19/2000 | # of pages 3
To John Johnson | From Joe Morin
Co./Dept. Lockheed Martin REAC | Co. SwRI
Phone # | Phone #
Fax # 732-494-4020 | Fax # 210-522-6628

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason			Time
1 Analysis	[signature]	12/4/99	[signature] Joe Morin	12/6/99	0925				

FORM #4

000034

REAC, Edison, NJ
732) (908) 321-4200
EPA Contract 68-~~C4-0022~~ C9-223

CHAIN OF CUSTODY RECORD

Project Name: APG · Burn Support
Project Number: 21A00110
RFW Contact: John Johnson Phone: 732-321-4248

No: 03133
SHEET NO. 1 OF 1

Sample Identification METALS **Analyses Requested**

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Volume (L)	VOCs 7500		
	28050	O-1	A	12/3/99	1	1-Vk pak/ice	678	✓		
	28051	O-2					698.5	✓		
	28052	O-3					713	✓		
	28053	O-4					669.9	✓		
	28054	O-5					693	✓		
	28055	O-UW1					636	✓		
	28056	O-UW2					648	✓		
	28057	FIELD BLANK					0	✓		
	28058	Trip Blank					0	✓		
	28059	LOT BLANK					0	✓		
	—	BS/BSD			2		0	✓		
							1			
							Cooler Temp. 12 °C			

Matrix:
SD - Sediment PW - Potable Water S - Soil
DS - Drum Solids GW - Groundwater W - Water
DL - Drum Liquids SW - Surface Water O - Oil
X - Other SL - Sludge A - Air

Special Instructions:
All metals (elements) samples collected using MCE filter LOT # 58900

FOR SUBCONTRACTING USE ONLY
FROM CHAIN OF CUSTODY #

Southwest Research Institute
6220 Culebra Rd
San Antonio, TX 78228

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
(1) Analysis		12/4/99		12/4/99	09:45						

FORM #4

000055

APPENDIX C
SBC COM Clearances for GB, GD, VX, and HD
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

From: Smith Sandra D SBCCOM <sandra.smith@SBCCOM.APGEA.ARMY.MIL>
To: Alfreda Dean <alfreda.dean@SBCCOM.APGEA.ARMY.MIL>,...
Date: 12/8/99 4:57pm
Subject: EPA Clearances

POC: DuBois, 732-494-4013 O-FLD

Item#	GVH BKGD	taken 12/06/99
UW-1	9912060122-M01	Clear for GB, GD, VX, HD
UW-2	9912060123-M01	Clear for GB, GD, VX, HD
O-1	9912060124-M01	Clear for GB, GD, VX, HD
O-2	9912060125-M01	Clear for GB, GD, VX, HD
O-3	9912060126-M01	Clear for GB, GD, VX, HD
O-4	9912060127-M01	Clear for GB, GD, VX, HD
O-5	9912060128-M01	Clear for GB, GD, VX, HD

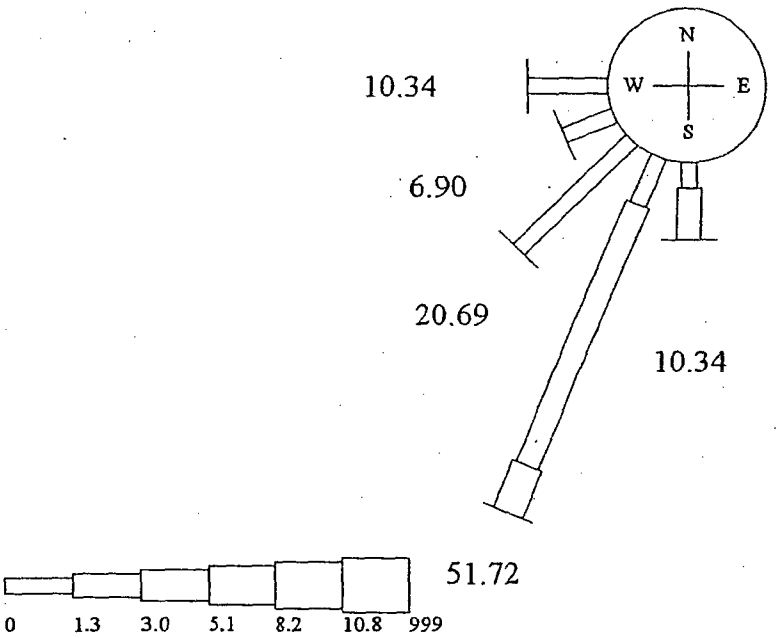
Sandra D. Smith (Sam)

APPENDIX D
Windroses
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

Aberdeen Proving Grounds Test Burn

Wind Rose Generated From H-Field Meteorological Data

12/3/99 14:00 - 21:00



SCALE (M/SEC)

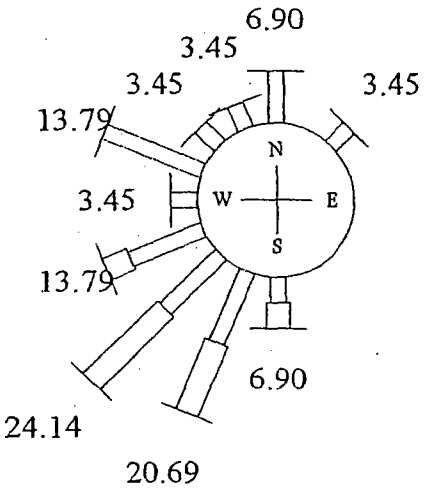
WIND SPEED (M/SEC) PERCENT OCCURRENCE						
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	>10.8
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

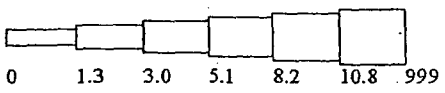
WIND SPEED (M/SEC) PERCENT OCCURRENCE						
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	>10.8
S	3.45	6.90	0.00	0.00	0.00	0.00
SSW	6.90	37.93	6.90	0.00	0.00	0.00
SW	20.69	0.00	0.00	0.00	0.00	0.00
WSW	6.90	0.00	0.00	0.00	0.00	0.00
W	10.34	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

Aberdeen Proving Grounds Test Burn

Wind Rose Generated From Poverty Island Meteorological Data

12/3/99 14:00 - 21:00





SCALE (M/SEC)

WIND SPEED (M/SEC) PERCENT OCCURRENCE						
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	>10.8
N	6.90	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	3.45	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

WIND SPEED (M/SEC) PERCENT OCCURRENCE						
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	>10.8
S	3.45	3.45	0.00	0.00	0.00	0.00
SSW	10.34	10.34	0.00	0.00	0.00	0.00
SW	10.34	13.79	0.00	0.00	0.00	0.00
WSW	10.34	3.45	0.00	0.00	0.00	0.00
W	3.45	0.00	0.00	0.00	0.00	0.00
WNW	13.79	0.00	0.00	0.00	0.00	0.00
NW	3.45	0.00	0.00	0.00	0.00	0.00
NNW	3.45	0.00	0.00	0.00	0.00	0.00

APPENDIX A-2

O-FIELD TRIP REPORT – BURN 2
(JULY 2000)

Lockheed Martin Technology Services Group
-onmental Services REAC
Woodbridge Avenue, Building 209 Annex Edison, NJ 08837-3679
/ephone 732-321-4200 Facsimile 732-494-4021

LOCKHEED MARTIN

DATE: July 5. 2000

TO: David Mickunas. U.S. EPA/ERTC Work Assignment Manager

THROUGH: Jeff Bradstreet. REAC Air Group Leader

FROM: Amy DuBois. REAC Task Leader

SUBJECT: AIR MONITORING AND SAMPLING AT THE AIR MONITORING SAMPLING. ANALYSIS. AND MODELING SUPPORT, AND UNDERWATER SURVEY ACTIVITIES SITE, ABERDEEN PROVING GROUND. ABERDEEN. MD. WORK ASSIGNMENT #0-110 - TRIP REPORT - O-FIELD - BURN 2

BACKGROUND

The United States Environmental Protection Agency/Environmental Response Team Center (U.S. EPA/ERTC) issued Work Assignment Number 0-110 to Lockheed Martin under the Response. Engineering, and Analytical Contract (REAC) to provide air monitoring and air sampling during two controlled burns in the Edgewood Area of Aberdeen Proving Ground (APG). One burn was to be conducted at O-Field and one at J-Field. After problems igniting the marsh area during the O-Field burn. a second controlled burn was scheduled at O-Field.

Ordnance firing. ongoing test activities, and lightning strikes occasionally cause accidental fires in the test range areas at APG. Because of APG's long history of weapons testing and disposal practices, there is concern that contaminants have accumulated in the surface soils and vegetation at these locations and could be transported in the smoke plumes produced by such fires. posing a health risk to exposed individuals on and off the installation.

The scope of work for this work assignment included air sampling for dioxins. metals. polynuclear aromatic hydrocarbons (PAHs). inorganic acids. volatile organic compounds (VOCs) and chemical warfare agents (CWAs). Particulate monitoring was conducted utilizing an MIE DataRAM at each location.

OBSERVATIONS AND ACTIVITIES

REAC personnel mobilized to APG on December 17. 1999. Air sampling and monitoring were conducted at 5 downwind and 2 upwind locations (Figure 1).

VOC sampling and analysis was conducted following EPA Method TO-14A: *Determination of Volatile Organic Compounds in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Mass Spectrometric (GC/MS) Analysis.* A sampling orifice was connected to each SUMMA canister to control the flow at 15 cubic centimeters per minute (cc/min). A solenoid valve was then connected to the SUMMA orifice. A battery operated timer was attached to each solenoid valve to trigger the solenoid at the anticipated start time for the burn.

PAH sampling and analysis was conducted following National Institute for Occupational Safety and Health (NIOSH) Method # 5515: *Polynuclear Aromatic Hydrocarbons.* Samples were collected utilizing a personal sampling pump

(SKC) to draw a measured volume of air (2 Liters per minute (L/min)) through a sampling train containing a teflon prefilter cassette and an XAD-2 sorbent tube. The pumps were programmed for a delayed start with a 4-hour sampling period.

Sampling and analysis for inorganic acids was conducted following NIOSH Method # 7903: *Acids, Inorganic*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (250 cc/min) through a sampling train containing a silica gel sorbent tube. The pumps were programmed for a delayed start with a 4-hour sampling period.

Sampling and analysis for dioxins was conducted following modified U.S. EPA Method TO9A, *Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a polyurethane foam (PUF) plug and quartz filter. The pumps were programmed for a delayed start with a 4-hour sampling period. PUF glassware, plugs, and quartz filters were cleaned and certified by Southwest Research Institute in San Antonio, Texas prior to use.

Sampling and analysis for metals was conducted following modified NIOSH Method # 7300: *Elements (ICP)*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a mixed cellulose ester filter cassette. The pumps were programmed for a delayed start with a 4-hour sampling period.

Samples were collected for CWAs utilizing a personal sampling pump (SKC) to draw a measured volume of air (100 cc/min) through a sampling train containing two Depot Area Air Monitoring System (DAAMS) sorbent tubes in a dual-sampling manifold. The pumps were programmed for a delayed start with a 4-hour sampling period. Tubes and analysis were provided by Soldiers Biological and Chemical Command (SBC COM).

Air monitoring for total particulates was performed utilizing an MIE DataRAM portable real-time aerosol monitor. Concentration data was logged every 10 seconds for the duration of the burn.

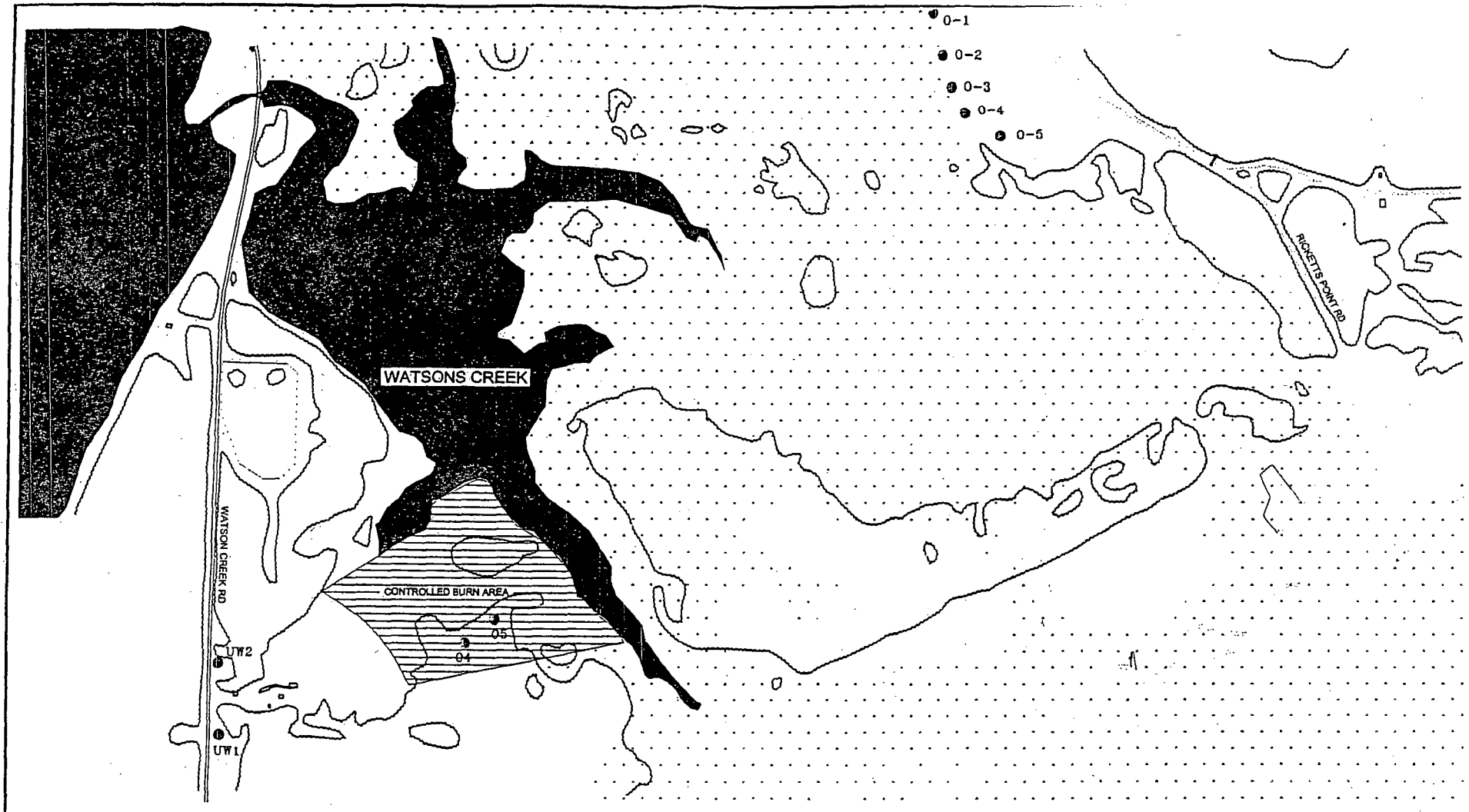
APG personnel positioned bridge sanctions at three downwind locations in Watsons Creek, prior to REAC's mobilization to the site. The two other downwind locations were positioned in trees along the edge of the marsh. REAC personnel set the samplers on the bridge sanctions and hoisted them into the trees with all timers set for a delayed start at 1345. When all personnel were out of the area, the APG Fire Department initiated the burn. In an attempt to propagate the burn through the marsh, approximately 8 to 10 gallons of kerosene were sprayed on the marsh vegetation. The fire still did not spread through the marsh and burned itself out after approximately 30 minutes.

RESULTS

Due to the short duration of the burn the decision was made between APG's Directorate of Safety, Health, and the Environment (DSHE) and the U.S. EPA/ERTC not to analyze the samples.

FUTURE ACTIVITIES

There are no future sampling activities planned for O-Field at this time.



U.S. EPA ENVIRONMENTAL RESPONSE TEAM CENTER
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-C99-223
W.O.# R1A00110

FIGURE 1
SAMPLING LOCATIONS O-FIELD CONTROLLED BURN AR
AIR MONITORING, SAMPLING, ANALYSIS, AND
MODELING SUPPORT, AND UNDERWATER
SURVEY ACTIVITIES
ABERDEEN, MARYLAND
JUNE 2000

APPENDIX A-3

J-FIELD TRIP REPORT
(JULY 2000)

Lockheed Martin Technology Services Group
Environmental Services REAC
Woodbridge Avenue, Building 209 Annex Edison, NJ 08837-3679
Phone 732-321-4200 Facsimile 732-494-4021

LOCKHEED MARTIN

DATE: July 5, 2000

TO: David Mickunas, U.S. EPA/ERTC Work Assignment Manager

THROUGH: Jeff Bradstreet, REAC Air Group Leader

FROM: Amy DuBois, REAC Task Leader

SUBJECT: AIR MONITORING AND SAMPLING AT THE AIR MONITORING SAMPLING, ANALYSIS, AND MODELING SUPPORT, AND UNDERWATER SURVEY ACTIVITIES SITE, ABERDEEN PROVING GROUND, ABERDEEN, MD, WORK ASSIGNMENT #0-110 - TRIP REPORT - J-FIELD

BACKGROUND

The United States Environmental Protection Agency/Environmental Response Team Center (U.S. EPA/ERTC) issued Work Assignment Number 0-110 to Lockheed Martin under the Response, Engineering, and Analytical Contract (REAC) to provide air monitoring and air sampling during two controlled burns in the Edgewood Area of Aberdeen Proving Ground (APG). One burn was to be conducted at O-Field and one at J-Field.

Ordnance firing, ongoing test activities, and lightning strikes occasionally cause accidental fires in the test range areas at APG. Because of APG's long history of weapons testing and disposal practices, there is concern that contaminants have accumulated in the surface soils and vegetation at these locations and could be transported in the smoke plumes produced by such fires, posing a health risk to exposed individuals on and off the installation.

The scope of work for this work assignment included air sampling for dioxins, metals, polynuclear aromatic hydrocarbons (PAHs), inorganic acids, volatile organic compounds (VOCs) and chemical warfare agents (CWAs). Particulate monitoring was conducted utilizing an MIE DataRAM at five locations.

OBSERVATIONS AND ACTIVITIES

REAC personnel mobilized to APG on April 6, 2000. Air sampling and monitoring was conducted at 5 downwind and 2 upwind locations (see Figure 1).

VOC sampling and analysis was conducted following EPA Method TO-14A: *Determination of Volatile Organic Compounds in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Mass Spectrometric (GC/MS) Analysis*. A sampling orifice was connected to each SUMMA canister to control the flow at 15 cubic centimeters per minute (cc/min). A solenoid valve was then connected to the SUMMA orifice. A battery operated timer was attached to each solenoid valve to trigger the solenoid at the anticipated start time for the burn.

PAH sampling and analysis was conducted following National Institute for Occupational Safety and Health (NIOSH) Method # 5515: *Polynuclear Aromatic Hydrocarbons*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (2 Liters per minute (L/min)) through a sampling train containing a teflon

prefilter cassette and an XAD-2 sorbent tube. The pumps were programmed for a delayed start with a 3-hour sampling period.

Sampling and analysis for inorganic acids was conducted following NIOSH Method # 7903: *Acids, Inorganic*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (250 cc/min) through a sampling train containing a silica gel sorbent tube. The pumps were programmed for a delayed start with a 3-hour sampling period.

Sampling and analysis for dioxins was conducted following modified U.S. EPA Method TO9A, *Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a polyurethane foam (PUF) plug and quartz filter. The pumps were programmed for a delayed start with a 3-hour sampling period. PUF glassware, plugs, and quartz filters were cleaned and certified by Southwest Research Institute in San Antonio, Texas prior to use.

Sampling and analysis for metals was conducted following modified NIOSH Method # 7300: *Elements (ICP)*. Samples were collected utilizing a personal sampling pump (SKC) to draw a measured volume of air (3 L/min) through a sampling train containing a mixed cellulose ester filter cassette. The pumps were programmed for a delayed start with a 3-hour sampling period.

Samples were collected for CWAs utilizing a personal sampling pump (SKC) to draw a measured volume of air (100 cc/min) through a sampling train containing two Depot Area Air Monitoring System (DAAMS) sorbent tubes in a dual-sampling manifold. The CWAs analyzed for included: Sarin (GB), Soman (GD), Mustard (HD), and VX. The pumps were programmed for a delayed start with a 3-hour sampling period. Tubes and analysis were provided by Soldiers Biological and Chemical Command (SBC COM).

Air monitoring for total particulates was performed utilizing an MIE DataRAM portable real-time aerosol monitor. Concentration data was logged every 10 seconds for the duration of the burn. DataRAMs were positioned at locations DW1, DW2, DW3, DW4 and UW2.

The sampling devices were suspended 15 feet above the ground from trees and/or support poles, this positioned the samplers in the plume but out of the potential burn path of the fire. The collection of sampling devices was hoisted off the ground after setting the timers on the individual pumps and SUMMA canisters. The timers for the pumps controlled the start time and duration of the sampling period. The SUMMA timers only controlled the start of the sampling period. When all personnel were out of the area, the APG Fire Department initiated the burn.

RESULTS

VOCs: A summary of VOCs sampling results can be found in Table 1. Benzene and toluene were the only compounds detected above their quantitation limit in any of the samples. Benzene was detected at locations DW3 and DW4, and toluene was detected at locations DW3 and DW5. For complete analytical results for VOCs, see the Analytical Report in Appendix A.

PAHs: No PAHs were detected above the method detection limit in any of the samples.

Inorganic Acids: A summary of inorganic acids sampling results can be found in Table 2. Hydrochloric acid (Hcl) was detected in samples DW1, DW3, DW5, and the Lot Blank. The detected Hcl concentration ranged from 0.0176 to 0.1230 parts per million by volume (ppmv). The Lot Blank contained 0.0031 milligrams (mg) Hcl. Hydrofluoric acid (HF) was detected in samples DW1 through DW5 at concentrations ranging from 0.0292 to 0.1030 ppmv. For complete analytical results for inorganic acids see the Analytical Report in Appendix B.

Dioxins/Furans: A summary of dioxins/furans results can be found in Table 3. Dioxins/furans were detected at six of the seven sampling locations. The OCDD results for samples DW3, DW5, UW1, and UW2 should be considered not detected because the concentration in the sample was less than five times that detected in the trip blank. The total dioxins/furans detected at each location after adjusting the OCDD results are as follows: DW1(not detected), DW2(1.920 picograms per cubic meter (pg/m^3)), DW3(not detected), DW4(1.003 pg/m^3), DW5(0.126 pg/m^3), UW1(not detected), UW2(not detected), Trip Blank(0.0122 pg), Field Blank(not detected), and Lot Blank(0.070 pg). For complete analytical results for dioxins/furans, see the Analytical Report in Appendix B.

Metals: A summary of metals results are shown in Table 4. Aluminum was detected in samples DW1, DW2, DW3, DW5, UW1, and UW2 at concentrations ranging from 1.9 to 31.0 micrograms per cubic meter (µg/m^3). Copper was detected at DW2 at 0.2 µg/m^3. Lead was detected at DW2 at 0.3 µg/m^3. Magnesium was detected at locations DW1, DW2, DW3, and UW2 at concentrations ranging from 2.0 to 30.0 µg/m^3. Manganese was detected at locations DW2, DW3, and UW2 at concentrations ranging from 0.8 to 1.0 µg/m^3. Phosphorous was detected at locations DW1, DW2, DW3, DW4, UW1, and UW2 at concentrations ranging from 0.8 to 2.2 µg/m^3. Titanium was detected at locations UW1 and UW2 at 1.0 and 2.1 µg/m^3, respectively. Sodium was detected in the method blank and should be regarded as not detected in all of the samples. Calcium, chromium, and zinc were detected in the lot blank and should be regarded as not detected in the rest of the samples because the concentrations were less than five times that detected in the lot blank. Iron was also detected in the lot blank. Locations DW3 and UW2 both had iron concentrations greater than 5 times the lot blank, iron should be regarded as not detected in the rest of the samples. Nickel was detected in the trip blank. Location UW1 had a nickel concentration greater than 5 times the trip blank, nickel should be regarded as not detected in the rest of the samples. For complete analytical results for metals, see the Analytical Report in Appendix B.

CWAs: No chemical warfare agents were detected in any of the samples. CWA results are provided by SBC COM, see Appendix C.

Particulates: Particulates results are shown in Figures 2 through 5. The DataRAM at location UW2 did not log data. The overall maximum concentration of 407,574.9 micrograms per cubic meter (µg/m^3) was detected at location DW2 at 17:16 eastern standard time.

Meteorological data: Windroses representing local wind speed and wind direction during the burn period are provided in Appendix D. The data was collected at H-Field using a 10-meter tower, and at Poverty Island using a 5-meter tower. Winds were predominantly out of the west northwest. Times shown are in eastern standard time.

Analysis for VOCs and PAHs were provided by REAC, Edison, NJ. Analysis for dioxins/furans, inorganic acids, and metals were provided by Southwest Research Institute, San Antonio, TX. Analysis for CWAs was provided by SBC COM, APG, MD.

FUTURE ACTIVITIES

There are no future sampling activities planned at this time.

Table 1
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities
Summary of VOCs Sampling Results - J-Field Controlled Burn - April 6, 2000

Sample Number	17747	17740	17741	17742	17743	17744	17744 Dup	17745	17746
Sample Location	trip blank	DW3	DW2	DW1	DW4	DW5	DW5	UW1	UW2
concentration	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
Chloromethane	U	2 J	9 J	2 J	3 J	1 J	1 J	U	1 J
Benzene	U	7	U	3 J	5	3 J	3 J	U	U
Toluene	U	4	U	1 J	3 J	6	6	U	U
Ethylbenzene	U	U	U	U	U	1 J	1 J	U	U
m & p-Xylenes	U	1 J	U	U	U	4 J	4 J	U	U
o-Xylene	U	U	U	U	U	1 J	1 J	U	U

VOCs - Volatile organic compounds
ppbv - parts per billion by volume
J - Below 1.00 nL Quantitation Limit
U - Not Detected

Table 2
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities
Summary of Inorganic Acids Sampling Results - J-Field Controlled Burn - April 6, 2000

Sample Number Sample Location	17734 Lot Blank	17732 Field Blank	17733 Trip Blank	17700 DW3	17701 DW2	17702 DW1	17703 DW4	17704 DW5	17705 UW1	17706 UW2
concentration	mg	mg	mg	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv
Hydrobromic Acid	U	U	U	U	U	U	U	U	U	U
Hydrochloric Acid	0.0031	U	U	0.1230	U	0.0387	U	0.0188	U	0.0176
Hydrofluoric Acid	U	U	U	0.0724	0.1030	0.0292	0.0439	0.0389	U	U
Nitric Acid	U	U	U	U	U	U	U	U	U	U
Phosphoric Acid	U	U	U	U	U	U	U	U	U	U
Sulfuric Acid[1]	0.0050	U	0.0013	0.0225	0.0262	0.0182	0.0161	0.0404	0.0175	0.0217

mg - total milligrams
ppmv - parts per million by volume
U - Not detected

[1] Due to the sulfuric acid concentration detected in the Trip Blank, the results for samples 17700 through 17706 are considered not detected.

Table 3
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities
Summary of Dioxins/Furans Sampling Results - J-Field Controlled Burn - April 6, 2000

Sample Number Sample Location	17677 Trip Blank	17678 Field Blank	17679 Lot Blank	17670 DW3	17671 DW2	17672 DW1	17673 DW4	17674 DW5	17675 UW1	17676 UW2
Adjusted concentration[1]	pg	pg	pg	pg/m^3	pg/m^3	pg/m^3	pg/m^3	pg/m^3	pg/m^3	pg/m^3
2,3,7,8-TCDD	U	U	U	U	U	U	U	U	U	U
1,2,3,7,8-PeCDD	U	U	U	U	1.88	U	U	U	U	U
1,2,3,4,7,8-HxCDD	U	U	U	U	U	U	U	U	U	U
1,2,3,6,7,8-HxCDD	U	U	U	U	U	U	0.42	U	U	U
1,2,3,7,8,9-HxCDD	U	U	0.066	U	U	U	U	U	U	U
1,2,3,4,6,7,8-HpCDD	U	U	U	U	U	U	0.277	0.126	U	U
OCDD[2]	0.0122	U	U	0.035	U	U	0.0738	0.094	0.033	0.03
2,3,7,8-TCDF	U	U	U	U	U	U	U	U	U	U
1,2,3,7,8-PeCDF	U	U	U	U	U	U	U	U	U	U
2,3,4,7,8-PeCDF	U	U	U	U	U	U	U	U	U	U
1,2,3,4,7,8-HxCDF	U	U	U	U	U	U	0.232	U	U	U
1,2,3,6,7,8-HxCDF	U	U	U	U	U	U	U	U	U	U
1,2,3,7,8,9-HxCDF	U	U	U	U	U	U	U	U	U	U
2,3,4,6,7,8-HxCDF	U	U	U	U	U	U	U	U	U	U
1,2,3,4,6,7,8-HpCDF	U	U	U	U	U	U	U	U	U	U
1,2,3,4,7,8,9-HpCDF	U	U	U	U	0.0396	U	U	U	U	U
OCDF[3]	U	U	0.00442	U	U	U	U	U	U	U
Total	**0.0122**	**U**	**0.07042**	**0.035**	**1.9196**	**U**	**1.0028**	**0.22**	**0.033**	**0.03**

pg - picograms
pg/m^3 - picograms per cubic meter
[1] Adjusted concentration - detected concentration multiplied by the toxicity equivalency factor (TEF) for each compound.
[2] The OCDD results for samples 17670, 17674, 17675, and 17676 are considered not detected because the concentration in the sample was less than five times that found in the trip blank.
[3] The OCDF result for sample 17679 is considered estimated because the method blank contained 13 pg OCDF.

Table 4
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities
Summary of Metals Sampling Results - J-Field Controlled Burn - April 6, 2000

Sample Number	17687	17688	17689	17680	17681	17682	17683	17684	17685	17686
Sample Location	Field Blank	Trip Blank	Lot Blank	DW3	DW2	DW1	DW4	DW5	UW1	UW2
concentration	ug/filter	ug/filter	ug/filter	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Aluminum	U	U	U	3.8	4.0	1.9	U	1.9	4.0	31.0
Calcium[2]	6.6	7.6	6.2	34.0	40.0	15.0	11.0	13.0	16.0	22.0
Chromium[2]	0.6	0.9	0.5	1.0	1.1	1.0	1.1	1.0	1.1	1.2
Copper	U	U	U	U	0.2	U	U	U	U	U
Iron[3]	4.0	2.7	1.6	25.0	9.2	3.6	2.6	2.0	5.7	58.0
Lead	U	U	U	U	0.3	U	U	U	U	U
Magnesium	U	U	U	4.2	5.6	2.0	U	U	U	30.0
Manganese	U	U	U	1.0	1.0	U	U	U	U	0.8
Nickel[4]	0.4	0.2	U	U	0.8	U	0.4	U	6.9	0.6
Phosphorous	U	U	U	1.3	2.2	1.3	0.8	U	1.0	2.1
Sodium[1]	9.8	9.0	7.3	17.0	18.0	17.0	16.0	11.0	14.0	18.0
Titanium	U	U	U	U	U	U	U	U	0.6	0.7
Zinc[2]	2.1	2.4	1.1	3.4	2.0	0.9	1.1	0.8	1.7	1.2

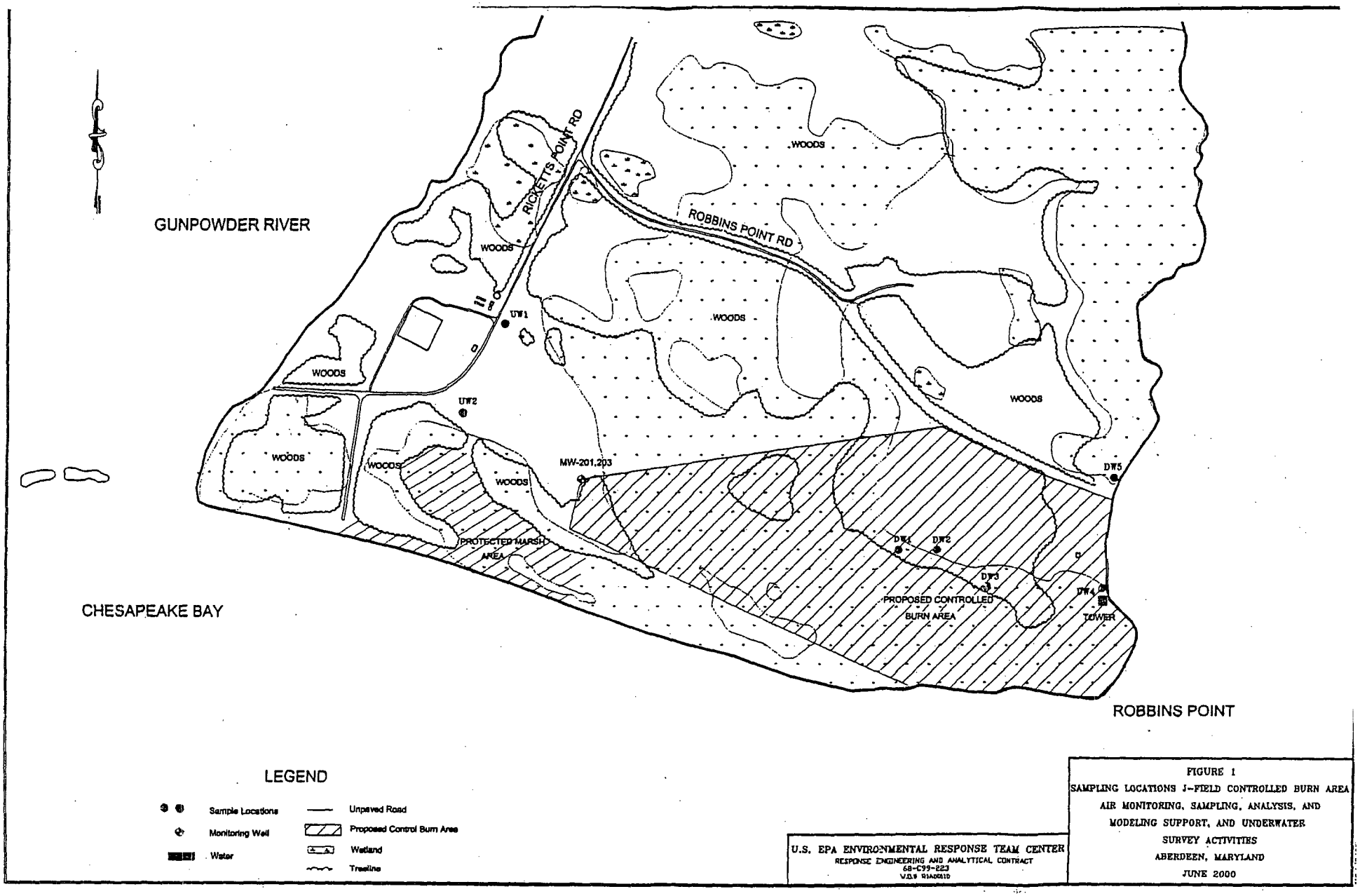
ug/filter - micrograms per filter
ug/m^3 - micrograms per cubic meter
U - not detected

[1] The method blank contained 11.81 ug/filter sodium, the sodium results for all samples should be considered not detected.

[2] The Calcium, Chromium and Zinc results for samples 17680 through 17688 are considered not detected because the concentration in the sample is less than 5 times that of the lot blank.

[3] The Iron results for samples 17681 through 17685, 17687 and 17688 are considered not detected because the concentration in the sample is less than 5 times that of the lot blank.

[4] The Nickel results for samples 17681, 17683, 17686, and 17687 are considered not detected because the concentration in the sample is less than 5 times that of the trip blank.



U.S. EPA ENVIRONMENTAL RESPONSE TEAM CENTER
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-C99-223
W.O.# 01AD010

FIGURE 1
SAMPLING LOCATIONS J-FIELD CONTROLLED BURN AREA
AIR MONITORING, SAMPLING, ANALYSIS, AND
MODELING SUPPORT, AND UNDERWATER
SURVEY ACTIVITIES
ABERDEEN, MARYLAND
JUNE 2000

Figure 2
Aberdeen Proving Ground
J-Field Burn Data - Particulates
April 6, 2000
Location DW1 - Peak Burn Period

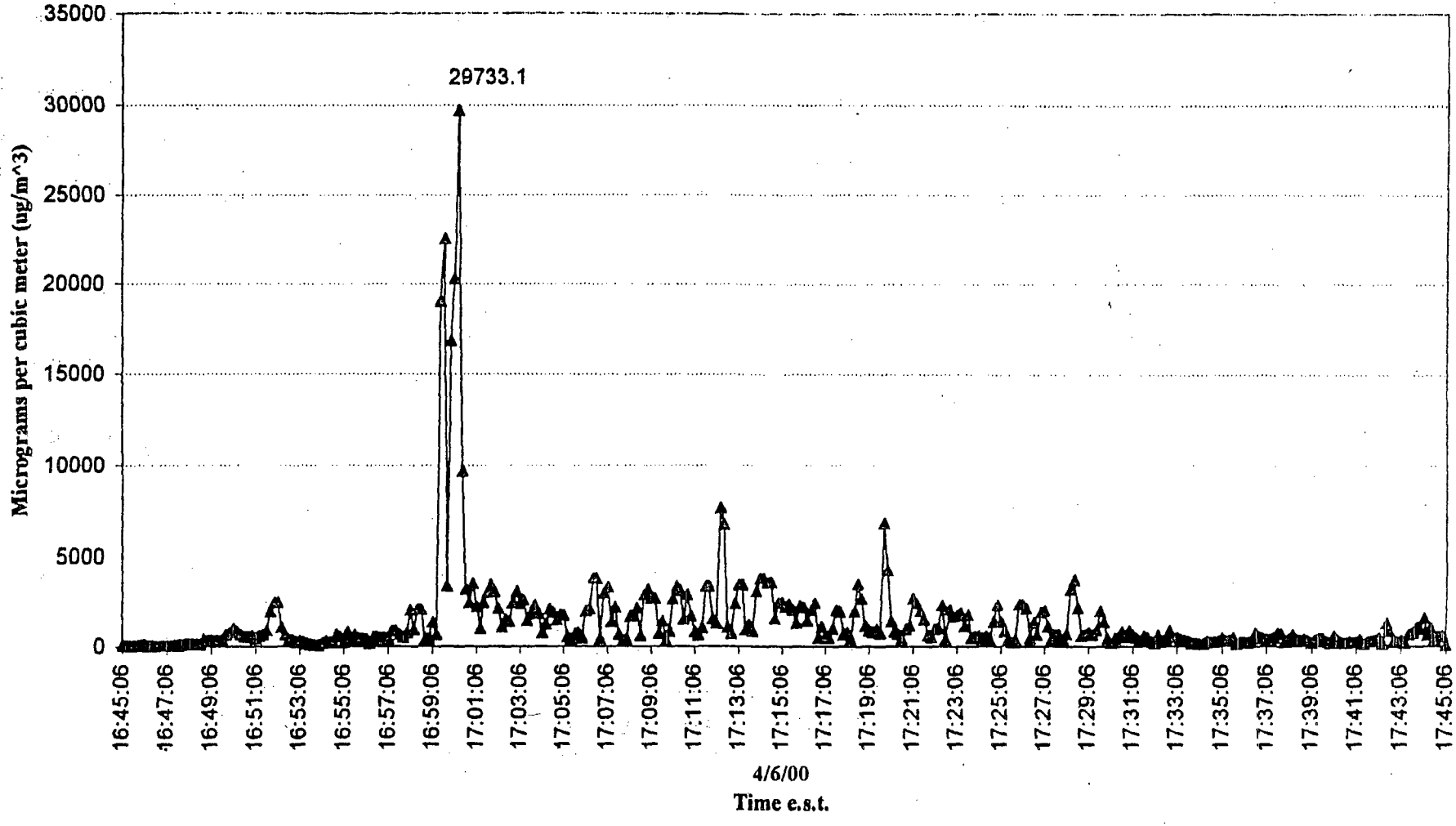


Figure 3
Aberdeen Proving Ground
J-Field Burn Data - Particulates
April 6, 2000
Location DW2 - Peak Burn Period

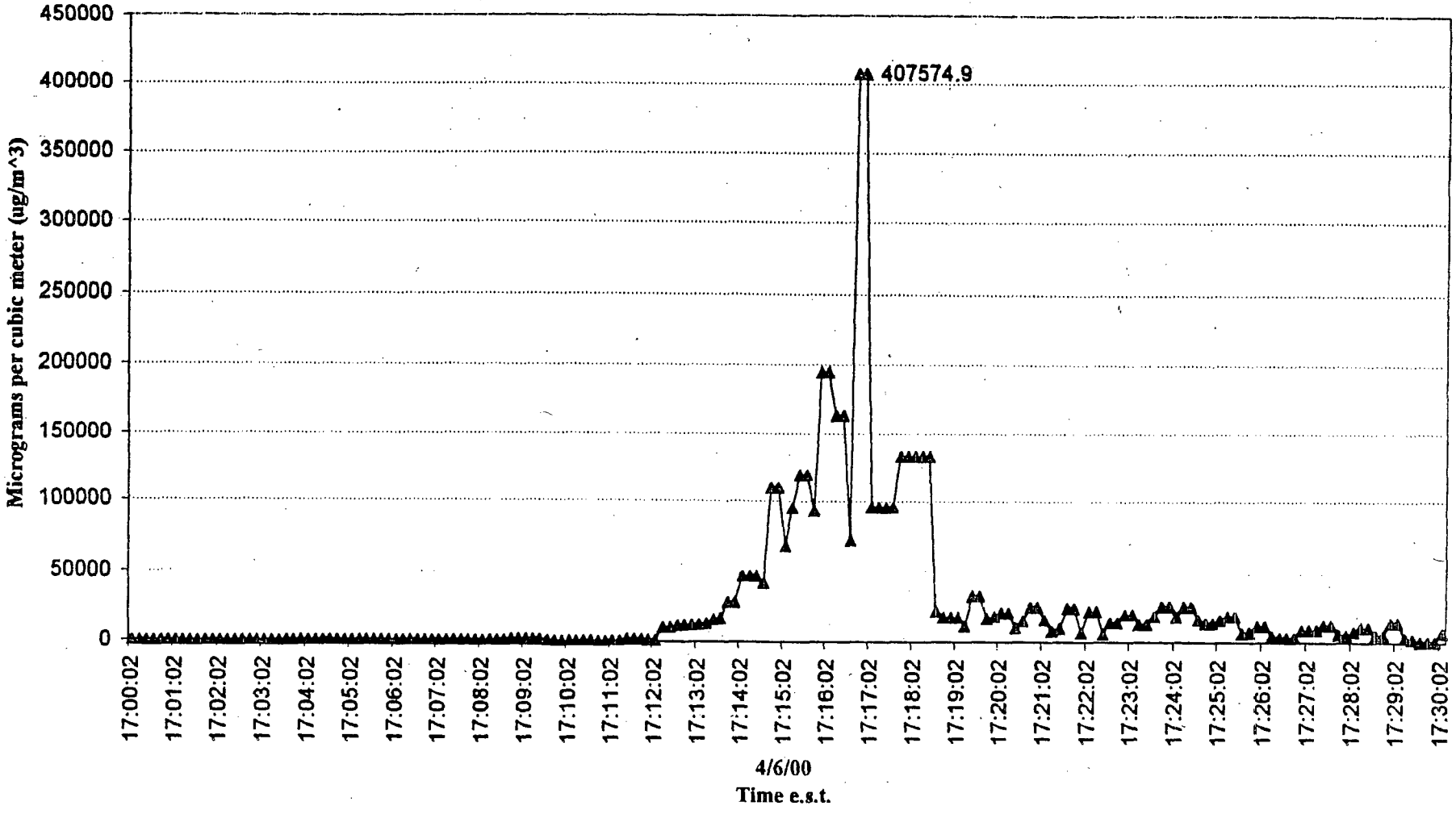


Figure 4
Aberdeen Proving Ground
J-Field Burn Data - Particulates
April 6, 2000
Location DW3 - Peak Burn Period

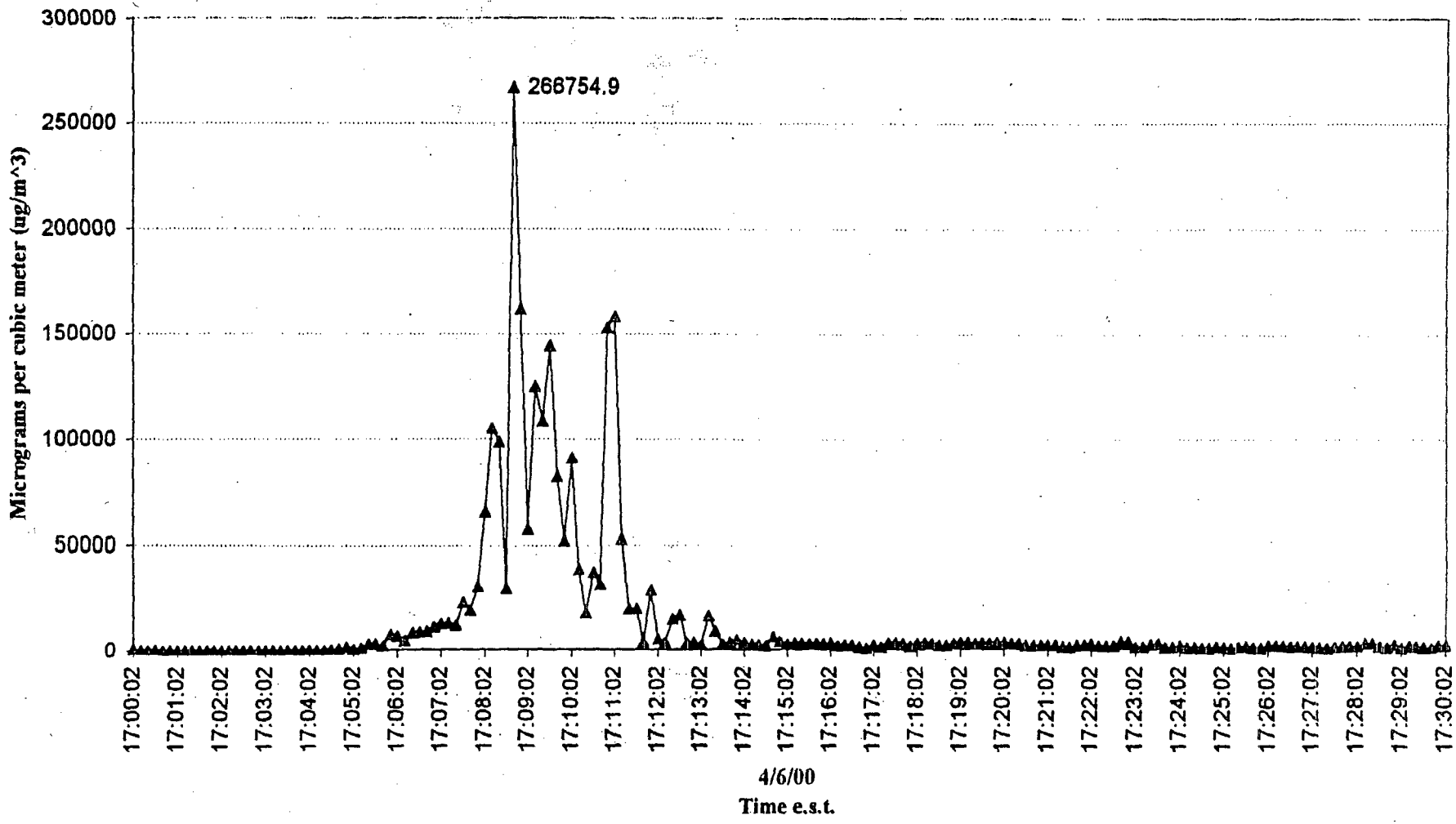
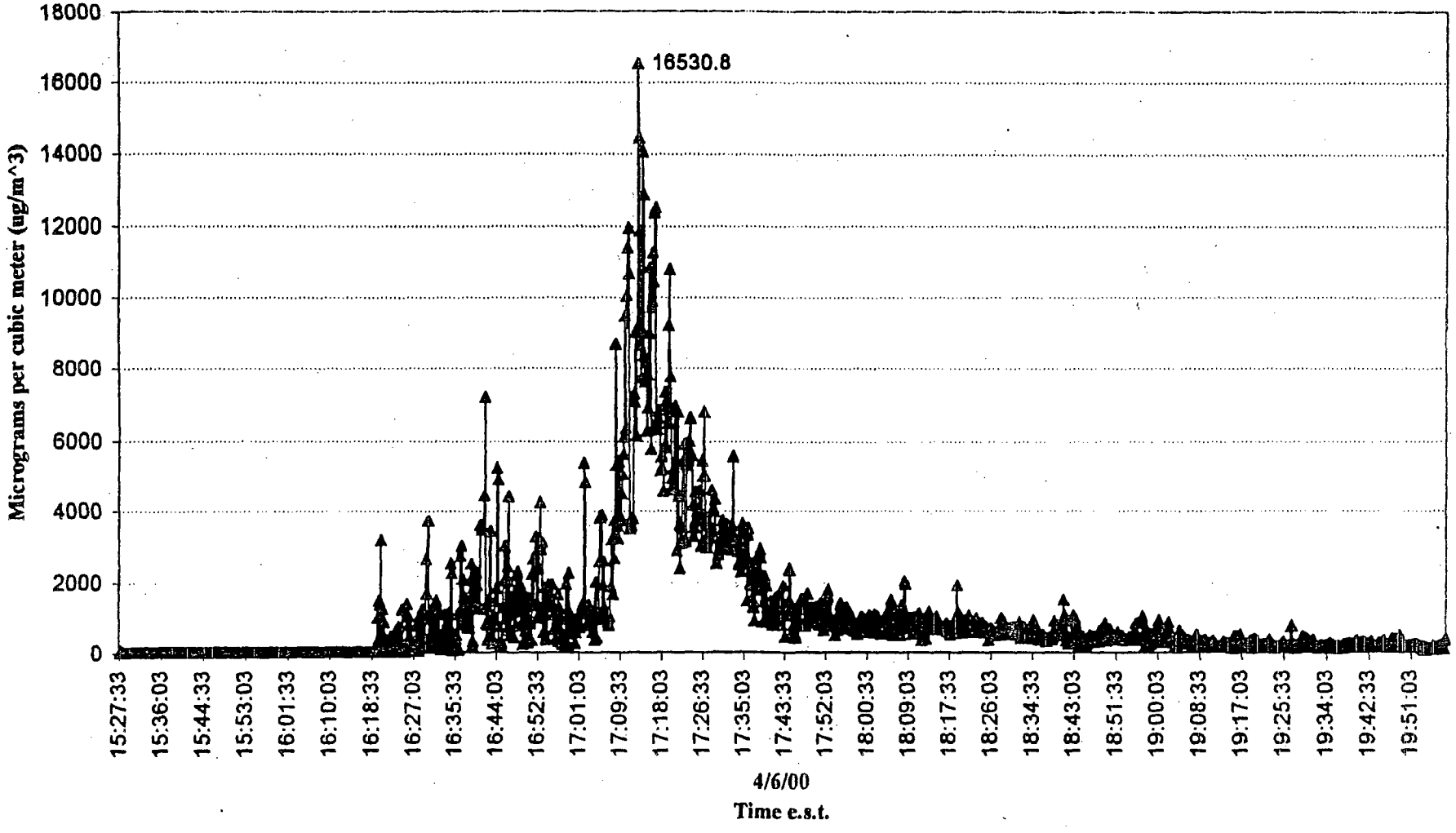


Figure 5
Aberdeen Proving Ground
J-Field Burn Data - Particulates
April 6, 2000
Location DW4



APPENDIX A
Analytical Report (VOCs)
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

ANALYTICAL REPORT

Prepared by
Lockheed Martin Technology Services Group

Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
Aberdeen Proving Ground, Aberdeen, MD

May 2000

EPA Work Assignment No. 0-110
Lockheed Martin Work Order No. R1A00110
EPA Contract No. 68-C99-223

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00110/del/ar/0005/APGBurnar

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1.0 INTRODUCTION

Summa canister samples were collected in support of the Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities work assignment at the Aberdeen Proving Ground, Aberdeen, MD on 06 April 2000. A total of seven (7) samples and a field blank were collected in 6-liter passivated Summa canisters. The samples were transported back to the Environmental Response Team Center (ERTC) facility in Edison, New Jersey. These samples were analyzed by the Response Engineering and Analytical Contract (REAC) using gas chromatography/mass spectrometry (GC/MS) on 10 and 11 April 2000.

2.0 GC/MS CANISTER PROCEDURES

2.1 Sample Pressurization

The Summa canisters used for sampling were cleaned by REAC using REAC Standard Operating Procedure (SOP) #1703 and were selected from clean batches certified by REAC. Before analysis, all canisters were pressurized. A pressurizing train was setup with a pressure gauge accurate to ± 0.1 pounds per square inch absolute (psia). The gauge and train were purged with nitrogen gas (Ultra High Pure grade) for 5 minutes. The train was then connected to the canister, an initial reading was taken. Nitrogen was added to all canister samples as followed:

Sample	Location	Initial Pressure (psia)	Final Pressure (psia)
17740	DW3	14.8	29.6
17741	DW2	2.0	16.0
17742	DW1	15.2	30.4
17743	DW4	8.8	17.6
17744	DW5	14.0	28.0
17745	UW1	8.4	16.8
17746	UW2	8.4	16.8
17747	Trip/Field	0.3	20.0

2.2 Summa Canister Analysis

Samples were analyzed by cryogenic trapping of aliquots from Summa canisters via a canister using a Hewlett-Packard 5890 gas chromatography (GC) and 5971A mass selective detector (MSD) running ChemStation software. Table 1 lists cryogenic trap and GC/MS conditions.

All canisters were attached to the Summa canister autosampler. Sample analysis began by cooling the first cryotrap, module -1 (M-1), to -160 degree Celsius (°C). Once M-1 was cooled, a specified aliquot of sample or standard was cryotrapped. This aliquot was transferred to a Tenax trap, M-2, to eliminate most of the water, and then cryofocussed at a third trap, M-3, before injection by direct heating.

2.3 Calibration and Sample Spiking

Standard mixture containing twenty-five (25) compounds was provided in compressed gas cylinder No ALM009519 by Scott Specialty Gases, Inc. These standard concentrations are .97 to 1.05 parts per million in volume (ppmv) and are listed in Table 2. The standards were diluted to a nominal concentration of 20 parts per billion (ppbv) in a Silco canister. An initial calibration range was obtained by varying the volume of the nominal 20 ppbv standard from 50 to 1250 milliliters (mL), equivalent to 1 nanoliter (nL) to 25 nL. Daily standards were obtained by analyzing the 20 ppbv standard at 500 mL (equivalent to 10 nL).

Bromochloromethane (BCM) and p-bromofluorobenzene (BFB) were added to both samples and standards. Both standards were provided in compressed gas cylinder No. ALM046281 by Scott Specialty Gases. These standard concentrations were 1.06 ppmv. BCM was used as an internal standard and BFB was used as a surrogate standard. This standard was diluted from a nominal concentration of 1 ppmv to 100 ppbv in a Silco canister. An aliquot of 100 mL (equivalent to 10 nL) was added to all standards and samples. To validate the mass spectrometer tuning, an aliquot of 70 mL (equivalent to 50 nanograms of BFB) was analyzed alone. Standard cylinder I.D. numbers, concentrations, and their quantitation ions are listed in Table 2.

2.4 Compound Identification/Quantitation

Target Compounds in samples were identified and quantitated using ChemStation software. This software was used to tentatively identify and quantitate target compounds using reconstructed and extracted ion chromatogram which were matched with retention time windows. The report format includes the identified compound mass spectra (both raw and background subtracted), quantitation, and qualifier ion chromatogram.

Target compound results are originally reported in nL. The limit of quantitation (LOQ) for all the target compounds is estimated to be 1 nL, being the lowest volume of standard on the calibration curve. Any target compound detected at 4 times lower than the LOQ is not reported. The target compound results are calculated in ppbv using the following equation:

$$Concentration(ppbv) = \frac{Quant\ Result(nL) \times 1000}{Undiluted\ Sample\ Volume(mL)}$$

Non-target compounds were identified by a library search of all peaks in a chromatogram. The library search report prints out the sample spectrum along with the ten best library matches and the three best library match spectra. These matches were used along with mass spectral interpretation techniques to tentatively identify the unknowns. Concentrations were calculated based on the total ion response of bromochloromethane in the daily standard. All compounds appearing in the method blank as well as other background compounds commonly found in Summa canister GC/MS analyses (siloxanes, carbon dioxide, etc.) were deleted from the sample results to provide a true listing of the compounds in the samples.

2.5 QA/QC

The following QA/QC procedures were performed for this analysis:

- The HP 5971A was tuned daily for perfluorotributylamine (PFTBA) to meet abundance criteria for p-bromofluorobenzene as listed in EPA Method 624. Tuning results are included in the QA/QC data section (Appendix B). The tune was adjusted when necessary.

- An initial calibration by automated injection from a Silco canister standard at 20 ppbv was performed on 24 March 2000. All compounds met the acceptance criteria of having relative standard deviations (RSD) of less than 25%.

- Continuing calibrations were performed on 10 and 11 April 2000 to satisfy the 12 hour requirement. All compounds met the acceptance criteria of having relative percent difference (RPD) less than 25%, except chloroethane (43.8%) on 11 April 2000. This compound was not detected in the associated samples; the data are not affected.

- A surrogate standard of BFB was added to all standards and samples. Percent recoveries were calculated against the daily standards, and are listed in Table 3. Recoveries should be within 70% to 130% for BFB.

- Method blanks were analyzed after each continuing calibration to ensure that the system was clean.
- A replicate was analyzed on sample 17744 (DW5).
- A set of matrix spike and matrix spike duplicates (MS/MSD) was analyzed on sample 17746 (UW2) by spiking the samples with 500 mL of the 20 ppbv standard. There is no specific recovery range established according to SOP # 1705.

3.0 RESULTS

Summa canister target and non-target results are listed in Tables 3 and 4, respectively. The recoveries for the MS/MSD are presented in Table 5. All results are reported in ppbv for Summa canister samples and blanks. The chain-of-custody is in Appendix A. The Summa canister data are in Appendix B.

In Appendix B, the Analysis Log is followed by the calibration package for each day of analysis. The calibration package includes the daily analysis log, canister pressurization log, BFB tune, and initial or continuing calibration quant report. The quant report lists the retention time, quantitation ion, peak area, and concentration in nL. Concentrations listed on the quant reports are generated by using the average response factors of the initial calibration and the response factors of the continuing calibrations.

The following is a list of the QA/QC flags used in qualifying the results:

A - Assumed volume for method blank.
B - Concentration less than 3 times method blank value.
C - Compound calibration relative standard deviation (RSD) >25% (concentrations calculated by average response factor only).
E - Exceeds calibration range.
J - Below 1.0 nL quantitation limit.
U -Not detected.

4.0 DATA ASSESSMENT

A total of 7 samples and a field blank were collected on 4/6/00 on chain of custody numbers 03310 from the Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities in Aberdeen Proving Ground, Aberdeen, MD under U.S.EPA WA# 0-110. The samples were received on 4/10/00.

The data contained in this report has been validated to two significant figures. Any other interpretation of the data is the responsibility of the user.

The samples were treated with procedures consistent with those described in SOP # 1008.

The reported year on the raw data for the acquisition time is incorrectly reported as "100" and the reported year on the raw data for the quatitation time is incorrectly reported as "19100". This is due to a software problem related to the year 2000.

In the continuing calibration on 4/11/00 the percent difference for chloroethane (44%) exceeded the QC limits. This compound was not detected in the associated samples; the data are not affected.

TABLE 1 - GC/MS Instrument Conditions

A. Preconcentrator Conditions:

M-1 Cryotrap Temperature	: -160°C
Internal Standard Trap Time	: 1.0 minute
Sample flow	: 150 mL/min
M-1 Cryotrap Desorb Temperature	: 20°C
M-2 Cryotrap Temperature	: -10°C
Transfer (M-1 to M-2) Time	: 4.5 minutes
M-2 Cryotrap Desorb Temperature	: 240°C
M-3 Cryotrap Temperature	: -160°C
Transfer (M-2 to M-3) Time	: 3.5 minutes
Injection Time	: 2.0 minutes

B. GC/MS Conditions, Sample Analysis:

Initial Temperature	: 40.0°C
Initial Time	: 6.0 minutes
Ramp Rate	: 8.0°C/min
Final Temperature	: 220.0°C
Final Time	: 9.5 minutes
Run Time	: 35.03 minutes
Mass Scan Range:	: 35 to 250 AMU

Column: 0.25 mm x 30 meter Restek RTx-VOA, 3.0 µm film thickness (Restek Corporation)

TABLE 2 - Air Toxic Standards (Concentrations and Quantitation Ions)

Compound	Cylinder	Conc. (ppmv)	Quant. Ion
chloromethane	ALM009519	0.98	50
vinyl chloride	ALM009519	0.97	62
chloroethane	ALM009519	1.00	64
trichlorofluoromethane	ALM009519	1.04	101
1,1-dichloroethene	ALM009519	1.02	61
dichloromethane	ALM009519	1.00	49
trans-1,2-dichloroethene	ALM009519	1.00	61
1,1-dichloroethane	ALM009519	1.02	63
trichloromethane	ALM009519	1.02	83
1,1,1-trichloroethane	ALM009519	1.01	97
1,2-dichloroethane	ALM009519	1.02	62
benzene	ALM009519	1.00	78
carbon tetrachloride	ALM009519	0.98	117
trichloroethene	ALM009519	1.00	130
dibromomethane	ALM009519	0.98	174
bromodichloromethane	ALM009519	1.01	83
toluene	ALM009519	1.01	91
1,1,2-trichloroethane	ALM009519	0.98	97
tetrachloroethene	ALM009519	1.00	166
ethylbenzene	ALM009519	1.01	91
meta-xylene	ALM009519	1.02	91
styrene	ALM009519	1.04	104
ortho-xylene	ALM009519	1.04	91
1,1,2,2-tetrachloroethane	ALM009519	1.00	83
1,3,5-trimethylbenzene	ALM009519	1.05	120
Surrogate Standards			
bromochloromethane	ALM046281	1.06	49
p-bromofluorobenzene	ALM046281	1.06	95

Table 3 - Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
(concentrations in ppbv)

Sample Number	Method	17747	17740	17741	17742
Sample Location	Blank	Trip/Field	DW3	DW2	DW1
Date Sampled	N/A	04/06/00	04/06/00	04/06/00	04/06/00
Date Analyzed	04/10/00	04/10/00	04/10/00	04/10/00	04/10/00
Data File	AGS003	AGS004	AGS005	AGS006	AGS007
Chloromethane	4 U	4 U	2 J	9 J	2 J
Vinyl Chloride	4 U	4 U	4 U	16 U	4 U
Chloroethane	4 U	4 U	4 U	16 U	4 U
Trichlorofluoromethane	4 U	4 U	4 U	16 U	4 U
1,1-Dichloroethene	4 U	4 U	4 U	16 U	4 U
Methylene Chloride	4 U	4 U	4 U	16 U	4 U
trans-1,2-Dichloroethylene	4 U	4 U	4 U	16 U	4 U
1,1-Dichloroethane	4 U	4 U	4 U	16 U	4 U
Trichloromethane	4 U	4 U	4 U	16 U	4 U
1,1,1-Trichloroethane	4 U	4 U	4 U	16 U	4 U
Carbon Tetrachloride	4 U	4 U	4 U	16 U	4 U
1,2-Dichlroethane	4 U	4 U	4 U	16 U	4 U
Benzene	4 U	4 U	7	16 U	3 J
Trichloroethylene	4 U	4 U	4 U	16 U	4 U
Bromodichloromethane	4 U	4 U	4 U	16 U	4 U
Dibromomethane	4 U	4 U	4 U	16 U	4 U
Toluene	4 U	4 U	4	16 U	1 J
1,1,2-Trichloroethane	4 U	4 U	4 U	16 U	4 U
Tetrachloroethylene	4 U	4 U	4 U	16 U	4 U
Ethylbenzene	4 U	4 U	4 U	16 U	4 U
m & p-Xylenes	4 U	4 U	1 J	16 U	4 U
o-Xylene	4 U	4 U	4 U	16 U	4 U
Styrene	4 U	4 U	1 J	16 U	4 U
1,1,2,2-Tetrachloroethane	4 U	4 U	4 U	16 U	4 U
1,3,5-Trimethylbenzene	4 U	4 U	4 U	16 U	4 U
p-Bromofluorobenzene (% Rec)	103	100	107	101	109
Pressurized Sample Volume (mL)	250	250	500	500	500
Initial Pressure (psia)	N/A	N/A	14.8	2.0	15.2
Final Pressure (psia)	N/A	N/A	29.6	16.0	30.4
Quantitation Limit (ppbv)	4	4	4	16	4

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected

Table 3 - Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
(concentrations in ppbv)

Sample Number	17743	17744	17744 Rep	17745	17746
Sample Location	DW4	DW5	DW5	UW1	UW2
Date Sampled	04/06/00	04/06/00	04/06/00	04/06/00	04/06/00
Date Analyzed	04/10/00	04/10/00	04/11/00	04/10/00	04/10/00
Data File	AGS008	AGS009	AGS016	AGS010	AGS012
Chloromethane	3 J	1 J	1 J	4 U	1 J
Vinyl Chloride	4 U	4 U	4 U	4 U	4 U
Chloroethane	4 U	4 U	4 U	4 U	4 U
Trichlorofluoromethane	4 U	4 U	4 U	4 U	4 U
1,1-Dichloroethene	4 U	4 U	4 U	4 U	4 U
Methylene Chloride	4 U	4 U	4 U	4 U	4 U
trans-1,2-Dichloroethylene	4 U	4 U	4 U	4 U	4 U
1,1-Dichloroethane	4 U	4 U	4 U	4 U	4 U
Trichloromethane	4 U	4 U	4 U	4 U	4 U
1,1,1-Trichloroethane	4 U	4 U	4 U	4 U	4 U
Carbon Tetrachloride	4 U	4 U	4 U	4 U	4 U
1,2-Dichlroethane	4 U	4 U	4 U	4 U	4 U
Benzene	5	3 J	3 J	4 U	4 U
Trichloroethylene	4 U	4 U	4 U	4 U	4 U
Bromodichloromethane	4 U	4 U	4 U	4 U	4 U
Dibromomethane	4 U	4 U	4 U	4 U	4 U
Toluene	3 J	6	6	4 U	4 U
1,1,2-Trichloroethane	4 U	4 U	4 U	4 U	4 U
Tetrachloroethylene	4 U	4 U	4 U	4 U	4 U
Ethylbenzene	4 U	1 J	1 J	4 U	4 U
m & p-Xylenes	4 U	4 J	4 J	4 U	4 U
o-Xylene	4 U	1 J	1 J	4 U	4 U
Styrene	4 U	4 U	4 U	4 U	4 U
1,1,2,2-Tetrachloroethane	4 U	4 U	4 U	4 U	4 U
1,3,5-Trimethylbenzene	4 U	4 U	4 U	4 U	4 U
p-Bromofluorobenzene (% Rec)	110	112	112	106	105
Pressurized Sample Volume (mL)	500	500	500	500	500
Initial Pressure (psia)	8.8	14.0	14.0	8.4	8.4
Final Pressure (psia)	17.6	28.0	28.0	16.8	16.8
Quantitation Limit (ppbv)	4	4	4	4	4

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected
N/A - Not Applicable

Table 3 - Air Toxic Target Compound Results for Summa Canister Samples
WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities
(concentrations in ppbv)

Sample Number	Method Blank	
Sample Location		
Date Sampled	N/A	
Date Analyzed	04/11/00	
Data File	AGS015	
Chloromethane	4	U
Vinyl Chloride	4	U
Chloroethane	4	U
Trichlorofluoromethane	4	U
1,1-Dichloroethene	4	U
Methylene Chloride	4	U
trans-1,2-Dichloroethylene	4	U
1,1-Dichloroethane	4	U
Trichloromethane	4	U
1,1,1-Trichloroethane	4	U
Carbon Tetrachloride	4	U
1,2-Dichloroethane	4	U
Benzene	4	U
Trichloroethylene	4	U
Bromodichloromethane	4	U
Dibromomethane	4	U
Toluene	4	U
1,1,2-Trichloroethane	4	U
Tetrachloroethylene	4	U
Ethylbenzene	4	U
m & p-Xylenes	4	U
o-Xylene	4	U
Styrene	4	U
1,1,2,2-Tetrachloroethane	4	U
1,3,5-Trimethylbenzene	4	U
p-Bromofluorobenzene (% Rec)	100	
Pressurized Sample Volume (mL)	250	
Initial Pressure (psia)	N/A	
Final Pressure (psia)	N/A	
Quantitation Limit (ppbv)	4	

A - Assumed volume for Blanks
B - <3 times Method Blank value
C - Compound Calibration >25% RSD
D - Compound Calibration Check >25% RPD
E - Concentration exceeded calibration limit (25nL)
J - Below 1.00 nL Quantitation Limit
U - Not Detected
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	Method	Reference Standard:	Bromochloromethane
Sample Location:	Blank	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	N/A	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	N/A
Data File:	AGS003	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)
No non-targets were found.			

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17747	Reference Standard:	Bromochloromethane
Sample Location:	Trip/Field	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	N/A
Data File:	AGS004	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)
No non-targets were found.			

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17740	Reference Standard:	Bromochloromethane
Sample Location:	DW3	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	14.8
Data File:	AGS005	Final Pressure (psig):	29.6

Compound Name	Retention Time	Area	Concentration (ppbv)	
cycloalkane/alkene	2.792	2442275	8	
cycloalkane/alkene	3.611	962606	3	*
acetealdehyde	3.914	916963	3	*
furan + unknown	6.675	2271909	7	
acetone	6.937	1719096	6	
2methyl-furan + unknown	10.765	1956463	6	
aldehyde	19.271	2398466	8	

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17741	Reference Standard:	Bromochloromethane
Sample Location:	DW2	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	2.0
Data File:	AGS006	Final Pressure (psig):	16.0

Compound Name	Retention Time	Area	Concentration (ppbv)
acetone	6.999	1058843	13 *

* - Below 16 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17742	Reference Standard:	Bromochloromethane
Sample Location:	DW1	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	15.2
Data File:	AGS007	Final Pressure (psig):	30.4

Compound Name	Retention Time	Area	Concentration (ppbv)	
unknown	8.192	987161	3	*
aldehyde	19.288	940362	3	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17743	Reference Standard:	Bromochloromethane
Sample Location:	DW4	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	8.8
Data File:	AGS008	Final Pressure (psig):	17.6

Compound Name	Retention Time	Area	Concentration (ppbv)	
alkene	2.800	1499003	5	
acetone	6.968	1622183	5	
unknown	8.193	1208501	4	*
alkane	9.626	942198	3	*
2-methyl-furan + unknown	10.772	924300	3	*
aldehyde	19.283	936177	3	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17744	Reference Standard:	Bromochloromethane
Sample Location:	DW5	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	14.0
Data File:	AGS009	Final Pressure (psig):	28.0

Compound Name	Retention Time	Area	Concentration (ppbv)	
cycloalkane/alkene	2.800	834872	3	*
alkane + alkane	3.238	1004830	3	*
n-butane + alkane	3.628	1397502	4	
n-hexane	9.635	1440931	5	
toluene + siloxane	16.720	2327997	7	
trimethyl-benzene isomer	22.913	939916	3	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17745	Reference Standard:	Bromochloromethane
Sample Location:	UW1	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	8.4
Data File:	AGS010	Final Pressure (psig):	16.8

Compound Name	Retention Time	Area	Concentration (ppbv)
No non-targets were found.			

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17746	Reference Standard:	Bromochloromethane
Sample Location:	UW2	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	13322670
Date Analyzed:	04/10/00	Initial Pressure (psig):	8.4
Data File:	AGS012	Final Pressure (psig):	16.8

Compound Name	Retention Time	Area	Concentration (ppbv)
No non-targets were found.			

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	Method	Reference Standard:	Bromochloromethane
Sample Location:	Blank	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	250	Reference Std Volume (mL):	500
Date Sampled:	N/A	Reference Std Area:	8543457
Date Analyzed:	04/11/00	Initial Pressure (psig):	N/A
Data File:	AGS015	Final Pressure (psig):	N/A

Compound Name	Retention Time	Area	Concentration (ppbv)
No non-targets were found.			

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 4 - Air Toxic Non-target Compound Results
Summa Canister Samples

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample Number:	17744 Rep	Reference Standard:	Bromochloromethane
Sample Location:	DW5	Reference Std Conc. (ppbv):	21.2
Sample Volume (mL):	500	Reference Std Volume (mL):	500
Date Sampled:	04/06/00	Reference Std Area:	8543457
Date Analyzed:	04/11/00	Initial Pressure (psig):	14.0
Data File:	AGS016	Final Pressure (psig):	28.0

Compound Name	Retention Time	Area	Concentration (ppbv)	
unknown + alkane	3.198	696075	4	*
alkane	3.596	898837	5	
alkene	4.956	613106	3	*
acetone	6.890	892721	4	
toluene + siloxane	16.677	1684447	8	
trimethyl-benzene isomer	22.853	716418	4	*

* - Below 4 ppbv Limit of Quantitation
N/A - Not Applicable

Table 5 - Air Toxic MS/MSD Recovery Summary for Summa Canister Samples
APG Burn Site, Edgewood, MD WA # 0-110

ample Number		17746	17746 MS		17746 MSD	
mple Location		UW2	UW2		UW2	
)ate Sampled		04/06/00	04/06/00		04/06/00	
)ate Analyzed	Spike	04/10/00	04/10/00	%	04/10/00	%
)ata File	Amount	AGS012	AGS013	Recovery	AGS014	Recovery
Chloromethane	9.8	0.19	10.95	110	10.99	110
Vinyl Chloride	9.7	0.00	11.12	115	11.50	119
Chloroethane	10.0	0.00	11.91	119	11.99	120
Trichlorofluoromethane	10.4	0.00	12.87	124	13.33	128
1,1-Dichloroethene	10.2	0.00	10.65	104	10.79	106
Methylene Chloride	10.0	0.00	10.14	101	10.23	102
rans-1,2-Dichloroethene	10.0	0.00	10.34	103	10.58	106
1,1-Dichloroethane	10.2	0.00	10.56	104	10.79	106
Trichloromethane	10.2	0.00	10.22	100	10.54	103
1,1,1-Trichloroethane	10.1	0.00	10.17	101	10.64	105
Carbon Tetrachloride	9.8	0.00	10.40	106	10.68	109
1,2-Dichloroethane	10.2	0.00	10.61	104	10.74	105
Benzene	10.0	0.00	10.06	101	10.19	102
Trichloroethylene	10.0	0.00	9.95	99	10.12	101
Bromodichloromethane	10.1	0.00	10.16	101	10.43	103
Dibromomethane	9.8	0.00	10.10	103	10.23	104
Toluene	10.1	0.00	10.07	100	10.19	101
1,1,2-Trichloroethane	9.8	0.00	10.12	103	10.45	107
Tetrachloroethylene	10.0	0.00	10.35	103	10.49	105
Ethylbenzene	10.1	0.00	10.13	100	10.17	101
eta & para-Xylenes	10.2	0.00	10.20	100	10.25	100
ho-Xylene	10.4	0.00	10.31	99	10.42	100
Styrene	10.4	0.00	10.51	101	10.52	101
1,1,2,2-Tetrachloroethane	10.0	0.00	10.70	107	10.96	110
1,3,5-trimethlybenzene	10.5	0.00	10.67	102	10.82	103
-Bromofluorobenzene (% Rec.)	N/A	105	105	N/A	103	N/A

N/A - Not Applicable

APPENDIX A

CHAIN-OF-CUSTODY

Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sampled on 06 April 2000

WA#: R1A00110

REAC, E[illegible]on, NJ
132 (908) 321-4200
EPA Contract 68-C4-0022
68-C9-223

CHA[illegible]F CUSTODY RECORD

Project Name: APG Burn
Project Number: 14700/10
RFW Contact: Amy DuBois Phone: 494 4013

No: 03310
SHEET NO. 1 OF 1

D41000

Sample Identification

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles (Summa)	Container/Preservative	VOCs	Volume
426	17740	DW3	A	4/6/00	1	none	✓	6 (L)
427	17741	DW2					✓	6 (L)
428	17742	DW1					✓	6 (L)
429	17743	DW4					✓	4.5 (L)
430	17744	DW5					✓	6 (L)
431	17745	UW1					✓	3.96 (L)
432	17746	UW2					✓	4.8 (L)
433	17747	TRIP/FIELD	↓	↓	↓	↓	✓	6 (L)

AGJ

AGJ

0029

Matrix:

SD -	Sediment	PW -	Potable Water	S -	Soil
DS -	Drum Solids	GW -	Groundwater	W -	Water
DL -	Drum Liquids	SW -	Surface Water	O -	Oil
X -	Other	SL -	Sludge	(A -	Air)

Special Instructions:

VOCs - Volatile Organic Compounds Analysis by Modified TO-14

(L) - Liters

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time
Analysis	[signature]	4/6/00	[signature]	4/10/00	1410

Items/Reason	Relinquished By	Date	Received By	Date	Time
ALL Analysis	[signature]	4/10/00	[signature]	4/10/00	1510

APPENDIX B

Analytical Report (PAH, Inorganic Acids, Metals, and Dioxins/Furans)
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

ANALYTICAL REPORT

Prepared by
Lockheed Martin

Air Monitoring. Sampling, and Modeling Support, and Underwater Survey Activities
Aberdeen Proving Ground, Aberdeen, MD

May 2000

EPA Work Assignment No. 0-110
LOCKHEED MARTIN Work Order No. R1A00110
EPA Contract No. 68-C99-223

Submitted to
D. Mickunas
EPA-ERT

5/31/00
A. Dubois — Date
Task Leader

6/1/2000
D. Miller — Date
Analytical Section Leader

6/1/00
S. Clapp — Date
Program Manager

Analysis by:
REAC
SWRI

Prepared by:
M. Bernick

Reviewed by:
D. Killeen

Table of Contents

Appendices will be furnished on request.

Introduction

REAC in response to WA # 0-110, provided analytical support for environmental samples collected from Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities, located in Aberdeen Proving Ground, Aberdeen, MD as described in the following table. The support also included QA/QC, data review, and preparation of an analytical report containing a summary of the analytical methods, the results, and the QA/QC results.

The samples were treated with procedures consistent with those described in SOP # 1008 and are summarized in the following table:

COC #	Number of Samples	Sampling Date	Date Received	Matrix	Analysis	Laboratory
06966	10	4/6/00	4/11/00	Air	Dioxin	SWRI*
05254	10	4/6/00	4/11/00		Metals	
06965	10	4/6/00	4/11/00		Inorganic Acids	
05654	10	4/6/00	4/10/00		PAH	REAC

* SWRI denotes Southwest Research Institute

Case Narrative

The data in this report have been validated to two significant figures. Any other representation of the data is the responsibility of the user.

PAH in Air Package J142

The data were examined and were found to be satisfactory.

Inorganic Acids in Air Package J159

All sample results were lot blank subtracted.

Sample 17733, the trip blank, contained 0.0013 mg of sulfuric acid. The sulfuric acid results for samples 17700 through 17706 are considered not detected.

Metals in Air Package J158

The method blank contained 11.81 µg/filter sodium (Na). The Na results for samples 17680 through 17689 are considered not detected.

Sample 17689, the lot blank, contained 6.2 µg/filter calcium (Ca), 0.51 µg/filter chromium (Cr), 1.6 µg/filter iron (Fe) and 1.1 µg/filter zinc (Zn). The Ca, Cr and Zn results for samples 17680 through 17688, and the Fe results for samples 17681 through 17685, 17687 and 17688 are considered not detected because the concentration in the

sample is less then five times the concentration in the lot blank.

Sample 17688, the trip blank, contained 0.23 µg/filter nickel (Ni). The Ni results for samples 17681, 17683, 17686 and 17687 are considered not detected because the concentration in the sample is less then five times the concentration in the trip blank.

The LCS percent recovery exceeded the QC limits for tellurium (Te) (6.7%). The BS/BSD percent recovery exceeded the QC limits for Te (BS 8.2%, BSD 8.6%), phosphorus (P) (BS 126%, BSD 127%), tin (Sn) (BS 131%, BSD 132%), and zirconium (Zr) (BS 134%, BSD 131%). The Te results for samples 17680 through 17689 are considered unusable.

Dioxins in Air Package J 160

The method blank contained 13 pg OCDF. The OCDF result for sample 17679 is considered estimated.

Sample 17679, the lot blank, contained 0.660 pg 123789-HxCDD. This compound was not detected in the associated samples; the data are not affected.

Sample 17677, the trip blank, contained 12.2 pg OCDD. The OCDD results for samples 17670, 17675, 17674 and 17676 are considered not detected because the sample concentrations were less than five times that found in the trip blank.

Lock mass ion 342 (penta dioxins and furans) exhibited a loss of sensitivity during the calibration verification on 4/17/00 (6:41 am) on instrument H. None of the associated samples exhibited a sensitivity loss for this ion during analysis; the data are not affected.

In the ending calibration verification standard of 4/17/00 (6:41 am), the acceptable percent difference QC limits were exceeded for ^{13}C-12378-PeCDD (45%) and ^{13}C-OCDD (46%). As required by the method criteria, the subcontracted laboratory used the two continuing calibrations bracketing the samples to calculate average relative response factors for quantitation.. Samples 17673, 17674, 17675, 17676, 17677 and 17678 were quantiated using these average response factors. The percent relative standard deviation of these average response factors exceeded the QC limits for OCDF (21), ^{13}C-12378-PeCDD (43) and ^{13}C-OCDD (33). The OCDD results for samples 17673, 17674, 17675, 17676 and 17677 are considered estimated.

The acceptable QC limits were exceeded for the percent recovery for internal standard ^{13}C-12378-PeCDD (138%) for sample 17676. 12378-PeCDD was not detected in this sample; the data are not affected

The acceptable QC limits were exceeded for the percent recovery for internal standard ^{13}C-12378-PeCDF (137%) for sample 17676. Pentafurans were not detected in this sample; the data are not affected.

Summary of Abbreviations

AA	Atomic Absorption
B	The analyte was found in the blank
BFB	Bromofluorobenzene
C	Centigrade
D	(Surrogate Table) this value is from a diluted sample and was not calculated (Result Table) this result was obtained from a diluted sample
Dioxin	denotes Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans and/or PCDD and PCDF
CLP	Contract Laboratory Protocol
COC	Chain of Custody
CONC	Concentration
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
DFTPP	Decafluorotriphenylphosphine
DL	Detection Limit
E	The value is greater than the highest linear standard and is estimated
EMPC	Estimated maximum possible concentration
ICAP	Inductively Coupled Argon Plasma
ISTD	Internal Standard
J	The value is below the method detection limit and is estimated
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDL	Method Detection Limit
MI	Matrix Interference
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Molecular Weight
NA	either Not Applicable or Not Available
NC	Not Calculated
NR	Not Requested
NS	Not Spiked
% D	Percent Difference
% REC	Percent Recovery
PPB	Parts per billion
PPBV	Parts per billion by volume
PPMV	Parts per million by volume
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QL	Quantitation Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SIM	Selected Ion Monitoring
TCLP	Toxic Characteristics Leaching Procedure
U	Denotes not detected
W	Weathered analyte; the results should be regarded as estimated

m^3	cubic meter	kg	kilogram	μg	microgram
L	liter	g	gram	pg	picogram
mL	milliliter	mg	milligram	ng	nanogram
μL	microliter				

*	denotes a value that exceeds the acceptable QC limit
	Abbreviations that are specific to a particular table are explained in footnotes on that table

Revision 1/5/00

Analytical Procedure for PAH in Air (XAD-2 Tubes)

XAD-2 Tube Preparation

The XAD-2 tubes were analyzed for polycyclic aromatic hydrocarbons (PAH) using modified NIOSH Method 5515. The front, back and filter portions of the tubes were analyzed separately by extracting them with 2.0 mL methylene chloride. A preweighed filter was also collected with these tubes and this filter was extracted with 4.0 mL methylene chloride. One mL of extract was spiked with 20 µL of a 2000 ppm XAD internal standards solution consisting of naphthalene-d_8, acenaphthene-d_{10}, phenanthrene-d_{10}, chrysene-d_{12}, and perylene-d_{12}, resulting in a 40.0 ppm concentration and analyzed.

GC/MS Analysis

An HP 6890 MSD, equipped with a 6890 autosampler and controlled by a personal computer equipped with HP-Enviroquant software was used to analyze the samples.

The instrument conditions were:

Column	Restek Rtx-5 (cross bonded SE-54) 30 meter x 0.25 mm ID, 0.50 µm film thickness.
Flow Rate	1 mL/min, EPC enabled
Injection Temperature	280° C
Transfer Temperature	280° C
Source Temperature & Analyzer Temperature	Controlled by thermal transfer of heat from Transfer Line
Temperature	280° C
Temperature Program	70° C for 0.5 min 30° C/min to 295° C; hold for 8 minutes 30° C/min to 315° C; hold for 7 min
Pulsed Splitless Injection	Pressure Pulse = 16 psi for 1.0 min, then normal flow 8:1 Split Ratio
Injection Volume	1µL

The GC/MS was calibrated using 6 PAH standards at 10, 25, 50, 75, 100 and 150 ppm. Before analysis each day the system was tuned with 50-ng decafluorotriphenylphosphine (DFTPP) and passed a continuing calibration check by analyzing a 50µg/mL daily standard. The QC limit for the initial calibration is %RSD less than 30 and %D less than 25 for the daily check. Sample quantification is based on the average response factor of the calibration curve or the response factor of the daily calibration check.

The XAD-2 tube PAH results are listed in Table 1.1. Tentatively identified compounds are listed in Table 1.2. The following equations were used to calculate the analyte - total µg/sample:

$$\mu g/sample = C_u x V x DE = \frac{A_u x C_{is} x V x DE}{A_{is} x RF}$$

where

C_u = Concentration of the analyte (µg/mL)
V = Extraction Volume (mL)
DE = Desorption Efficiency = 100/(% Recovery)
A_u = Area of the analyte
C_{is} = Concentration of the internal standard (µg/mL)
A_{is} = Area of the internal standard

The Relative Response Factor, RRF, is calculated from the calibration standard mixture using

$$RRF = \frac{A_u x C_{is}}{A_{is} x C_u}$$

where

RRF = Relative Response Factor (unitless)
A_u = Area of Analyte in the standard mixture
C_{is} = Concentration of Internal Standard in the standard mixture (µg/mL)
A_{is} = Area of Internal Standard in the standard mixture
C_u = Concentration of Analyte in the standard mixture (µg/mL)

The concentration of the analyte in mg/m^3 and ppbv (parts per billion by volume) is calculated using the following:

$$mg/m^3 = \frac{(Total\,\mu g\,front + Total\,\mu g\,back)}{Liters\,Sampled}$$

$$ppbv = \frac{mg/m^3 x 24.45 x 1000}{MW}$$

where MW is the molecular weight of the analyte

Revision of 3/6/00

Analytical Procedure for Inorganic Acids in Air

The subcontract laboratory determined the concentration of inorganic acids in the samples by analyzing them according to NIOSH Method 7903. The results of the analysis for the air samples are listed in Table 1.3.

Analytical Procedure for Metals in Air

The subcontract laboratory determined the concentration of Metals in the samples by analyzing them according to NIOSH Method 7300. The results of the analysis for the air samples are listed in Table 1.4.

Analytical Procedure for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

The subcontract laboratory determined the concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in the samples by analyzing them according to USEPA SW-846 Method 8290. The results of the analysis are listed in Table 1.5.

Table 1.1 Results of the Analysis for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample No.	17689		17690		17691		17692		17693	
Sampling Location	Lot Blank		DW3		DW2		DW1		DW4	
Volume (L)	0		360		351		360		369	
Compound Name	Conc. µg	MDL µg	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv
Naphthalene	U	11	U	5.6	1.7 J	5.7	U	5.6	U	5.4
2-Methylnaphthalene	U	11	U	5.3	U	5.4	U	5.3	U	5.2
1-Methylnaphthalene	U	11	U	5.2	U	5.3	U	5.2	U	5.0
Biphenyl	U	11	U	5.0	U	5.1	U	5.0	U	4.8
2,6-Dimethylnaphthalene	U	11	U	4.9	U	5.0	U	4.9	U	4.7
Acenaphthylene	U	12	U	5.2	U	5.3	U	5.2	U	5.1
Acenaphthene	U	11	U	4.7	U	4.9	U	4.7	U	4.6
Dibenzofuran	U	11	U	4.6	U	4.7	U	4.6	U	4.5
Fluorene	U	11	U	4.7	U	4.8	U	4.7	U	4.6
Phenanthrene	U	11	U	4.1	U	4.2	U	4.1	U	4.0
Anthracene	U	10	U	3.9	U	4.0	U	3.9	U	3.8
Carbazole	U	12	U	4.8	U	4.9	U	4.8	U	4.6
Fluoranthene	U	12	U	4.0	U	4.1	U	4.0	U	3.9
Pyrene	U	12	U	4.0	U	4.1	U	4.0	U	3.9
Benzo(a)anthracene	U	12	U	3.5	U	3.6	U	3.5	U	3.4
Chrysene	U	14	U	4.3	U	4.4	U	4.3	U	4.2
Benzo(b)fluoranthene	U	11	U	2.9	U	3.0	U	2.9	U	2.8
Benzo(k)fluoranthene	U	11	U	3.1	U	3.2	U	3.1	U	3.0
Benzo(e)pyrene	U	12	U	3.2	U	3.3	U	3.2	U	3.1
Benzo(a)pyrene	U	12	U	3.3	U	3.4	U	3.3	U	3.2
Indeno(1,2,3-cd)pyrene	U	13	U	3.1	U	3.2	U	3.1	U	3.0
Dibenzo(a,h)anthracene	U	12	U	3.0	U	3.1	U	3.0	U	2.9
Benzo(g,h,i)perylene	U	12	U	3.1	U	3.1	U	3.1	U	3.0

Table 1.1 (cont.) Results of the Analysis for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample No.	17694		17695		17696		17697		17698	
Sampling Location	DW5		UW1		UW2		Field Blank		Trip Blank	
Volume (L)	360		332		360		0		0	
Compound Name	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. ppbv	MDL ppbv	Conc. µg	MDL µg	Conc. µg	MDL µg
Naphthalene	U	5.6	U	6.1	U	5.6	U	11	U	11
2-Methylnaphthalene	U	5.3	U	5.8	U	5.3	U	11	U	11
1-Methylnaphthalene	U	5.2	U	5.6	U	5.2	U	11	U	11
Biphenyl	U	5.0	U	5.4	U	5.0	U	11	U	11
2,6-Dimethylnaphthalene	U	4.9	U	5.3	U	4.9	U	11	U	11
Acenaphthylene	U	5.2	U	5.6	U	5.2	U	12	U	12
Acenaphthene	U	4.7	U	5.1	U	4.7	U	11	U	11
Dibenzofuran	U	4.6	U	5.0	U	4.6	U	11	U	11
Fluorene	U	4.7	U	5.1	U	4.7	U	11	U	11
Phenanthrene	U	4.1	U	4.4	U	4.1	U	11	U	11
Anthracene	U	3.9	U	4.2	U	3.9	U	10	U	10
Carbazole	U	4.8	U	5.2	U	4.8	U	12	U	12
Fluoranthene	U	4.0	U	4.3	U	4.0	U	12	U	12
Pyrene	U	4.0	U	4.3	U	4.0	U	12	U	12
Benzo(a)anthracene	U	3.5	U	3.8	U	3.5	U	12	U	12
Chrysene	U	4.3	U	4.6	U	4.3	U	14	U	14
Benzo(b)fluoranthene	U	2.9	U	3.1	U	2.9	U	11	U	11
Benzo(k)fluoranthene	U	3.1	U	3.4	U	3.1	U	11	U	11
Benzo(e)pyrene	U	3.2	U	3.5	U	3.2	U	12	U	12
Benzo(a)pyrene	U	3.3	U	3.6	U	3.3	U	12	U	12
Indeno(1,2,3-cd)pyrene	U	3.1	U	3.4	U	3.1	U	13	U	13
Dibenzo(a,h)anthracene	U	3.0	U	3.2	U	3.0	U	12	U	12
Benzo(g,h,i)perylene	U	3.1	U	3.3	U	3.1	U	12	U	12

Table 1.2 Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17699 Lot Blank

LabFile # APG059 Con. Factor 2.0

	CAS#	Compound	Q	RT	Conc ** Total µg
1	85-68-7	Butyl benzyl phthalate	95	9.73	28
2		Unknown		15.14	13
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17690

LabFile # APG062 Con. Factor 5.6

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	91	9.73	97
2		Unknown		15.15	48
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17691

LabFile # APG065 Con. Factor 5.7

	CAS#	Compound	Q	RT	Conc ** µg/m3
1		Unknown phenol		4.96	28
2	85-68-7	Butyl benzyl phthalate	91	7.93	100
3		Unknown		15.15	45
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17692

LabFile # APG068 Con. Factor 5.6

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	70	9.73	93
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17693

LabFile # APG071 Con. Factor 5.4

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	95	9.73	92
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17694

LabFile # APG074 Con. Factor 5.6

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	91	9.73	91
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17695

LabFile # APG077 Con. Factor 6.0

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	94	9.73	95
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17696

LabFile # APG080 Con. Factor 5.6

	CAS#	Compound	Q	RT	Conc ** µg/m3
1	85-68-7	Butyl benzyl phthalate	70	9.73	85
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17697

LabFile # APG083 Con. Factor 2.0

	CAS#	Compound	Q	RT	Conc ** Total µg
1	85-68-7	Butyl benzyl phthalate	94	9.73	30
2		Unknown		15.13	12
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.2 (cont.) Results of the TIC for PAH in Air

WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample # 17698

LabFile # APG086 Con. Factor 2.0

	CAS#	Compound	Q	RT	Conc ** Total µg
1	85-68-7	Butyl benzyl phthalate	94	9.73	33
2		Unknown		15.14	14
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

**Estimated Concentration (Response Factor = 1.0)

Table 1.3 Results of the Analysis for Inorganic Acids in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID	17734		17732		17733			17700			
Location	Lot Blank		Field Blank		Trip blank			DW-3			
Air Volume (L):	0		0		0			45.9			
Analyte	Conc mg	MDL mg	Conc mg	MDL mg	Conc mg	MDL mg		Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv
Hydrobromic acid	U	0.0010	U	0.0010	U	0.0010		U	0.0220	U	0.0067
Hydrochloric acid	0.0031	0.0010	U	0.0010	U	0.0010		0.184	0.0224	0.123	0.0150
Hydrofluoric acid	U	0.0011	U	0.0011	U	0.0011		0.0592	0.0229	0.0724	0.0280
Nitric acid	U	0.0045	U	0.0045	U	0.0045		U	0.0980	U	0.0380
Phosphoric acid	U	0.0032	U	0.0032	U	0.0032		U	0.0689	U	0.0172
Sulfuric acid	0.0050	0.0010	U	0.0010	0.0013	0.0010		0.0901	0.0222	0.0225	0.0055

Sample ID	17701				17702				17703			
Location	DW2				DW1				DW4			
Air Volume (L):	45.0				45.9				45.5			
Analyte	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv
Hydrobromic acid	U	0.0225	U	0.0068	U	0.0220	U	0.0067	U	0.0222	U	0.0067
Hydrochloric acid	U	0.0223	U	0.0153	0.0578	0.0224	0.0387	0.0150	U	0.0226	U	0.0152
Hydrofluoric acid	0.0842	0.0234	0.103	0.0286	0.0239	0.0229	0.0292	0.0280	0.0359	0.0231	0.0439	0.0283
Nitric acid	U	0.1000	U	0.0388	U	0.0980	U	0.0380	U	0.0989	U	0.0384
Phosphoric acid	U	0.0702	U	0.0175	U	0.0689	U	0.0172	U	0.0695	U	0.0173
Sulfuric acid	0.105	0.0227	0.0262	0.0057	0.0732	0.0222	0.0182	0.0055	0.0644	0.0224	0.0161	0.0056

Sample ID	17704				17705				17706			
Location	DW5				UW1				UW2			
Air Volume (L):	45.0				41.8				45.5			
Analyte	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv	Conc mg/m³	MDL mg/m³	Conc ppmv	MDL ppmv
Hydrobromic acid	U	0.0225	U	0.0068	U	0.0242	U	0.0073	U	0.0222	U	0.0067
Hydrochloric acid	0.0281	0.0223	0.0188	0.0153	U	0.0246	U	0.0165	0.0262	0.0226	0.0176	0.0152
Hydrofluoric acid	0.0318	0.0234	0.0389	0.0286	U	0.0252	U	0.0308	U	0.0231	U	0.0283
Nitric acid	U	0.1000	U	0.0388	U	0.1077	U	0.0418	U	0.0989	U	0.0384
Phosphoric acid	U	0.0702	U	0.0175	U	0.0756	U	0.0189	U	0.0695	U	0.0173
Sulfuric acid	0.162	0.0227	0.0404	0.0057	0.0703	0.0244	0.0175	0.0061	0.087	0.0224	0.0217	0.0056

All sample results are lot blank subtracted.

Table 1.4 Results of the Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Client ID	Method Blank		17680		17681		17682		17683		17684	
Location	-		DW3		DW2		DW1		DW4		DW5	
Air Volume (L)	0		540		540		540		540		540	
Parameter	Conc µg	MDL µg	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³
Aluminum	U	1.0	3.8	1.9	4.0	1.9	1.9	1.9	U	1.9	1.9	1.9
Arsenic	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Beryllium	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Cadmium	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Calcium	U	2.0	34	3.7	40	3.7	15	3.7	11	3.7	13	3.7
Chromium	U	0.10	1.0	0.19	1.1	0.19	1.0	0.19	1.1	0.19	0.98	0.19
Cobalt	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Copper	U	0.10	U	0.19	0.22	0.19	U	0.19	U	0.19	U	0.19
Iron	U	1.0	25	1.9	9.2	1.9	3.6	1.9	2.6	1.9	2.0	1.9
Lead	U	0.10	U	0.19	0.33	0.19	U	0.19	U	0.19	U	0.19
Lithium	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Magnesium	U	1.0	4.2	1.9	5.6	1.9	2.0	1.9	U	1.9	U	1.9
Manganese	U	0.10	1.0	0.19	1.0	0.19	U	0.19	U	0.19	U	0.19
Molybdenum	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Nickel	U	0.20	U	0.37	0.81	0.37	U	0.37	0.38	0.37	U	0.37
Phosphorus	U	0.40	1.3	0.74	2.2	0.74	1.3	0.74	0.81	0.74	U	0.74
Platinum	U	1.0	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9
Selenium	U	0.20	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37
Silver	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Sodium	11.8	6.0	17	11	18	11	17	11	16	11	11	11
Tellurium	U	1.0	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9
Thallium	U	0.40	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74
Tin	U	0.40	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74
Titanium	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Vanadium	U	0.10	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Yttrium	U	0.20	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37
Zinc	U	0.30	3.4	0.56	2.0	0.56	0.93	0.56	1.1	0.56	0.81	0.56
Zirconium	U	0.20	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37
Tungsten	U	0.40	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74

Table 1.4 (cont.) Results of the Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Client ID	17685		17686		17687		17688		17689	
Location	UW1		UW2		Field Blank		Trip Blank		Lot Blank	
Air Volume (L)	498		540		0		0		0	
Parameter	Conc µg/m³	MDL µg/m³	Conc µg/m³	MDL µg/m³	Conc µg/filter	MDL µg/filter	Conc µg/filter	MDL µg/filter	Conc µg/filter	MDL µg/filter
Aluminum	4.0	2.0	31	1.9	U	1.0	U	1.0	U	1.0
Arsenic	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Beryllium	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Cadmium	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Calcium	16	4.0	22	3.7	6.6	2.0	7.6	2.0	6.2	2.0
Chromium	1.1	0.20	1.2	0.19	0.62	0.10	0.88	0.10	0.51	0.10
Cobalt	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Copper	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Iron	5.7	2.0	58	1.9	4.0	1.0	2.7	1.0	1.6	1.0
Lead	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Lithium	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Magnesium	U	2.0	30	1.9	U	1.0	U	1.0	U	1.0
Manganese	U	0.20	0.77	0.19	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Nickel	6.9	0.40	0.55	0.37	0.44	0.20	0.23	0.20	U	0.20
Phosphorus	1.0	0.80	2.1	0.74	U	0.40	U	0.40	U	0.40
Platinum	U	2.0	U	1.9	U	1.0	U	1.0	U	1.0
Selenium	U	0.40	U	0.37	U	0.20	U	0.20	U	0.20
Silver	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Sodium	14	12	18	11	9.8	6.0	9.0	6.0	7.3	6.0
Tellurium	U	2.0	U	1.9	U	1.0	U	1.0	U	1.0
Thallium	U	0.80	U	0.74	U	0.40	U	0.40	U	0.40
Tin	U	0.80	U	0.74	U	0.40	U	0.40	U	0.40
Titanium	0.62	0.20	0.71	0.19	U	0.10	U	0.10	U	0.10
Vanadium	U	0.20	U	0.19	U	0.10	U	0.10	U	0.10
Yttrium	U	0.40	U	0.37	U	0.20	U	0.20	U	0.20
Zinc	1.7	0.60	1.2	0.56	2.1	0.30	2.4	0.30	1.1	0.30
Zirconium	U	0.40	U	0.37	U	0.20	U	0.20	U	0.20
Tungsten	U	0.80	U	0.74	U	0.40	U	0.40	U	0.40

Table 1.5 Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		Blank				17670			
Location		04/12/00				DW3			
Volume of Air (L)		0				540			
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	TEF
2,3,7,8-TCDD		0.72	10.0	U		3.89	18.5	U	1
1,2,3,7,8-PeCDD		1.40	10.0	U		2.92	18.5	U	0.5
1,2,3,4,7,8-HxCDD	U		25.0	U		4.85	46.3	U	0.1
1,2,3,6,7,8-HxCDD		3.16	25.0	U		1.22	46.3	U	0.1
1,2,3,7,8,9-HxCDD		2.20	25.0	U		3.37	46.3	U	0.1
1,2,3,4,6,7,8-HpCDD		4.66	25.0	U		2.63	46.3	U	0.01
OCDD		16.7	50.0	U	35.7 J		92.5	0.035	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	U				U				
Total Hexa-Dioxins	U				U				
Total Hepta-Dioxins	U				U				
2,3,7,8-TCDF	U		10.0	U		2.04	18.5	U	0.1
1,2,3,7,8-PeCDF	U		10.0	U	U		18.5	U	0.05
2,3,4,7,8-PeCDF	U		10.0	U		1.44	18.5	U	0.5
1,2,3,4,7,8-HxCDF		2.72	25.0	U		0.259	46.3	U	0.1
1,2,3,6,7,8-HxCDF		1.38	25.0	U		0.592	46.3	U	0.1
1,2,3,7,8,9-HxCDF	U		25.0	U		1.41	46.3	U	0.1
2,3,4,6,7,8-HxCDF	U		25.0	U		1.41	46.3	U	0.1
1,2,3,4,6,7,8-HpCDF		12.5	25.0	U		7.33	46.3	U	0.01
1,2,3,4,7,8,9-HpCDF	U		25.0	U	U		46.3	U	0.01
OCDF	13.0 J		50.0	0.0130		5.11	92.5	U	0.001
Total Tetra-Furans	U				U		46.3		
Total Penta-Furans	U				U		92.5		
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				U				
Total				0.0130				0.035	

Table 1.5 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		17673				17674			
Location		DW4				DW5			
Volume of Air (L)		0				540			
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg/m^3	EMPC pg/m^3	MDL pg/m^3	Adjusted Conc (pg/m^3)	TEF
2,3,7,8-TCDD		0.400	10.0	U	U		18.5	U	1
1,2,3,7,8-PeCDD		0.440	10.0	U		0.888	18.5	U	0.5
1,2,3,4,7,8-HxCDD		3.72	25.0	U		1.96	46.3	U	0.1
1,2,3,6,7,8-HxCDD	4.20 J		25.0	0.420		6.66	46.3	U	0.1
1,2,3,7,8,9-HxCDD		3.12	25.0	U		2.48	46.3	U	0.1
1,2,3,4,6,7,8-HpCDD	27.7		25.0	0.277	12.6 J		46.3	0.126	0.01
OCDD	73.8		50.0	0.0738	94.6		92.5	0.094	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	U				U				
Total Hexa-Dioxins	4.20				U				
Total Hepta-Dioxins	27.7				12.6				
2,3,7,8-TCDF		2.10	10.0	U	U		18.5	U	0.1
1,2,3,7,8-PeCDF		0.980	10.0	U		0.629	18.5	U	0.05
2,3,4,7,8-PeCDF		0.700	10.0	U		0.851	18.5	U	0.5
1,2,3,4,7,8-HxCDF	2.32 J		25.0	0.232		0.207	46.3	U	0.1
1,2,3,6,7,8-HxCDF		1.76	25.0	U	U		46.3	U	0.1
1,2,3,7,8,9-HxCDF		1.56	25.0	U		0.666	46.3	U	0.1
2,3,4,6,7,8-HxCDF		2.58	25.0	U	U	2.04	46.3	U	0.1
1,2,3,4,6,7,8-HpCDF		9.64	25.0	U		14.5	46.3	U	0.01
1,2,3,4,7,8,9-HpCDF		6.36	25.0	U		6.11	46.3	U	0.01
OCDF		21.3	50.0	U		14.0	92.5	U	0.001
Total Tetra-Furans	U				U				
Total Penta-Furans	U				3.18				
Total Hexa-Furans	2.32				U				
Total Hepta-Furans	U				U				
Total				1.00				0.221	

Table 1.5 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID	17675				17676				
Location	UW1				UW2				
Volume of Air (L)	498				540				
Analyte	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	Result pg/m³	EMPC pg/m³	MDL pg/m³	Adjusted Conc (pg/m³)	TEF
2,3,7,8-TCDD		1.73	20.1	U	U		18.5	U	1
1,2,3,7,8-PeCDD	U		20.1	U		2.04	18.5	U	0.5
1,2,3,4,7,8-HxCDD		1.53	50.2	U	U		46.3	U	0.1
1,2,3,6,7,8-HxCDD		3.01	50.2	U	U		46.3	U	0.1
1,2,3,7,8,9-HxCDD		3.14	50.2	U		1.48	46.3	U	0.1
1,2,3,4,6,7,8-HpCDD		10.0	50.2	U		4.18	46.3	U	0.01
OCDD	33.0 J		100	0.033	30.9 J		92.5	0.030	0.001
Total Tetra-Dioxins	U				U				
Total Penta-Dioxins	U				U				
Total Hexa-Dioxins	U				U				
Total Hepta-Dioxins	U				U				
2,3,7,8-TCDF		1.33	20.1	U		1.11	18.5	U	0.1
1,2,3,7,8-PeCDF		1.65	20.1	U		0.481	18.5	U	0.05
2,3,4,7,8-PeCDF		0.804	20.1	U		0.888	18.5	U	0.5
1,2,3,4,7,8-HxCDF		1.81	50.2	U		1.37	46.3	U	0.1
1,2,3,6,7,8-HxCDF		1.85	50.2	U		1.44	46.3	U	0.1
1,2,3,7,8,9-HxCDF	U		50.2	U		0.925	46.3	U	0.1
2,3,4,6,7,8-HxCDF		2.17	50.2	U	U		46.3	U	0.1
1,2,3,4,6,7,8-HpCDF		28.9	50.2	U		7.84	46.3	U	0.01
1,2,3,4,7,8,9-HpCDF	U		50.2	U		0.703	46.3	U	0.01
OCDF		12.0	100	U		9.47	92.5	U	0.001
Total Tetra-Furans	U				U				
Total Penta-Furans	U				U				
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				U				
Total				0.033				0.030	

Table 1.5 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID		17677				17678				
Location		Trip Blank				Field Blank				
Volume of Air (L)		0				0				
Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	TEF
2,3,7,8-TCDD		0.720	10.0	U		0.840	10.0	U	1
1,2,3,7,8-PeCDD	U		10.0	U		0.880	10.0	U	0.5
1,2,3,4,7,8-HxCDD		0.280	25.0	U	U		25.0	U	0.1
1,2,3,6,7,8-HxCDD		0.920	25.0	U		1.80	25.0	U	0.1
1,2,3,7,8,9-HxCDD	U		25.0	U		0.840	25.0	U	0.1
1,2,3,4,6,7,8-HpCDD		1.84	25.0	U		2.16	25.0	U	0.01
OCDD	12.2 J		50.0	0.0122		21.3	50.0	U	0.001
								U	
Total Tetra-Dioxins	U				U			U	
Total Penta-Dioxins	U				U			U	
Total Hexa-Dioxins	U				U			U	
Total Hepta-Dioxins	U				U			U	
								U	
2,3,7,8-TCDF		0.780	10.0	U	U		10.0	U	0.1
1,2,3,7,8-PeCDF		0.680	10.0	U		1.00	10.0	U	0.05
2,3,4,7,8-PeCDF		0.520	10.0	U		0.240	10.0	U	0.5
1,2,3,4,7,8-HxCDF	U		25.0	U	U		25.0	U	0.1
1,2,3,6,7,8-HxCDF	U		25.0	U	U		25.0	U	0.1
1,2,3,7,8,9-HxCDF		0.600	25.0	U		0.260	25.0	U	0.1
2,3,4,6,7,8-HxCDF		0.520	25.0	U		1.04	25.0	U	0.1
1,2,3,4,6,7,8-HpCDF		3.38	25.0	U		2.64	25.0	U	0.01
1,2,3,4,7,8,9-HpCDF	U		25.0	U		0.720	25.0	U	0.01
OCDF		2.82	50.0	U		6.70	50.0	U	0.001
Total Tetra-Furans	U				U				
Total Penta-Furans	U				1.96				
Total Hexa-Furans	U				U				
Total Hepta-Furans	U				U				
Total				0.0122				U	

Table 1.5 (cont.) Results of the Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Sample ID	17679
Location	Lot Blank
Volume of Air (L)	0

Analyte	Result pg	EMPC pg	MDL pg	Adjusted Conc (pg)	TEF
2,3,7,8-TCDD		1.70	10.0	U	1
1,2,3,7,8-PeCDD		1.02	10.0	U	0.5
1,2,3,4,7,8-HxCDD		1.06	25.0	U	0.1
1,2,3,6,7,8-HxCDD		0.500	25.0	U	0.1
1,2,3,7,8,9-HxCDD	0.660 J		25.0	0.0660	0.1
1,2,3,4,6,7,8-HpCDD		0.330	25.0	U	0.01
OCDD		20.9	50.0	U	0.001
Total Tetra-Dioxins	U				
Total Penta-Dioxins	U				
Total Hexa-Dioxins	0.660				
Total Hepta-Dioxins	U				
2,3,7,8-TCDF	U		10.0	U	0.1
1,2,3,7,8-PeCDF	U		10.0	U	0.05
2,3,4,7,8-PeCDF	U		10.0	U	0.5
1,2,3,4,7,8-HxCDF		1.20	25.0	U	0.1
1,2,3,6,7,8-HxCDF		0.440	25.0	U	0.1
1,2,3,7,8,9-HxCDF	U		25.0	U	0.1
2,3,4,6,7,8-HxCDF	U		25.0	U	0.1
1,2,3,4,6,7,8-HpCDF		5.64	25.0	U	0.01
1,2,3,4,7,8,9-HpCDF	U		25.0	U	0.01
OCDF	4.22 J		50.0	0.00442	0.001
Total Tetra-Furans	U				
Total Penta-Furans	U				
Total Hexa-Furans	U				
Total Hepta-Furans	U				
Total				0.0702	

Results of the BS/BSD Analysis for PAH in Air

An XAD lot blank and a lot blank filter were chosen for the blank spike/blank spike duplicate (BS/BSD) analyses. The percent recoveries, for the XAD lot blank, ranging from 95 to 132, are listed in Table 2.1. The relative percent differences, also listed in Table 2.1, ranged from zero (0) to 6. The percent recoveries, for the lot blank filter, ranging from 82 to 96, are also listed in Table 2.1. The relative percent differences, also listed in Table 2.1, ranged from zero (0) to 4. QC limits are not available for either the percent recoveries or the relative percent differences for this analysis.

Table 2.1 Results of BS/BSD Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample ID: XAD Spike

Compound	Spike Added µg	BS Rec. µg	% Rec.	BSD Rec. µg	% Rec.	RPD
Naphthalene	50	50.02	100	50.73	101	1
2-Methylnaphthalene	50	50.11	100	50.87	102	2
1-Methylnaphthalene	50	52.95	106	53.81	108	2
Biphenyl	50	50.63	101	51.75	103	2
2,6-Dimethylnaphthalene	50	49.41	99	50.51	101	2
Acenaphthylene	50	49.07	98	49.70	99	1
Acenaphthene	50	49.56	99	49.02	98	1
Dibenzofuran	50	50.37	101	50.47	101	0
Fluorene	50	50.12	100	49.76	100	1
Phenanthrene	50	47.69	95	47.58	95	0
Anthracene	50	47.56	95	48.93	98	3
Carbazole	50	49.10	98	48.48	97	1
Fluoranthene	50	50.81	102	51.52	103	1
Pyrene	50	50.59	101	50.28	101	1
Benzo(a)anthracene	50	51.55	103	51.53	103	0
Chrysene	50	65.94	132	66.08	132	0
Benzo(b)fluoranthene	50	51.85	104	51.52	103	1
Benzo(k)fluoranthene	50	51.71	103	54.93	110	6
Benzo(e)pyrene	50	52.94	106	53.19	106	1
Benzo(a)pyrene	50	55.93	112	52.47	105	6
Indeno(1,2,3-cd)pyrene	50	53.51	107	53.66	107	0
Dibenzo(a,h)anthracene	50	54.32	109	53.84	108	1
Benzo(g,h,i)perylene	50	53.69	107	53.45	107	1

Table 2.1 (cont.) Results of BS/BSD Analysis for PAH in Air
WA # 0-110 Air Monitoring, Sampling, and Modeling Support, and Underwater Survey Activities

Sample ID: Filter Spike

Compound	Spike Added µg	BS Rec. µg	% Rec.	BSD Rec. µg	% Rec.	RPD
Naphthalene	50	46.32	93	45.88	92	1
2-Methylnaphthalene	50	45.10	90	44.80	90	0.7
1-Methylnaphthalene	50	48.10	96	48.24	96	0
Biphenyl	50	45.90	92	45.20	90	2
2,6-Dimethylnaphthalene	50	44.46	89	44.94	90	1
Acenaphthylene	50	44.10	88	44.40	89	1
Acenaphthene	50	46.78	94	44.98	90	4
Dibenzofuran	50	45.64	91	44.70	89	2
Fluorene	50	45.00	90	44.88	90	0
Phenanthrene	50	45.10	90	45.50	91	1
Anthracene	50	47.32	95	47.26	95	0
Carbazole	50	45.02	90	44.36	89	1
Fluoranthene	50	44.94	90	44.38	89	1
Pyrene	50	45.80	92	44.82	90	2
Benzo(a)anthracene	50	44.36	89	43.46	87	2
Chrysene	50	46.96	94	46.74	93	1
Benzo(b)fluoranthene	50	42.18	84	40.78	82	3
Benzo(k)fluoranthene	50	43.64	87	45.02	90	3
Benzo(e)pyrene	50	43.28	87	42.50	85	2
Benzo(a)pyrene	50	44.12	88	42.68	85	3
Indeno(1,2,3-cd)pyrene	50	43.02	86	41.78	84	3
Dibenzo(a,h)anthracene	50	43.04	86	41.74	83	3
Benzo(g,h,i)perylene	50	42.92	86	42.88	86	0

Results of the BS/BSD Analysis for Inorganic Acids in Air

A blank spike/blank spike duplicate analysis (BS/BSD) was run. The percent recoveries, listed in Table 2.2, ranged from 83 to 105. All twelve values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.2, ranged from 0 (zero) to 9. QC limits are not available for the RPD.

Table 2.2 Results of the BS/BSD Analysis for Inorganic Acids in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Analyte	Original Conc Spike mg	Original Conc Dup mg	Recovered Conc Spike mg	Recovered Conc Dup mg	% Recovery Spike	% Recovery Dup	RPD	Recommended QC Limits % Rec
Hydrobromic acid	0.0808	0.0808	0.0843	0.0845	104	105	0	75-125
Hydrochloric acid	0.0413	0.0413	0.0423	0.0414	102	100	2	75-125
Hydrofluoric acid	0.0211	0.0211	0.0191	0.0175	91	83	9	75-125
Nitric acid	0.0812	0.0812	0.0808	0.0808	100	100	0	75-125
Phosphoric acid	0.118	0.118	0.110	0.115	93	97	4	75-125
Sulfuric acid	0.0817	0.0817	0.0846	0.0852	104	104	1	75-125

Results of the BS/BSD Analysis for Metals in Air

A blank spike/blank spike duplicate analysis (BS/BSD) was run. The percent recoveries, listed in Table 2.3, ranged from 8 to 134. Fifty out of fifty-eight values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.3, ranged from 0 (zero) to 20. QC limits are not available for the RPD.

Results of the Analysis of the Laboratory Control Sample for Metals in Air

A laboratory control samples was also analyzed. The percent recoveries ranged from 7 to 116 and are listed in Table 2.4. Twenty-eight out of twenty-nine concentrations were within the acceptable QC limits.

Table 2.3 Results of the BS/BSD Analysis for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activites

Metal	Lot Blank Conc µg/filter	Original Conc Spike µg/filter	Original Conc Dup µg/filter	Recovered Conc Spike µg/filter	Recovered Conc Dup µg/filter	% Recovery Spike	% Recovery Dup	RPD	Recommended QC Limit % Rec
Aluminum	U	40.00	40.00	44.49	44.56	111	111	0	75-125
Arsenic	U	40.00	40.00	43.98	44.17	110	110	0	75-125
Beryllium	U	1.00	1.00	1.04	1.05	104	105	0	75-125
Cadmium	U	1.00	1.00	1.09	1.09	109	109	0	75-125
Calcium	6.2	1000	1000	1058	1062	105	106	0	75-125
Chromium	0.51	4.00	4.00	5.07	5.29	114	120	5	75-125
Cobalt	U	10.00	10.00	10.29	10.37	103	104	1	75-125
Copper	U	5.00	5.00	5.40	5.43	108	109	1	75-125
Iron	1.6	20.00	20.00	21.29	21.99	98	102	3	75-125
Lead	U	10.00	10.00	10.69	10.74	107	107	0	75-125
Lithium	U	40.00	40.00	43.52	44.06	109	110	1	75-125
Magnesium	U	1000	1000	1069	1072	107	107	0	75-125
Manganese	U	10.00	10.00	10.65	10.72	107	107	1	75-125
Molybdenum	U	40.00	40.00	44.04	44.30	110	111	1	75-125
Nickel	U	10.00	10.00	10.52	10.50	105	105	0	75-125
Phosphorus	U	40.00	40.00	50.42	50.81	126 *	127 *	1	75-125
Platinum	U	40.00	40.00	42.03	41.60	105	104	1	75-125
Selenium	U	40.00	40.00	42.56	42.44	106	106	0	75-125
Silver	U	1.00	1.00	1.10	1.11	110	111	0	75-125
Sodium	7.3	1000	1000	974	983	97	98	1	75-125
Tellurium	U	40.00	40.00	3.29	3.44	8 *	9 *	4	75-125
Thallium	U	40.00	40.00	44.27	44.02	111	110	1	75-125
Tin	U	40.00	40.00	52.36	52.70	131 *	132 *	1	75-125
Titanium	U	40.00	40.00	42.70	42.51	107	106	0	75-125
Vanadium	U	10.00	10.00	10.50	10.56	105	106	1	75-125
Yttrium	U	40.00	40.00	43.51	43.31	109	108	0	75-125
Zinc	1.1	10.00	10.00	11.43	11.41	103	103	0	75-125
Zirconium	U	40.00	40.00	53.59	52.21	134 *	131 *	3	75-125
Tungsten	U	40.00	40.00	42.05	34.50	105	86	20	75-125

Table 2.4 Results of the Analysis of the
Laboratory Control Sample for Metals in Air
WA # 0-110 Air Monitoring, Sampling, Analysis,
and Modeling Support, and Underwater Survey Activites

Metal	Analyzed Value µg/L	Accepted Value µg/L	% Rec		QC Limits % Rec
Aluminum	4301.16	4000	108		80-120
Arsenic	4299.25	4000	108		80-120
Beryllium	103.75	100	104		80-120
Cadmium	107.18	100	107		80-120
Calcium	52777.01	50000	106		80-120
Chromium	430.77	400	108		80-120
Cobalt	1025.19	1000	103		80-120
Copper	528.69	500	106		80-120
Iron	2038.85	2000	102		80-120
Lead	1058.99	1000	106		80-120
Lithium	2162.79	2000	108		80-120
Magnesium	53539.27	50000	107		80-120
Manganese	1055.69	1000	106		80-120
Molybdenum	2202.15	2000	110		80-120
Nickel	1024.3	1000	102		80-120
Phosphorus	2197.74	2000	110		80-120
Platinum	2123	2000	106		80-120
Selenium	4167.54	4000	104		80-120
Silver	107.28	100	107		80-120
Sodium	48612.46	50000	97		80-120
Tellurium	133.3	2000	7	*	80-120
Thallium	4446.75	4000	111		80-120
Tin	2324.71	2000	116		80-120
Titanium	2122.45	2000	106		80-120
Vanadium	1047.41	1000	105		80-120
Yttrium	2178.35	2000	109		80-120
Zinc	1061.42	1000	106		80-120
Zirconium	2269.74	2000	113		80-120
Tungsten	2035.00	2000	102		80-120

QA/QC for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

Results of the Internal Standard Recoveries for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

The internal standard percent recoveries, listed in Table 2.5, ranged from 70 to 138, One hundred and fifteen out of one hundred and seventeen values were within the acceptable QC limits.

Results of the BS/BSD Analysis for Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Air

A blank was spiked in duplicate and analyzed. The percent recoveries, listed in Table 2.6, ranged from 76 to 114. All thirty-four values were within the acceptable QC limits. The relative percent differences (RPDs), also listed in Table 2.6, ranged from 0 (zero) to 16. All 17 RPDs were within the acceptable QC limits.

Table 2.5 Results of the Internal Standard Recoveries for Polychlorinated Dibenzodioxin and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support and Underwater Survey Activites

Sample ID	Method Blank	17670	17671	17672	17673	17674		QC Limits
Units Internal Standard	%	%	%	%	%	%		
13C-2,3,7,8-TCDD	90	94	102	98	92	98		40-135
13C-1,2,3,6,7,8-HxCDD	107	109	116	117	116	117		40-135
13C-2,3,7,8-TCDF	91	103	103	108	108	112		40-135
13C-1,2,3,4,7,8-HxCDF	111	114	104	100	121	122		40-135
13C-1,2,3,7,8-PeCDD	98	121	118	118	135	133		40-135
13C-1,2,3,4,6,7,8-HpCDD	94	107	98	102	101	90		40-135
13C-1,2,3,7,8-PeCDF	104	106	109	112	127	137	*	40-135
13C-1,2,3,4,6,7,8-HpCDF	84	105	92	90	108	108		40-135
13C-OCDD	99	103	111	88	128	128		40-135

Sample ID	17675	17676	17677	17678	17679	Blank Spike	Blank Spike Duplicate	QC Limits
Units Internal Standard	%	%	%	%	%	%	%	
13C-2,3,7,8-TCDD	97	94	85	83	88	86	98	40-135
13C-1,2,3,6,7,8-HxCDD	113	114	114	115	122	126	119	40-135
13C-2,3,7,8-TCDF	112	110	100	96	91	95	109	40-135
13C-1,2,3,4,7,8-HxCDF	117	127	118	118	109	105	101	40-135
13C-1,2,3,7,8-PeCDD	126	138	* 114	113	110	111	115	40-135
13C-1,2,3,4,6,7,8-HpCDD	87	90	70	107	116	104	114	40-135
13C-1,2,3,7,8-PeCDF	132	132	110	111	102	102	105	40-135
13C-1,2,3,4,6,7,8-HpCDF	110	119	104	104	108	109	113	40-135
13C-OCDD	127	121	130	110	116	128	123	40-135

Table 2.6 Results of the BS/BSD Analysis
for Polychlorinated Dibenzodioxin and Polychlorinated Dibenzofurans in Air
WA # 0-110 Air Monitoring, Sampling, Analysis, and Modeling Support
and Underwater Survey Activites

Sample ID Blank Parameter Units	Spike pg	Blank Conc pg	BS Conc pg	Rec %	BSD Conc pg	Rec %	RPD	QC Limits % Rec	RPD
2378-TCDD	200	U	221	111	227	114	3	60-140	50
12378-PeCDD	200	U	204	102	203	102	0	60-140	50
123478-HxCDD	500	U	542	108	553	111	2	60-140	50
123678-HxCDD	500	U	447	89	452	90	1	60-140	50
123789-HxCDD	500	0.66	385	77	385	77	0	60-140	50
1234678-HpCDD	500	U	555	111	513	103	8	60-140	50
OCDD	1000	U	940	94	873	87	7	60-140	50
2378-TCDF	200	U	173	87	166	83	4	60-140	50
12378-PeCDF	200	U	190	95	179	90	6	60-140	50
23478-PeCDF	200	U	198	99	204	102	3	60-140	50
123478-HxCDF	500	U	499	100	521	104	4	60-140	50
123678-HxCDF	500	U	444	89	450	90	1	60-140	50
123789-HxCDF	500	U	427	85	465	93	9	60-140	50
234678-HxCDF	500	U	486	97	512	102	5	60-140	50
1234678-HpCDF	500	U	468	94	459	92	2	60-140	50
1234789-HpCDF	500	U	520	104	445	89	16	60-140	50
OCDF	1000	4.22	767	76	815	81	6	60-140	50

ockheed Martin Technology Services Group
nvironmental Services REAC
890 Woodbridge Avenue, Building 209 Annex Edison, NJ 08837-3679
elephone 732-321-4200 Facsimile 732-494-4021

LOCKHEED MARTIN

Southwest Research Institute
PO Box 28510, 6220 Culebra Road
San Antonio, TX 78228-0510

Attn: Jo Ann Boyd

19 November 1999

Project # RIA-00011 APG Burn Support

As per Lockheed Martin / REAC Purchase Order GA91969J73, please analyze samples according to the following parameters:

Analysis/Method	Matrix	# of samples
Dioxin/ Furans / Modified TO9	Air	20
Inorganic Acids / NIOSH 7903	Air	20
Metals/ NIOSH 7300	Air	20
Data package: Package with Diskette Deliverable		

Samples are expected to arrive at your laboratory between November 23-December 31, 1999. **All applicable QA/QC BS/BSD) analysis as per method. will be performed on our sample matrix.** Preliminary sample and QC result ables plus a signed copy of our Chain of Custody must be faxed to REAC 10 business days after receipt of the last samples. The complete data package is due 21 business days after receipt of the last samples. The complete data package must include all items on the deliverables checklist. **Expect all samples to be difficult matrix and all raw data must be included in final analytical report.**

All sample and QC results(ie: BS/BSD, LCS, Duplicates, and Blanks) must be summarized in a ExCel diskette deliverable.

Please submit all reports and technical questions concerning this project to **John Johnson at (732) 321-4248 or fax to (732) 494-4020.**

Sincerely,

Deborah Killeen
Data Validation and Report Writing Group Leader
Lockheed Martin / REAC Project

DK:jj Attachments

cc. R. Singhvi
D. Michunas
0011\non\mem\9911\sub\0011Con
D. Miller
Subcontracting File
D. Angwenyi
C. Lentini
A. DuBois
D. Killeen

APG Burn Compound List

NIOSH 7300 Metals	Inorganic Acids
Aluminum	Hydrofluoric Acids
Arsenic	Hydrochloric Acids
Beryllium	Phosophoric acid
Cadmium	Hydrobromic acid
Calcium	Nitric acid
Chromium	Sulfuric acid
Cobalt	
Copper	
Iron	
Lead	
Lithium	
Magnesium	
Manganese	
Molybdenum	
Nickel	
Phosphorus	
Platinum	
Selenium	
Silver	
Sodium	
Tellurium	
Tungsten	
Thallium	
Titanium	
Vanadium	
Yttrium	
Zinc	
Zirconium	

REAC, Edison, NJ
~~732 (908)~~ 321-4200
EPA Contract ~~68-C4-0022~~ 68-C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG Burn Support
Project Number: RIA00110
~~LM-RPW~~ Contact: Amy Dunbar Phone: 732-494-4013

No: 06966
SHEET NO. 1 OF 1

Sample Identification / Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Volume(L)	Dioxins
✓	17670	DW3	A	4/6/00	1	AMBER JAR/ICE	540	✓
✓	17671	DW2					540	✓
✓	17672	DW1					540	✓
✓	17673	DW4					Ø	✓
✓	17674	DW5					540	✓
✓	17675	UW1					498	✓
✓	17676	UW2					540	✓
✓	17677	TRIP BLANK					Ø	✓
✓	17678	FIELD BLANK					Ø	✓
✓	17679	LOT BLANK					Ø	✓
2	—	BS/BSD			2		Ø	✓

A-Ø

Matrix:
SD - Sediment; PW - Potable Water; S - Soil
DS - Drum Solids; GW - Groundwater; W - Water
DL - Drum Liquids; SW - Surface Water; O - Oil
X - Other; SL - Sludge; (A - All)

Southwest Research Institute

Special Instructions:
DW - Downwind
UW - Upwind
(L) - Liters
Analysis for Dioxins/Furans

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
Analysis	Amy D	4/7/00									
			Don Morrison	4/11/00	8:30						

00017

REAC, Edison, NJ
(908) 321-4200
EPA Contract ~~68-C4-0022~~ 68-C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG BURN
Project Number: 14A00110
~~RPM~~ Contact: Amy DuBois Phone: 732-494-4013

No: 06965
SHEET NO. 1 OF 1

Sample Identification — Inorganic Acids

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Volume (L)	NIOSH 7903
✓	17700	DW3	A	4/4/00	1	whirlpak/ICE	45.9	✓
✓	17701	DW2					45.0	✓
✓	17702	DW1					45.9	✓
✓	17703	DW4					45.5	✓
✓	17704	DW5					45.0	✓
✓	17705	UW1					41.8	✓
✓	17706	UW2					45.5	✓
✓	17732	FIELD BLANK					0	✓
✓	17733	TRIP BLANK					0	✓
✓	17734	LOT BLANK					0	✓
2 ✓	—	BS/BSD			2		0	✓

ARD

WSH

Matrix:

SD -	Sediment	PW -	Potable Water	S -	Soil
DS -	Drum Solids	GW -	Groundwater	W -	Water
DL -	Drum Liquids	SW -	Surface Water	O -	Oil
X -	Other	SL -	Sludge	(A) -	Air

Special Instructions:
Analysis for Inorganic Acids by NIOSH 7903
DW - Downwind
UW - Upwind
(L) - Liters

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
1/Analysis		4/7/00									
				4/11/00	0930						

REAC, Edison, NJ
(908) 321-4200
EPA Contract 68-C4-0022
68-C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG BURN
Project Number: R1A00110
RFW Contact: Amy DuBois Phone: 732-494-4013

No: 05654
SHEET NO. 1 OF 1

041000

Sample Identification

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	PAH	Volume (L)
415	17690	DW3	A	4/6/00	1	WHIRLPAK/ICE/DARK	✓	360
416	17691	DW2					✓	351
417	17692	DW1					✓	360
418	17693	DW4					✓	369
419	17694	DW5					✓	360
420	17695	UW1					✓	332
421	17696	UW2					✓	360
422	17697	FIELD BLANK					✓	∅
423	17698	TRIP BLANK					✓	∅
424	17699	LOT BLANK					✓	∅
	—	BS/BSD	↓	↓	2	↓	✓	∅

Matrix:

SD -	Sediment	PW -	Potable Water	S -	Soil
DS -	Drum Solids	GW -	Groundwater	W -	Water
DL -	Drum Liquids	SW -	Surface Water	O -	Oil
X -	Other	SL -	Sludge	A -	Air

DW - DOWNWIND
UW - UPWIND

L - Liters

Special Instructions:
Analysis for PAHs by NIOSH 5515
All tubes 226-30-06 LOT 1041

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
All analyses	[signature]	4/10/00	[signature]	4/10/00	0958	All/Analysis	[signature]	4/10/00	[signature]	4/10/00	1015

REAC, Edison, NJ
(908) 321-4200
EPA Contract 68-C4-0022
68-C99-223

CHAIN OF CUSTODY RECORD

Project Name: APG Burn Support
Project Number: R1A001/0
REAC Contact: Amy DuBois Phone: 732-494-4043

No: 05254

SHEET NO. 1 OF 1

Sample Identification

METALS

Analyses Requested

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Volume (L)	NIOSH 7300
	17680	DW3	A	4-6-00	1	whirlpak / ice	540	✓
	17681	DW2					540	✓
	17682	DW1					540	✓
	17683	DW4					540	✓
	17684	DW5					540	✓
	17685	UW1					498	✓
	17686	UW2					540	✓
	17687	FIELD BLANK					0	✓
	17688	TRIP BLANK					0	✓
	17689	LOT BLANK					0	✓
2	—	BS/BSD			2		0	✓

Matrix:

SD -	Sediment	PW -	Potable Water	S -	Soil
DS -	Drum Solids	GW -	Groundwater	W -	Water
DL -	Drum Liquids	SW -	Surface Water	O -	Oil
X -	Other	SL -	Sludge	A -	Air

Special Instructions:

DW - Down WIND
UW - UP WIND
L - Liters

Analysis for Metals by NIOSH 7300
LOT # 517

FOR SUBCONTRACTING USE ONLY

FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
1/Analysis		4/7/00									
			Dale Mount	4/11/00	0930						

APPENDIX C

SBC COM Clearances for GB, GD, VX, and HD

Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site

July 2000

Dubois, Amy E

From: Snyder Juanita A SBCCOM [juanita.snyder@SBCCOM.APGEA.ARMY.MIL]
Sent: Wednesday, April 12, 2000 12:55 PM
To: DUBOIS.AMY@EPAMAIL.EPA.GOV; salford@genphysics.com
Cc: axdean@CBDCOM-EMH1.APGEA.ARMY.MIL; dghall@CBDCOM-EMH1.APGEA.ARMY.MIL; fglattin@CBDCOM-EMH1.APGEA.ARMY.MIL; jasnyder@CBDCOM-EMH1.APGEA.ARMY.MIL; jefranch@CBDCOM-EMH1.APGEA.ARMY.MIL; rdmoore@CBDCOM-EMH1.APGEA.ARMY.MIL; sdsmith@CBDCOM-EMH1.APGEA.ARMY.MIL; tablades@CBDCOM-EMH1.APGEA.ARMY.MIL; thomas.rosso@SBCCOM.APGEA.ARMY.MIL
Subject: J-field Clearances

POC: Dubois, x (732)494-4013 J-Field

tem	GVH	background monitoring
4/06/00		
W3	0004070050-M01	Clear for GB GD VX & HD
W2	0004070051-M01	Clear for GB GD VX & HD
W1	0004070052-M01	Clear for GB GD VX & HD
W4	0004070053-M01	Clear for GB GD VX & HD
W5	0004070054-M01	Clear for GB GD VX & HD
W3	0004070055-M01	Clear for GB GD VX & HD
W4	0004070056-M01	Clear for GB GD VX & HD
PA	0004070057-M01	Clear for GB GD VX & HD
P1	0004070058-M01	Clear for GB GD VX & HD

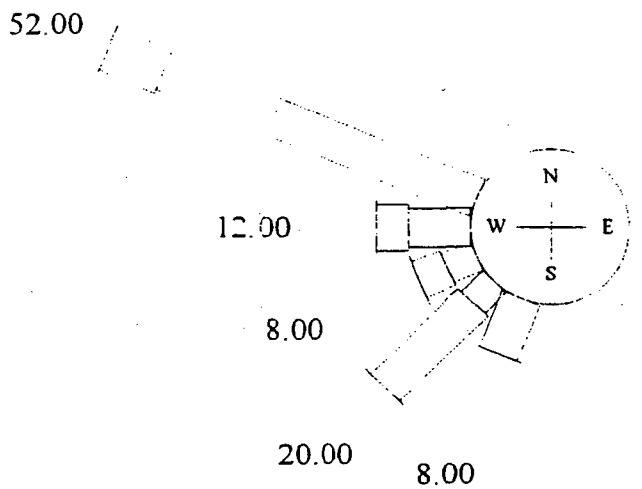
ita Snyder
ample Team

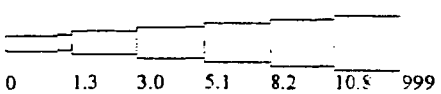
APPENDIX D
Windroses
Air Monitoring, Sampling, Analysis, and Modeling Support, and Underwater Survey Activities Site
July 2000

Aberdeen Proving Grounds Test Burn

Wind Rose Generated From H-Field Meteorological Data

4/6/00 14:30-20:30





SCALE (M/SEC)

	WIND SPEED (M/SEC) PERCENT OCCURRENCE					
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	10.8
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

	WIND SPEED (M/SEC) PERCENT OCCURRENCE					
	0-1.3	1.3-3.0	3.0-5.1	5.1-8.2	8.2-10.8	10.8
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	8.00	0.00	0.00
SW	0.00	0.00	4.00	16.00	0.00	0.00
WSW	0.00	0.00	4.00	4.00	0.00	0.00
W	0.00	0.00	0.00	8.00	4.00	0.00
WNW	0.00	0.00	0.00	44.00	8.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX B

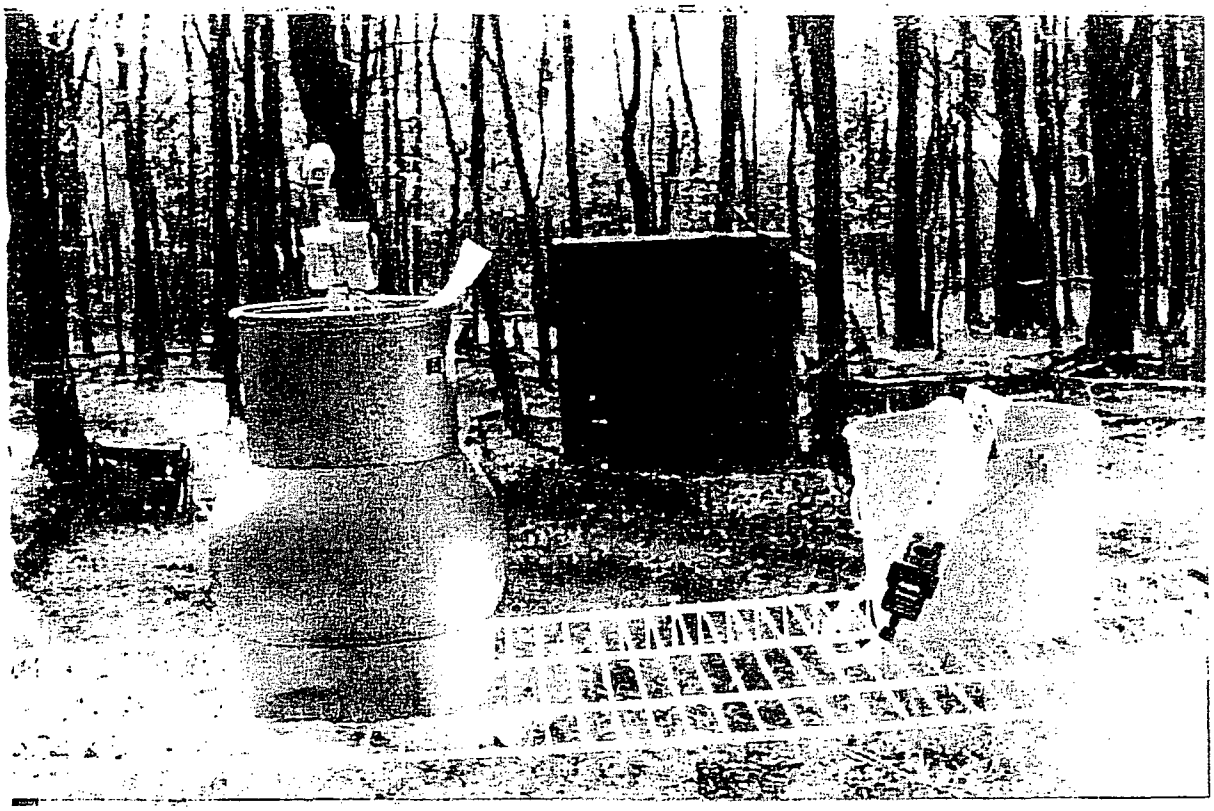
AIR SAMPLING EQUIPMENT PHOTOGRAPHS

Arrangement of Air Sampling Equipment

APG Controlled Burn Project – Analytes of Interest:

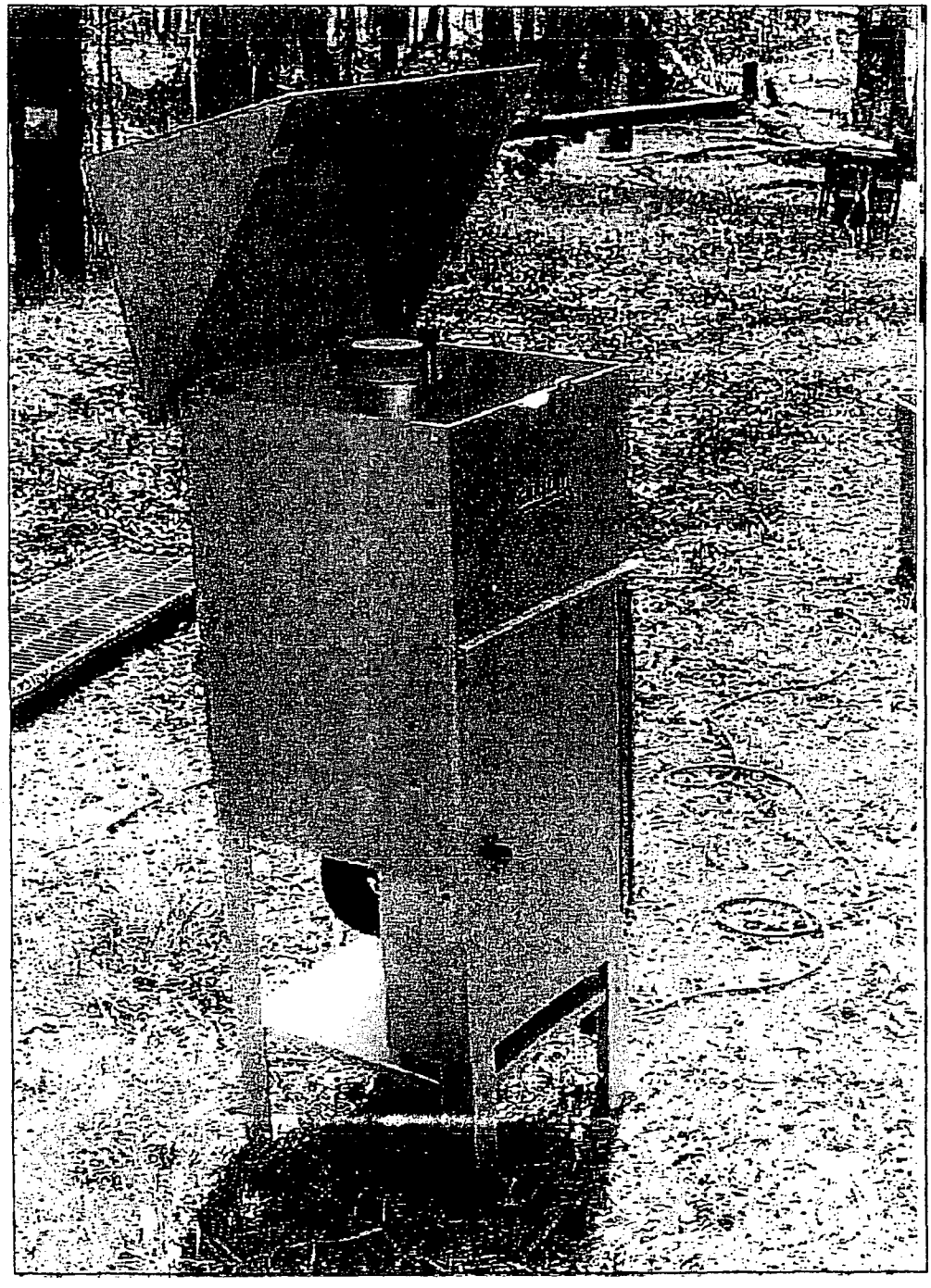
- Volatile Organic Compounds (VOCs)
- Pesticides and Polychlorinated Biphenyls (PCBs)
- Explosives
- Inorganics
- Radiologicals
- Chemical Agents

Summa Canister (left) and DAAMS Tube (right)



Summa canister for collection of air samples for volatile organic analysis. DAAMS tubes used for collection of samples for chemical agent analysis.

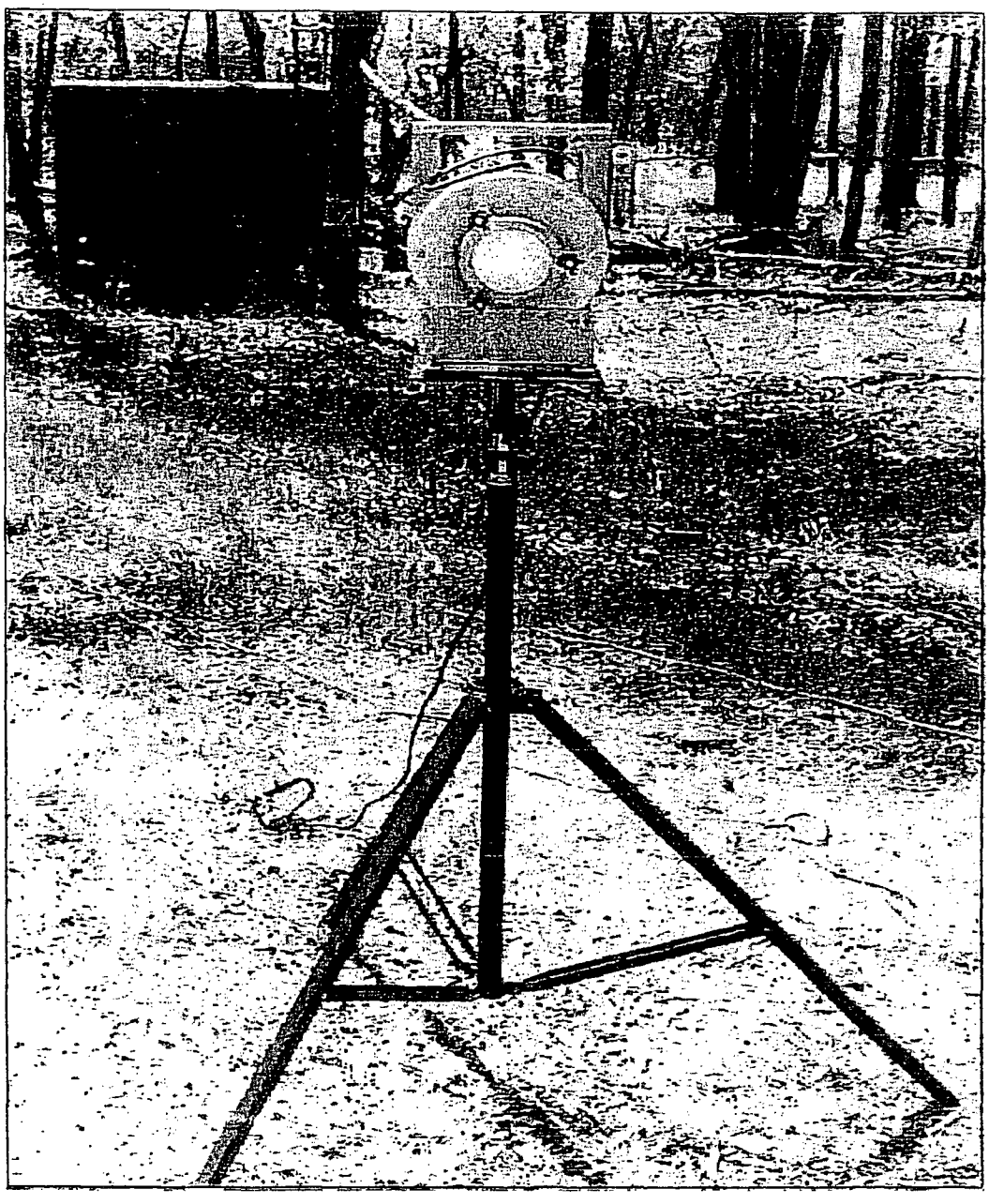
High Volume PUF Sampler



Sampler for collection of air samples for Pesticides, PCBs, and Explosives.

PUF – Polyurethane foam
PCB – Polychlorinated biphenyls

High Volume Sampler (Handi-Vol)



Sampler for collection of air samples for Inorganics and Radionuclides analyses

APPENDIX C

LIST OF ANALYTES FOR THE ABERDEEN PROVING GROUND CONTROLLED BURN PROJECT

Table C-1. TARGET ANALYTES FOR EACH ANALYSIS PERFORMED ON AIR SAMPLES FROM THE MAIN FRONT, NEW O-FIELD, AND J-FIELD CONTROLLED BURNS

Volatiles [1]	Pesticides/PCBs [2]	Explosives [2]	Metals (Total)	Radiologicals	Gamma Spectroscopy	Chemical Agents
Freon 12	4,4'-DDD	1,3,5-Trinitrobenzene	Aluminum	Gross Alpha	Actinium-228	Mustard (HD)
Chloromethane	4,4'-DDE	1,3-Dinitrobenzene	Antimony	Gross Beta	Bismuth-212	Sarin (GB)
Freon 114	4,4'-DDT	2,4,6-Trinitrotoluene	Arsenic		Bismuth-214	Soman (GD)
Chloroethene	Aldrin	2,4-Dinitrotoluene	Barium		Cesium-137	VX
Bromomethane	Dieldrin	2,6-Dinitrotoluene	Beryllium		Cobalt-60	
Chloroethane	Endosulfan I	2-Amino-4,6-dinitrotoluene	Cadmium		Lead-210	
Freon 11	Endosulfan II	2-Nitrotoluene	Calcium		Lead-212	
1,1-Dichloroethene	Endosulfan Sulfate	3-Nitrotoluene	Chromium		Lead-214	
Methylene chloride	Endrin	4-Amino-2,6-dinitrotoluene	Cobalt		Potassium-40	
Freon 113	Endrin Aldehyde	4-Nitrotoluene	Copper		Protactinium-231	
1,1,-Dichloroethane	Endrin Ketone	HMX	Iron		Protactinium-234	
cis-1,2-Dichloroethylene	Heptachlor	Nitrobenzene	Lead		Radium-223	
Chloroform	Heptachlor Epoxide	RDX	Magnesium		Radium-224	
1,2-Dichloroethane	Lindane (gamma-BHC)	Tetryl	Manganese		Radium-226	
1,1,1-Trichloroethane	Methoxychlor		Mercury		Uranium-235	
Benzene	Toxaphene		Nickel		Uranium-233/234 [4]	
Carbon tetrachloride	alpha-BHC		Potassium		Uranium-235/236 [4]	
1,2-Dichloropropane	alpha-Chlordane		Selenium		Uranium-238 [4]	
Trichloroethene	beta-BHC		Silver			
cis-1,3-Dichloropropene	delta-BHC		Sodium			
trans-1,3-Dichloropropene	gamma-Chlordane		Thallium			
1,1,2-Trichloroethane	2-Chlorobiphenyl		Uranium [3]			
Toluene	2,3-Dichlorobiphenyl		Vanadium			
1,2-Dibromoethane	2,2'5-Trichlorobiphenyl		Zinc			
Tetrachloroethene	2,4'5-Trichlorobiphenyl					
Chlorobenzene	2,2'5,5'-Tetrachlorobiphenyl					
Ethylbenzene	2,2'3,5'-Tetrachlorobiphenyl					
m-/p- Zylenes	2,3'4,4'-Tetrachlorobiphenyl					
Styrene	2,2'4,5,5'-Pentachlorobiphenyl					
o-Xylene	2,2',3,4,5'-Pentachlorobiphenyl					
1,1,2,2-Tetrachloroethane	2,3,3',4',6-Pentachlorobiphenyl					
1,3,5-Trimethylbenzene	2,2',4,4',5,5',6-Hexachlorobiphenyl					
1,2,4-Trimethylbenzene	2,2',4,4',5,5'-Hexachlorobiphenyl					
1.3-Dichlorobenzene	2,2',3,4,5,5'-Hexachlorobiphenyl					
1,4-Dichlorobenzene	2,2',3,4,4'-Hexachlorobiphenyl					
1,2-Dichlorobenzene	2,2',3,4',5,5',6-Heptachlorobiphenyl					
1,2,4-Trichlorobenzene	2,2',3,4,4',5',6-Heptachlorobiphenyl					
Hexachlorobutadiene	2,2',3,4,4',5,5'-Heptachlorobiphenyl					
	2,2',3,3',4,4',5-Heptachlorobiphenyl					
	2,2'3,3'4,4',5,5'6-Nonchlorobiphenyl					

[1] Volatiles analysis on air samples collected during New O-Field and Main Front controlled burns was performed for the purposes of identifying only non-target peaks (a.k.a., Tentatively Identified Compounds (TICs)) and not the full range of TO-14 compounds.

[2] Analysis for these analytes was performed on PUF and filter samples from the Main Front controlled burn; analysis for these analytes on the air samples from the New O-Field and J-Field controlled burns was performed only on filter samples.

[3] Analysis for Total Uranium was performed only on the air samples from the Main Front and New O-Field controlled burns.

[4] Analysis for these radionuclides was performed only on the air samples from the J-Field controlled burn.

Table C-2. Volatile Organic Compound Detection Limits

Compound	Method Detection Limit (MDL)* ppb	Compound	Method Detection Limit (MDL) * ppb
Freon 12	~ 0.2	Cis-1,3-Dichloropropene	~ 0.2
Chloromethane	~ 0.2	Trans-1,3-Dichloropropene	~ 0.2
Freon 114	~ 0.2	1,1,2-Trichloroethane	~ 0.2
Chloroethene	~ 0.2	Toluene	~ 0.2
Bromomethane	~ 0.2	1,2-Dibromoethane	~ 0.2
Chloroethane	~ 0.2	Tetrachloroethene	~ 0.2
Freon 11	~ 0.2	Chlorobenzene	~ 0.2
1,1-Dichloroethene	~ 0.2	Ethylbenzene	~ 0.2
Methylene chloride	~ 0.2	m-/p-Xylenes	~ 0.2
Freon 113	~ 0.2	Styrene	~ 0.2
1,1-Dichloroethane	~ 0.2	o-Xylene	~ 0.2
Cis-1,2-Dichloroethylene	~ 0.2	1,1,2,2-Tetrachloroethane	~ 0.2
Chloroform	~ 0.2	1,3,5-Trimethylbenzene	~ 0.2
1,2-Dichloroethane	~ 0.2	1,2,4-Trimethylbenzene	~ 0.2
1,1,1-Trichloroethane	~ 0.2	1,3-Dichlorobenzene	~ 0.2
Benzene	~ 0.2	1,4-Dichlorobenzene	~ 0.2
Carbon tetrachloride	~ 0.2	1,2-Dichlorobenzene	~ 0.2
1,2-Dichloropropane	~ 0.2	1,2,4-Trichlorobenzene	~ 0.2
Trichloroethene	~ 0.2	Hexachlorobutadiene	~ 0.2

- Laboratory reports MDL of approximately 0.2 ppb for all compounds as adjusted for flow and sample volume.

Table C-3. Explosive Detection Limits

Compound	Method Detection Limit (MDL) ug/L *	Compound	Method Detection Limit (MDL) ug/L *
1,3,5-Trinitrobenzene	0.11	3-Nitrotoluene	0.16
2-Nitrotoluene	0.09	HMX	0.23
4-Nitrotoluene	0.21	Tetryl	0.22
RDX	0.23	2,4,6-Trinitrotoluene	0.10
2,4-Dinitrotoluene	0.10	2-Amino-4,6-Dinitrotoluene	0.09
1,3-Dinitrobenzene	0.09	4-Amino-2,6-Dinitrotoluene	0.11
2,6-Dinitrotoluene	0.13	Nitrobenzene	0.08

* The sample being analyzed is in a liquid matrix; therefore, the analytical MDL is expressed as ug/L.

Table C-4. Pesticides/Polychlorinated Biphenyls Detection Limits

Compound	Method Detection Limit (MDL) ug/L *	Compound	Method Detection Limit (MDL) ug/L *
4,4'-DDD	0.016	Methoxychlor	0.0096
4,4'-DDE	0.0076	Toxaphene	0.39
4,4'-DDT	0.0069	2,3-Dichlorobiphenyl	0.021
Aldrin	0.010	2,2',5-Trichlorobiphenyl	0.015
alpha-BCH	0.0085	2,4',5-Trichlorobiphenyl	0.0080
alpha-Chlordane	0.0084	2,2'5,5'-Tetrachlorobiphenyl	0.0084
beta-BHC	0.012	2,2'3,5'-Tetrachlorobiphenyl	0.012
delta-BHC	0.0073	2,3'4,4'-Tetrachlorobiphenyl	0.0070
Dieldrin	0.012	2,2',4,5,5'-Pentachlorobiphenyl	0.0030
Endosulfan I	0.038	2,2',3,4,5'-Pentachlorobiphenyl	0.0036
Endosulfan II	0.0097	2,3,3',4',6-Pentachlorobiphenyl	0.0046
Endosulfan Sulfate	0.012	2,2',3,5,5',6-Hexachlorobiphenyl	
Endrin	0.0068	2,2',4,4',5,5'-Hexachlorobiphenyl	0.0045
Endrin Aldehyde	0.024	2,2',3,4,5,5'-Hexachlorobiphenyl	0.0067
Endrin Ketone	0.0089	2,2'3,4,4',5'-Hexachlorobiphenyl	0.0081
gamma-BHC (Lindane)	0.0065	2,2',3,4',5,5',6-Heptachlorobiphenyl	0.014
gamma-Chlordane	0.020	2,2',3,4,4',5',6-Heptachlorobipnenyl	0.012
Heptachlor	0.017	2,2',3,4,4',5,5'-Heptachlorobiphenyl	0.0033
Heptachlor Epoxide	0.0065	2,2',3,3',4,4',5-Heptachlorobiphenyl	0.9992
		2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	0.0031

* The sample being analyzed is in a liquid matrix; therefore, the analytical MDL is expressed as ug/L.

Table C-5. Metals Detection Limits

Compound	Method Detection Limit (MDL) ug/L *	Compound	Method Detection Limit (MDL) ug/L *
Aluminum	176.0	Magnesium	82.4
Antimony	3.7	Manganese	3.5
Arsenic	1.5	Mercury	0.2
Barium	17.9	Nickel	6.4
Beryllium	0.7	Potassium	68.3
Cadmium	0.5	Selenium	2.0
Calcium	86.4	Silver	1.4
Chromium	11.9	Sodium	281.0
Cobalt	4.4	Thallium	3.0
Copper	1.9	Vanadium	4.5
Iron	114.0	Zinc	3.0
Lead	1.1		

* The sample being analyzed is in a liquid matrix; therefore, the analytical MDL is expressed as ug/L.

Table C-6. Chemical Agents Detection Limits

Compound	Method Detection Limit (MDL) (mg/m^3)*
Sarin (GB)	0.0003
Soman (GD)	0.0003
O-ethyl-S-(2-diisopropylaminoethyl)-methylphosphonothiolate (VX)	0.0003
Mustard (HD)	0.003

* MDL/sensitivity is not uniformly defined or reported. The above MDL/sensitivity is based on a 2 – 3 hour sampling time and represents the information currently available. (Reference: Site Monitoring Concept Plan, U.S. Army Chemical Materiel Destruction Agency, 15 September 1993).

APPENDIX D

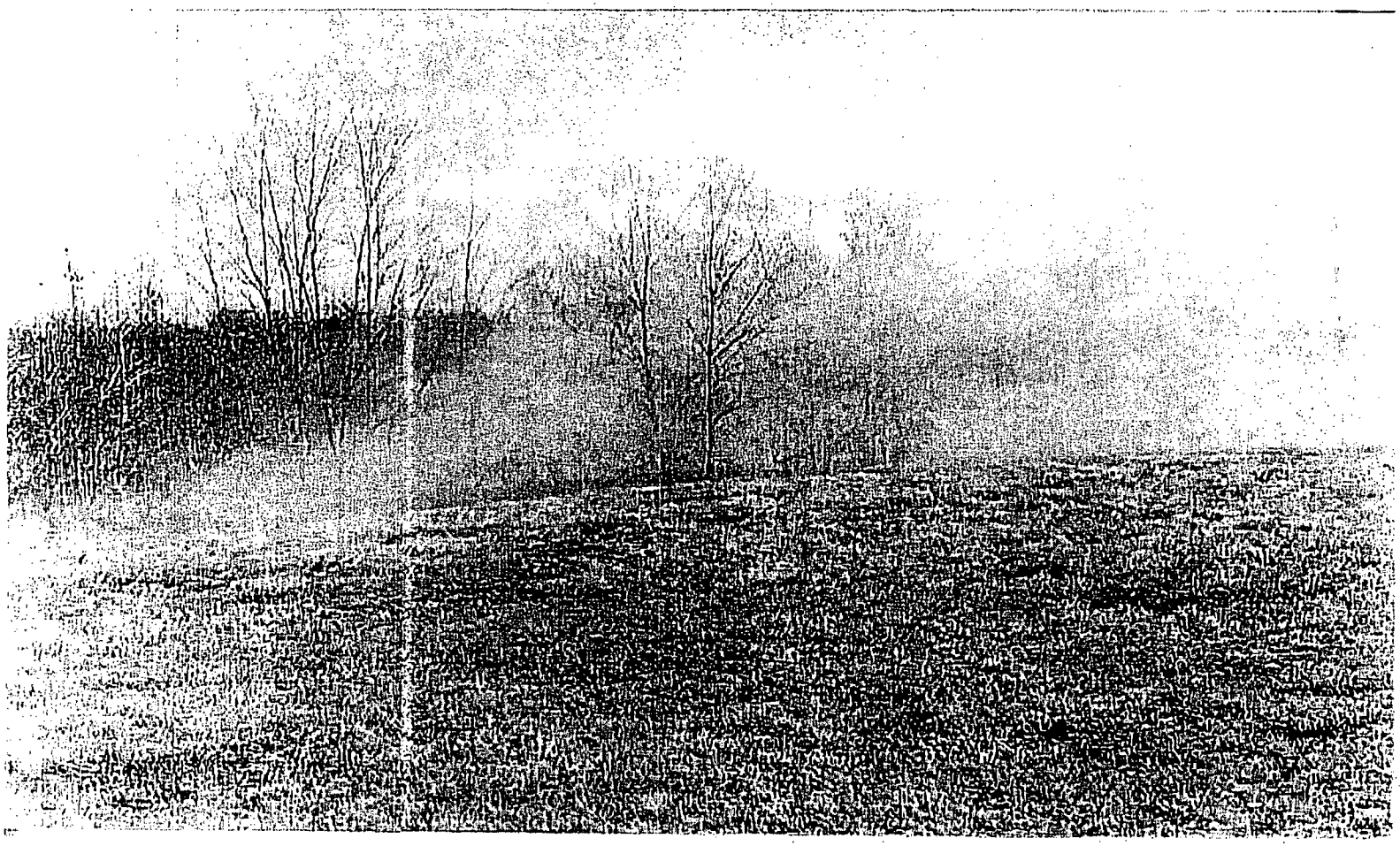
BURN EVENT PHOTOGRAPHS

APPENDIX D-1

MAIN FRONT – 1999

Smoke Plume at the Beginning of the Main Front Range Controlled Burn – April 1999

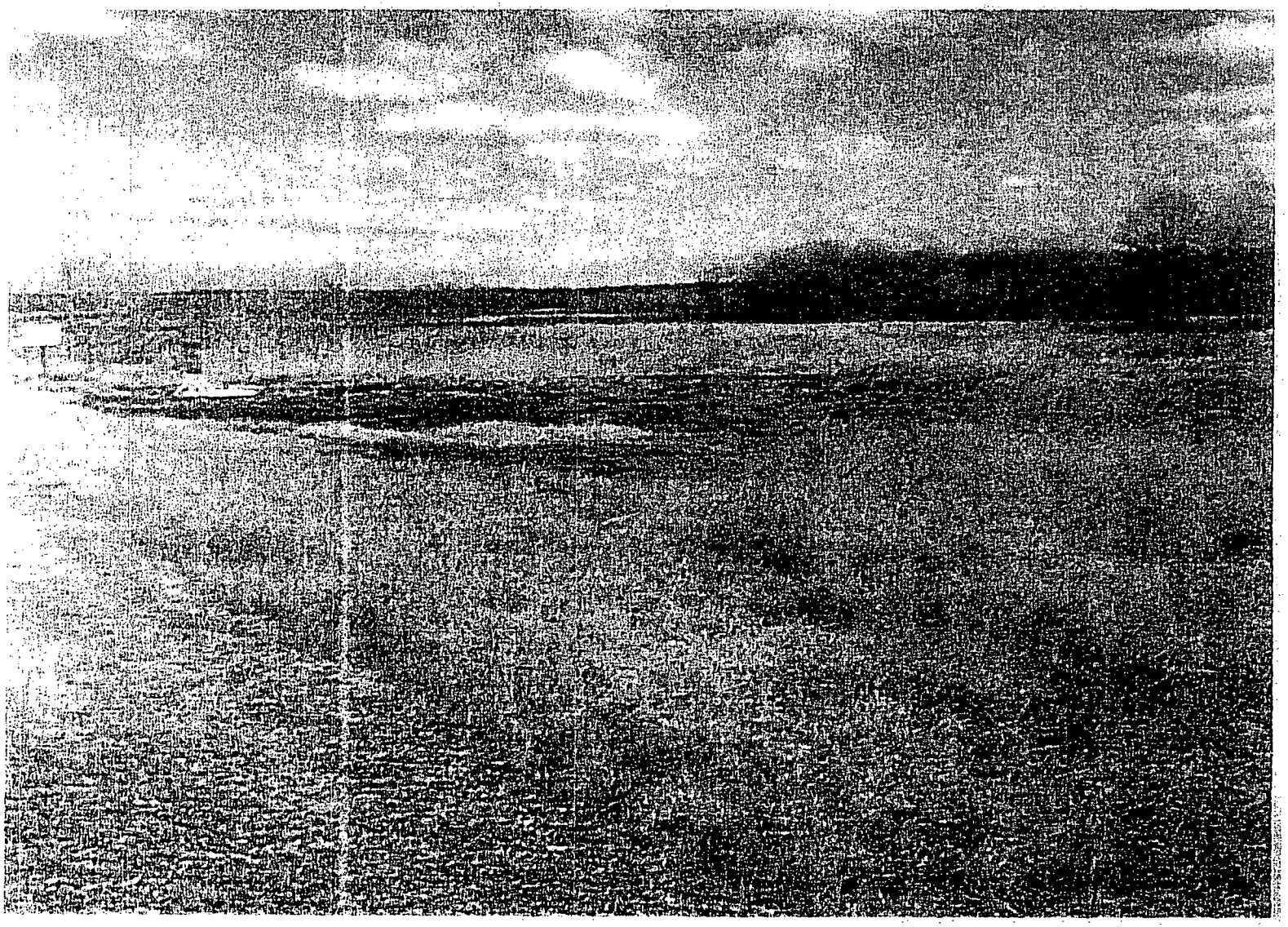
Smoke Plume at the Beginning of the Main Front Range Controlled Burn – April 1999



APPENDIX D-2

NEW O-FIELD – 1999

New O-Field Burn Area – Facing Watson Creek (Northeast)

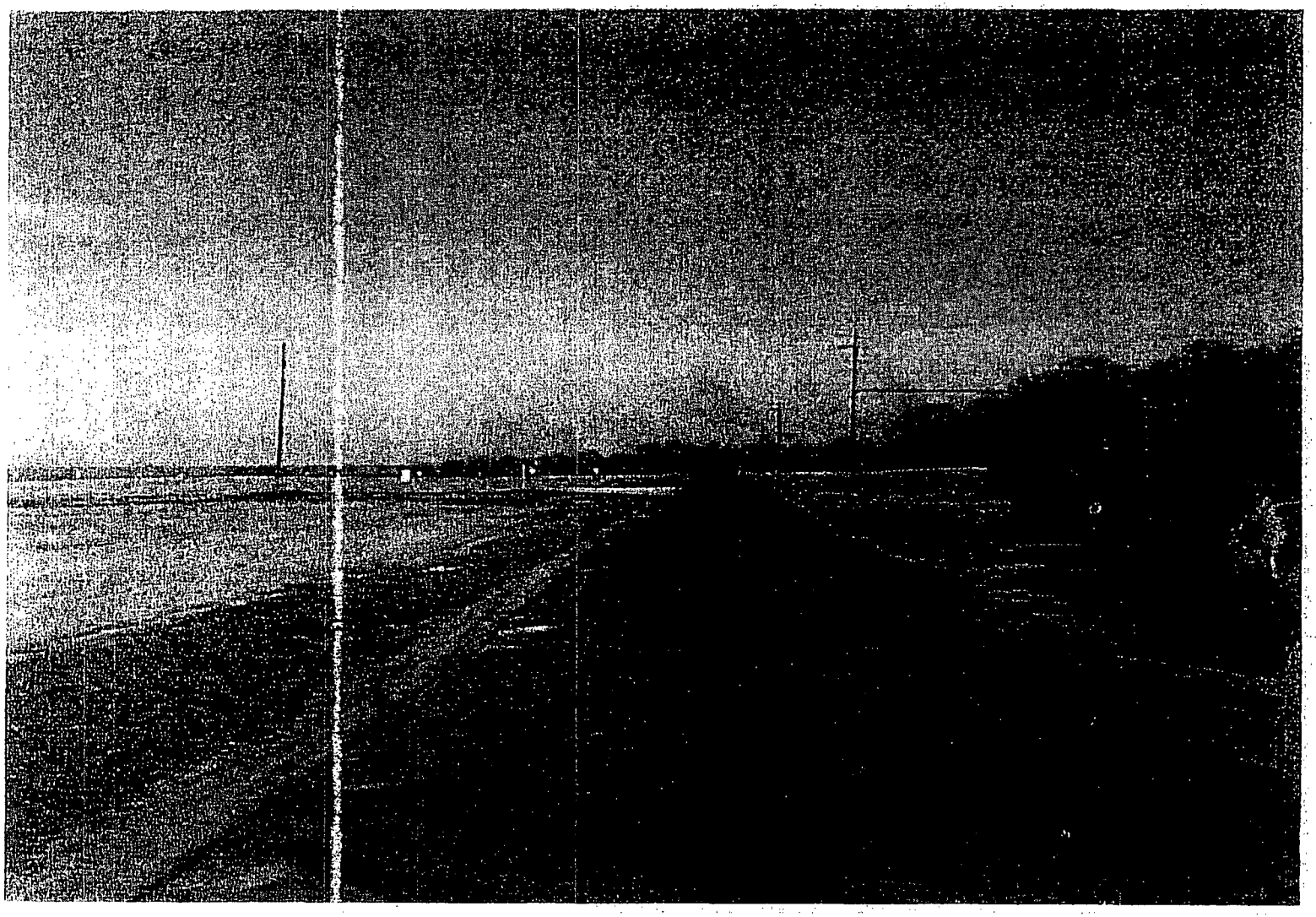


Aerial View – New O-Field Controlled Burn Area – December 1999

APPENDIX D-3

J-FIELD – 2000

Initial Smoke Plume Produced by the J-Field Controlled Burn – April 2000



Smoke Plume Produced by the J-Field Controlled Burn – April 2000

Aerial View of Area Burned During J-Field Controlled Burn – April 2000

APPENDIX E

CONTROLLED BURN DATA TABLES

APPENDIX E-1

DATA TABLES FOR THE MAIN FRONT CONTROLLED BURN – APRIL 1999

Table E-1. Main Front Controlled Burn Air Samples - April 1999

Volatile Organic Compound Analysis Results from Summa Canisters

Analytes *	1-Hour Screening Level Concentration (ug/m³)	EPA Region III's Ambient Air RBCs Concentration (ug/m³)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4	
				Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)
Acetone	17,820	37	2,400,000	3.04	7.22	3.01	7.15	5.16	12.26	3.08	7.32
Methylene chloride	NA	3.8	86,843	ND	ND	ND	ND	1.69	5.87	1.85	6.43
Toluene	NA	42	753,703	0.91	3.42	2.31	8.71	42.83	161.4	8.56	32.26
Octane	17500	NA	2,350,000	ND	ND	ND	ND	2.94	13.7	ND	ND
Nonane	NA	NA	NA	ND	ND	4.1	21.5	20.2	106	4.05	21.25
Decane	NA	NA	NA	ND	ND	4.22	24.56	4.08	23.7	2.75	16
m-/p-xylene	6,510	730	435,000	1.77	-	7.12	-	32.13	-	30.8	-
o-xylene	6,510	730	435,000	ND	ND	ND	ND	3.89	16.9	3.83	16.63
Unknown hydrocarbon	-	-	-	ND	ND	24.59	-	18.05	-	4.37	-
Unknown hydrocarbon	-	-	-	ND	ND	2.71	-	3.48	-	18.75	-
Unknown hydrocarbon	-	-	-	ND	ND	2.11	-	3.76	-	2.23	-
Unknown hydrocarbon	-	-	-	ND	ND	1.61	-	3.13	-	6.13	-
Unknown hydrocarbon	-	-	-	ND	ND	1.54	-	2.56	-	8.06	-
Unknown hydrocarbon	-	-	-	ND	ND	ND	ND	3.25	-	ND	ND
Benzaldehyde	NA	73	NA	1.01	4.38	ND	ND	ND	ND	ND	ND
Ethylhexanol	NA	NA	NA	4.86	-	ND	ND	ND	ND	ND	ND
Methylheptanone	NA	NA	NA	0.87	4.56	ND	ND	ND	ND	ND	ND
Methylbutane	NA	NA	NA	ND	ND	ND	ND	ND	ND	19.92	58.78
Hexamethylcyclotrisiloxane	NA	NA	NA	ND	ND	ND	ND	ND	ND	7.49	68.01
Trimethylbenzene	NA	0.62	NA	ND	ND	ND	ND	ND	ND	2.55	12.54
Dichlorobenzene	60.12	0.28	300,000	ND	ND	ND	ND	ND	ND	1.56	9.40
Total VOC				12.46		53.32		147.15		126	

* The detected analytes were reported as Tentatively Identified Compounds (TICs)

NA - Screening criteria not available or does not apply

ND - nondetected

Shadowed cells indicate detected concentrations above screening criteria

Table E-2. Main Front Controlled Burn Air Samples - April 1999

Chemical Agent Analysis Results

Chemical Agent	SP1		SP2		SP3		SP4	
	Concentration (ppb)	Concentration (ug/m^3)	Concentration (ppb)	Concentration (ug/m^3)	Concentration (ppb)	Concentration (ug/m^3)	Concentration (ppb)	Concentration (ug/m^3)
Sarin (GB)	ND	ND	ND	ND	ND	ND	ND	ND
Soman (GD)	ND	ND	ND	ND	ND	ND	ND	ND
VX	ND	ND	ND	ND	ND	ND	ND	ND
Mustard (HD)	ND	ND	ND	ND	ND	ND	ND	ND

ND - nondetected

Analysis provided by Edgewood Chemical Biological Center.

Table E-3. Main Front Controlled Burn Air Samples - April 1999

Radiological Analysis Results

Analytes	Toxic Air Pollutant 1-Hour Screening Level Concentration (ug/m³)	EPA Region III Ambient Air RBCs Concentration (ug/m³)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4 (Upwind)		Blank
				Results (pCi/filter)	Concentrations (pCi/m³)	Results (pCi/filter)	Concentrations (pCi/m³)	Results (pCi/filter)	Concentrations (pCi/m³)	Results (pCi/filter)	Concentrations (pCi/m³)	Results (pCi/filter)
Gross Alpha	NA	NA	NA	6.8	0.0231	6.2	0.0210	1	0.0122	1.4	0.0133	5.6
Gross Beta	NA	NA	NA	37	0.1257	42	0.1424	0.6	0.0073	1.6	0.0152	32
Actinium-228	NA	NA	NA	-2.1	-0.0071	1.6	0.0054	15	0.1833	2.1	0.0199	13
Bismuth-212	NA	NA	NA	43	0.1461	42	0.1424	-72	-0.8797	13	0.1233	21
Bismuth-214	NA	NA	NA	-8.5	-0.0289	3.7	0.0125	0.64	0.0078	-7.4	-0.0702	-6.1
Cesium-137	NA	NA	NA	-0.72	-0.0024	-3.8	-0.0129	3.6	0.0440	1.3	0.0123	3.7
Cobalt-60	NA	NA	NA	0.88	0.0030	1.2	0.0041	-0.41	-0.0050	1.3	0.0123	0.71
Lead-210	NA	NA	NA	-46	-0.1563	-14	-0.0475	-70	-0.8552	-95	-0.9012	10
Lead-212	NA	NA	NA	0.37	0.0013	16	0.0543	-2.5	-0.0305	-1.4	-0.0133	5.6
Lead-214	NA	NA	NA	-3.6	-0.0122	7.4	0.0251	-5.3	-0.0648	-0.18	-0.0017	-3.6
Potassium-40	NA	NA	NA	52	0.1767	4.1	0.0139	-47	-0.5742	22	0.2087	11
Protactinium-231	NA	NA	NA	-7.8	-0.0265	20	0.0678	120	1.4661	97	0.9202	4.6
Protactinium-234	NA	NA	NA	3.5	0.0119	-23	-0.0780	6.3	0.0770	-3.4	-0.0323	-4.9
Radium-223	NA	NA	NA	-5.4	-0.0184	1.4	0.0047	-6.9	-0.0843	-1.4	-0.0133	4.6
Radium-224	NA	NA	NA	9	0.0306	180	0.6104	120	1.4661	-53	-0.5028	160
Radium-226	NA	NA	NA	-8.3	-0.0282	3.6	0.0122	0.62	0.0076	-7.2	-0.0683	-5.9
Uranium-235	NA	NA	NA	-5.6	-0.0190	-3.3	-0.0112	-14	-0.1710	4.4	0.0417	12
				Results (ug/filter)	Concentration (ug/m³)	Results (ug/filter)	Concentration (ug/m³)	Results (ug/filter)	Concentration (ug/m³)	Results (ug/filter)	Concentration (ug/m³)	Results (ug/filter)
Total Uranium by Mass Spectrometry	6	11	50	2	0.0068	2	0.0068	ND	ND	ND	ND	2.2

Sampling Location	Sampler ID	Total Air Flow (m³)
SP1	TSP3	294.26
SP2	TSP6	294.87
SP3	Handi Vol 6	81.85
SP4 (Upwind)	Handi Vol 7	105.41

NA - Screening criteria not available or does not apply
ND - Nondetected

Table E-4. Main Front Controlled Burn Air Samples - April 1999

Inorganics Analysis Results

Analytes	Toxic Air Pollutant 1-Hour Screening Level Concentration (ug/m³)	EPA Region III Ambient Air RBCs Concentration (ug/m³)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4 (Upwind)		Blank
				Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)
Mercury	0.3	0.031	100 (acceptable ceiling)	0.01	0.00003	0.01	0.00003	BQL	-	BQL	-	BQL
Silver	NA	1.8	10	2	0.0068	1.7	0.0058	BQL	-	BQL	-	3.1
Aluminum	NA	0.37	5,000	15000	51.1910	11800	40.0489	43.7	0.5959	53.5	0.4598	21700
Arsenic	NA	0.00041	500	4.3	0.0147	3.6	0.0122	BQL	-	BQL	-	6.5
Barium	NA	0.051	500	36900	125.9300	29000	98.4252	2.5	0.0341	2.7	0.0232	48900
Beryllium	0.1	0.00075	2	0.14	0.0005	0.11	0.0004	BQL	-	BQL	-	0.17
Calcium	NA	NA	NA	10400	35.4925	8340	28.3057	67.5	0.9199	71.5	0.6145	13800
Cadmium	NA	0.00099	5	BQL	-	BQL	-	0.04	0.0005	BQL	-	BQL
Cobalt	NA	22	100	BQL	-	BQL	-	BQL	-	0.06	0.0005	BQL
Chromium	NA	0.00015	500	11.4	0.0389	9.1	0.0309	0.59	0.0080	0.52	0.0045	18.3
Copper	NA	15	100	16.2	0.0553	11.9	0.0404	22.8	0.3107	4.9	0.0421	BQL
Iron	NA	110	NA	274	0.9351	230	0.7806	38.3	0.5219	42.1	0.3618	315
Potassium	NA	NA	NA	22200	75.7627	17100	58.0369	23.8	0.3243	30.8	0.2647	28800
Magnesium	NA	NA	NA	991	3.3820	799	2.7118	15.2	0.2071	19.4	0.1667	1300
Manganese	NA	0.0052	5000	10.3	0.0352	9.2	0.0312	1.4	0.0191	1.7	0.0146	11.3
Sodium	NA	NA	NA	66600	227.2882	48500	164.6077	186	2.5348	166	1.4267	81400
Nickel	NA	7.3	1,000	1.7	0.0058	1.4	0.0048	0.45	0.0061	0.41	0.0035	1.7
Lead	NA	NA	50	5	0.0171	3.9	0.0132	0.45	0.0061	0.44	0.0038	4.9
Antimony	NA	0.15	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Selenium	NA	1.8	200	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Thallium	NA	0.026	100	1.5000	0.0051	1.3	0.0044	BQL	-	BQL	-	2.5
Vanadium	NA	2.6	500	0.6900	0.0024	0.68	0.0023	0.29	0.0040	0.33	0.0028	0.58
Zinc	100	110	NA	29300.0000	99.9932	22500	76.3644	3.5	0.0477	4.1	0.0352	38100

Sampling Location	Sampler ID	Total Air Flow (m³)	
SP1	TSP1	293.02	
SP1	TSP2	297.77	Mercury
SP2	TSP4	294.64	
SP2	TSP5	294.64	Mercury
SP3	Handi Vol 1	73.38	
SP3	Handi Vol 4	88.92	Mercury
SP4 (Upwind)	Handi Vol 2	116.35	
SP4 (Upwind)	Handi Vol 5	114.11	Mercury

NA - Screening criteria not available or does not apply
BQL - Below Quantitation Limit
Shadowed cells indicate detected concentrations above screening criteria.

Table E-5. Main Front Controlled Burn Air Samples - April 1999

PCBs Analysis Results from Filters

Analytes	SP1		SP2		SP3		SP4 (Upwind)		Blank
	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)
2,2',3,5'-Tetrachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2',5,5'-Tetrachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2',5-Trichlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,4'5-Hexachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,5'-Pentachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,5,5'Hexachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,5,5'6-Hexachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'4,4'5,5'Hexachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'4,5,5'-Pentachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3',4,4'-Tetrachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3,3'4'6-Pentachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3-Dichlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4',5-Trichlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Chlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'5-Heptachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'55'6-Nonachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'34'55'6-Heptachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'5'6-Heptachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'55'-Heptachlorobiphenyl	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	Filter7	53.39
SP2	Filter6	46.95
SP3	Filter1	37.78
SP4 (Upwind)	Filter3	61.1

BQL - Below Quantitation Limit

Table E-6. Main Front Controlled Burn Air Samples - April 1999

PCBs Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4 (Upwind)		Blank
				Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
2,2',3,5'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2',5,5'-Tetrachlorobipheny	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,4'5-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,5'-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	0.03	0.0008	BQL	-	BQL
2,2'3,4,5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,5,5'6-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'4,4'5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'4,5,5'-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3',4,4'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3,3'4'6-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3-Dichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	0.43	0.0110	0.073	0.0012	BQL
2-Chlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'5-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'55'6-Nonachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'34'55'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'5'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'55'-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m3)
SP1	PUF7	53.39
SP2	PUF6	46.95
SP3	PUF1	37.78
SP4 (Upwind)	PUF3	61.1

NA - Screening criteria not available or does not apply

BQL - Below Quantitation Limit

Shadowed cells indicated detected concentrations above screening criteria

Table E-7. Main Front Controlled Burn Air Samples - April 1999

Pesticides Analysis Results from Filters

Analytes	SP1		SP2		SP3		SP4 (Upwind)		Blank
	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)
alpha-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
beta-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
delta-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Lindane (gamma-BHC)	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Aldrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor epoxide	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan I	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Dieldrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDE	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan II	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDD	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan sulfate	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDT	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Methoxychlor	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin ketone	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin aldehyde	BQL	-	BQL	-	BQL	-	BQL	-	BQL
alpha-Chlordane	BQL	-	BQL	-	BQL	-	BQL	-	BQL
gamma-Chlordane	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Toxaphene	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	Filter9	60.17
SP2	Filter8	41.09
SP3	Filter2	33.16
SP4 (Upwind)	Filter4	45.89

BQL - Below Quantitation Limit

Table E-8. Main Front Controlled Burn Air Samples - April 1999

Pesticides Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PEL's Concentration (ug/m3)	SP1 Results (ug/PUF)	SP1 Concentration (ug/m^3)	SP2 Results (ug/PUF)	SP2 Concentration (ug/m^3)	SP3 Results (ug/PUF)	SP3 Concentration (ug/m^3)	SP4 (Upwind) Results (ug/PUF)	SP4 (Upwind) Concentration (ug/m^3)	Blank Results (ug/PUF)
alpha-BHC	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
beta-BHC	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
delta-BHC	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Lindane (gamma-BHC)	NA	NA	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor	NA	0.0014	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Aldrin	NA	0.00037	250	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor epoxide	NA	0.00069	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan I	NA	2.2	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Dieldrin	NA	0.00039	250	0.032	0.0005	0.02	0.0005	0.1	0.0030	BQL	-	BQL
4,4'-DDE	NA	0.018	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin	NA	0.11	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan II	NA	2.2	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDD	NA	0.026	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan sulfate	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDT	NA	0.018	1,000	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Methoxychlor	NA	1.8	1,500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin ketone	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin aldehyde	NA	NA	NA	BQL	-	BQL	-	BQL	-	BQL	-	BQL
alpha-Chlordane	NA	NA	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
gamma-Chlordane	NA	NA	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Toxaphene	NA	0.0057	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	PUF9	60.17
SP2	PUF8	41.09
SP3	PUF2	33.16
SP4 (Upwind)	PUF4	45.89

NA - Screening criteria not available or does not apply
BQL - Below Quantitation Limit
Shadowed cells indicate detected concentrations above screening criteria

Analytes	SP1				SP2				SP3			
	Results (pCi/filter)	Error +/-	MDA (pCi/filter)	Validation Qualifier	Results (pCi/filter)	Error +/-	MDA (pCi/filter)	Validation Qualifier	Results (pCi/filter)	Error +/-	MDA (pCi/filter)	Validation Qualifier
Gross Alpha	6.8	2.4	1.8	U3, J6	6.2	2.3	2	U3, J6	1	0.8	1	U1, U3, J6
Gross Beta	37	3.2	1.9	D	42	3.4	2	D	0.6	0.9	1.5	U1, U2, U3
Bismuth-212	43	43	85	U1, U2 *	42	75	130	U1, U2 *	-72	73	110	U1, U2 *
Lead-212	0.37	7.5	7.3	U1, U2 D	16	16	14	U1, U2 D	-2.5	9.2	15	U1, U2 *
Potassium-40	52	48	51	U1, J6 D	4.1	83	180	U1, U2 *	-47	75	160	U1, U2 *
Radium-223	-5.4	6.5	11	U1, U2 *	1.4	10	17	U1, U2 D	-6.9	11	17	U1, U2 *
Uranium-235	-5.6	14	23	U1, J6 *	-3.3	30	50	U1, U2 *	-14	30	49	U1, U2 *

Analytes	SP4 (Upwind)				Blank			
	Results (pCi/filter)	Error +/-	MDA (pCi/filter)	Validation Qualifier	Results (pCi/filter)	Error +/-	MDA (pCi/filter)	Validation Qualifier
Gross Alpha	1.4	0.8	1	U3, J6	5.6	2.1	1.7	J6
Gross Beta	1.6	1	1.5	U3, J6	32	2.9	1.6	D
Bismuth-212	13	42	79	U1, U2 *	21	69	120	U1, U2
Lead-212	-1.4	4.9	9	U1, U2 *	5.6	9	15	U1, U2 *
Potassium-40	22	57	65	U1, U2 D	11	120	80	U1, U2
Radium-223	-1.4	6.4	11	U1, U2 *	4.6	12	18	U1, U2 *
Uranium-235	4.4	4.2	24	U1, U2 D	12	29	50	U1, U2 *

* reported nondetected in 8 results
D reported detected in 8 results

MDA - minimum detectable amount

Qualifier
U1 - results less than MDA
U2 - results less than error
U3 - results less than blank
J6 - error greater than 20%

Table E-9. Main Front Controlled Burn Air Samples - April 1999
Explosives Analysis Results from PUF Samplers

Analytes	SP1		SP2		SP3		SP4 (Upwind)		Blank
	Results (ug/PUF)	Concentration (ug/m^3)	Results (ug/PUF)	Concentration (ug/m^3)	Results (ug/PUF)	Concentration (ug/m^3)	Results (ug/PUF)	Concentration (ug/m^3)	Results (ug/PUF)
1,3,5-Trinitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
1,3-Dinitrobezene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4,6-Trinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,6-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Amino-4,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
3-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Amino-2,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
HMX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Nitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
RDX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Tetryl	BQL	-	BQL	-	BQL	-	BQL	-	BQL

BQL - Below Quantitation Limit

Table E-10 Main Front Controlled Burn Air Samples - April 1999
Explosives Analysis Results from Filters

Analytes	SP1		SP2		SP3		SP4 (Upwind)		Blank
	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)
1,3,5-Trinitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
1,3-Dinitrobezene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4,6-Trinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,6-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Amino-4,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
3-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Amino-2,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
HMX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Nitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
RDX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Tetryl	BQL	-	BQL	-	BQL	-	BQL	-	BQL

BQL - Below Quantitation Limit

APPENDIX E-2

DATA TABLES FOR THE NEW O-FIELD CONTROLLED BURN – DECEMBER 1999

Table E-11. New O-Field Controlled Burn Air Samples - December 1999
Volatile Organic Compound Analysis Results from Summa Canisters

Analytes *	Texas Air Pollutant 1-hour Screening Level Concentration (ug/m³)	EPA Region III Ambient Air RBCs Concentration (ug/m³)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4-A (Background)		SP4-B (Background)	
				Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)	Concentration (ppb)	Concentration (ug/m³)
Acetone	17,820	37	2,400,000	1.68	3.99	27.6	65.56	1.11	2.64	ND	-	1.51	3.59
Benzene	80	0.22	3,195	0.806	2.58	6.23	19.9	0.727	2.32	1.42	4.54	1.54	4.92
Benzonitrile	NA	NA	NA	0.609	2.57	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Dioxide	2,088,000	NA	9,000,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	NA	73	62,275	ND	ND	5.94	18.5	ND	ND	ND	ND	ND	ND
Dodecene	NA	NA	NA	2.9	19.96	ND	ND	ND	ND	ND	ND	ND	ND
Hexane	NA	21	1,800,000	ND	ND	11.3	39.83	ND	ND	ND	ND	ND	ND
Methylene Chloride	NA	3.8	86,843	ND	ND	7.27	25.25	ND	ND	ND	ND	ND	ND
Pinene Isomer	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.49	-	ND	ND
Toluene	NA	42	753703	1.48	5.58	23.6	88.94	1.6	6.03	3.58	13.49	1.21	4.56
Xylene Isomer	6,510	730	NA	0.796	-	81.94	-	0.797	-	1.6	-	0.831	-
Unknown C11 Hydrocarbon	-	-	-	ND	ND	ND	ND	ND	ND	1.33	-	ND	ND
Unknown C12 Hydrocarbon	-	-	-	ND	ND	ND	ND	ND	ND	1.97	-	ND	ND
Unknown Chloroflurohydrocarbon	-	-	-	ND	ND	ND	ND	ND	ND	1.85	-	ND	ND
Unknown	-	-	-	ND	ND	ND	ND	ND	ND	3.26	-	ND	ND
Unknown	-	-	-	ND	ND	ND	ND	ND	ND	1.83	-	ND	ND
Unknown	-	-	-	ND	ND	ND	ND	ND	ND	1.89	-	ND	ND
Total VOC				8.271		81.940		4.2340		20.220		5.091	

* The detected analytes were reported as Tentatively Identified Compounds (TICs)
NA - Screening criteria not available or does not apply
ND - nondetected
Shadowed cells indicated detected concentrations above criteria

Table E-12. New O-Field Controlled Burn Air Samples - December 1999
Pesticide Analysis Results from PUF Samplers

Analytes	SP1		SP2		SP3		SP4 (Background)		Blank
	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
alpha-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
beta-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
delta-BHC	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Lindane (gamma-BHC)	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Aldrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Heptachlor epoxide	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan I	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Dieldrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDE	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan II	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDD	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endosulfan sulfate	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4,4'-DDT	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Methoxychlor	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin ketone	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Endrin aldehyde	BQL	-	BQL	-	BQL	-	BQL	-	BQL
alpha-Chlordane	BQL	-	BQL	-	BQL	-	BQL	-	BQL
gamma-Chlordane	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Toxaphene	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	PUF9	36.59
SP2	PUF8	42.36
SP3	PUF2	34.4
SP4 (Background)	PUF4	46.37

BQL - Below Quantitation Limit

Table E-13 New O-Field Controlled Burn Air Samples - December 1999
PCBs Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m³)	EPA Region III Ambient Air RBCs (ug/m³)	OSHA PELs Concentration (ug/m3)	SP1		SP2		SP3		SP4 (Background)		Blank
				Results (ug/PUF)	Concentrations (ug/m³)	Results (ug/PUF)	Concentrations (ug/m³)	Results (ug/PUF)	Concentrations (ug/m³)	Results (ug/PUF)	Concentrations (ug/m³)	Results (ug/PUF)
2,2',3,5'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2',5,5'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	0.017
2,2',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,4'5-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,4,5'-Pentachlorobiphenyl	NA	0.0031	500	0.042	0.0010	0.0160	0.0004	0.0130	0.0004	BQL	-	BQL
2,2'3,4,5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'3,5,5'6-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	0.0050	0.0001	0.0200	0.0006	0.009	0.0002	BQL
2,2'4,4'5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,2'4,5,5'-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3',4,4'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	0.091		0.004
2,3,3'4'6-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,3-Dichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	0.11
2,4',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Chlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'5-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'33'44'55'6-Nonachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'34'55'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'5'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL
22'344'55'-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL		BQL	-	BQL

Sampling Location	Sample ID	Total Air Flow (m³)
SP1	PUF9	36.59
SP2	PUF8	42.36
SP3	PUF2	34.4
SP4 (Background)	PUF4	46.37

NA - Screening criteria not available or does not apply
BQL - Below Quantitation Limit

Table E-14 New O-Field Controlled Burn Air Samples - December 1999
Explosives Analysis Results from PUF Samplers

Analytes	SP1		SP2		SP3		SP4 (Background)		Blank
	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
1,3,5-Trinitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
1,3-Dinitrobezene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4,6-Trinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,4-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2,6-Dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Amino-4,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
2-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
3-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Amino-2,6-dinitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
4-Nitrotoluene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
HMX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Nitrobenzene	BQL	-	BQL	-	BQL	-	BQL	-	BQL
RDX	BQL	-	BQL	-	BQL	-	BQL	-	BQL
Tetryl	BQL	-	BQL	-	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	PUF7	36.15
SP2	PUF6	42.95
SP3	PUF1	38.14
SP4 (Background)	PUF3	54.08

BQL - Below Quantitation Limit

Table E-15 New O-Field Controlled Burn Air Samples - December 1999
Inorganics Analysis Results

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m³)	EPA Region III Ambient Air RBCs (ug/m³)	OSHA PELs Concentration (ug/m³)	SP1		SP2		SP3		SP4 (Background)		Blank	Blank
				Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter)	Concentrations (ug/m³)	Results (ug/filter) TSP	Results (ug/filter) HANDIVOL
Mercury	0.3	0.03	100 (acceptable ceiling)	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Silver	NA	1.8	10	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Aluminum	NA	0.37	5,000	119	0.5200	55.7	0.2000	44.9	0.3600	39.9	0.3100	24.6	BQL
Arsenic	NA	0.00041	500	3.2	0.0100	BQL	-	BQL	-	BQL	-	BQL	BQL
Barium	NA	0.051	500	24.7	0.1100	18.4	0.0700	2.3	0.0200	2.2	0.0200	20.1	1.4
Beryllium	0.1	0.00075	2	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Calcium	NA	NA	NA	595	2.5900	362.0	1.3300	89.2	0.7200	77.2	0.6000	373	BQL
Cadmium	NA	0.00099	5	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Cobalt	NA	22	100	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Chromium	NA	0.00015	500	2.1	0.0100	1.4	0.0010	BQL	-	BQL	-	1.3	BQL
Copper	NA	15	100	87.7	0.3800	31.4	0.1200	6.4	0.0500	10.3	0.0800	0.68	BQL
Iron	NA	110	NA	186	0.8100	68.1	0.2500	49.6	0.4000	55	0.4300	13.2	BQL
Potassium	NA	NA	NA	197	0.8600	BQL	-	BQL	-	BQL	-	BQL	BQL
Magnesium	NA	NA	NA	80	0.3500	44.5	0.1600	BQL	-	BQL	-	35.3	BQL
Manganese	NA	0.0052	5000	4.5	0.0200	1.6	0.0100	1.0	0.0080	1	0.0080	BQL	BQL
Sodium	NA	NA	NA	1270	5.5300	993.0	3.6400	230.0	1.8500	225	1.7600	1150	213
Nickel	NA	7.3	1,000	3	0.0100	1.0	0.0040	BQL	-	BQL	-	BQL	BQL
Lead	NA	NA	50	17.1	0.0700	6.0	0.0220	5.5	0.0400	12.5	0.1000	BQL	BQL
Antimony	NA	0.15	500	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Selenium	NA	1.8	200	1.80	0.0100	0.5	0.0020	0.6	0.0050	0.52	0.0040	BQL	BQL
Thallium	NA	0.026	100	BQL	-	BQL	-	BQL	-	BQL	-	BQL	BQL
Vanadium	NA	2.6	500	6.9	0.0300	1.4	0.0050	1.4	0.0110	1.6	0.0100	BQL	BQL
Zinc	100	110	NA	33.9	0.1500	12.2	0.0450	6.5	0.0500	6.2	0.0500	2.1	BQL

Sampling Location	Sampler ID	Total Air Flow (m³)	
SP1	TSP3	222.12	Mercury
SP1	TSP2	229.68	
SP2	TSP6	271.98	Mercury
SP2	TSP5	272.62	
SP3	Handi Vol 6	138.96	Mercury
SP3	Handi Vol 4	124.06	
SP4 (Background)	Handi Vol 5	118.58	Mercury
SP4 (Background)	Handi Vol 7	127.04	

NA - Screening criteria not available or does not apply
BQL - Below Quantitation Limit
Shadowed cells indicate detected concentrations above screening criteria

Table E-16. New O-Field Controlled Burn Air Samples - December 1999
Chemical Agent Analysis Results

Chemical Agent	SP1		SP2		SP3		SP4	
	Concentration (ppb)	Concentration ($\mu g/m^3$)	Concentration (ppb)	Concentration ($\mu g/m^3$)	Concentration (ppb)	Concentration ($\mu g/m^3$)	Concentration (ppb)	Concentration ($\mu g/m^3$)
Sarin (GB)	ND	ND	ND	ND	ND	ND	ND	ND
Soman (GD)	ND	ND	ND	ND	ND	ND	ND	ND
VX	ND	ND	ND	ND	ND	ND	ND	ND
Mustard (HD)	ND	ND	ND	ND	ND	ND	ND	ND

ND - nondetected
Analysis provided by Edgewood Chemical Biological Center

Table E-17. New O-Field Controlled Burn Air Samples - December 1999
Radiological Analysis Results

Analytes	EPA Region III Ambient Air RBCs (ug/m^3)	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	OSHA PELs Concentration (ug/m^3)	SP1		SP2		SP3		SP4 (Background)	
				Results (pCi/filter)	Concentrations (pCi/m^3)	Results (pCi/filter)	Concentrations (pCi/m^3)	Results (pCi/filter)	Concentrations (pCi/m^3)	Results (pCi/filter)	Concentrations (pCi/m^3)
Gross Alpha	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Gross Beta	NA	NA	NA	23	0.1013	ND	ND	3.4	0.0255	4.3	0.0363
Actinium-228	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Bismuth-212	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Bismuth-214	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cesium-137	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt-60	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Lead-210	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Lead-212	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Lead-214	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Potassium-40	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Protactinium-231	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Protactinium-234	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Radium-223	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Radium-224	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Radium-226	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Uranium-235	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
				Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)	Results (ug/filter)	Concentration (ug/m^3)
Total Uranium by Mass Spectrometry	6	11	50	ND	ND	ND	ND	ND	ND	ND	ND

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	TSP1	226.98
SP2	TSP4	267.89
SP3	Handi Vol 1	133.45
SP4 (Background)	Handi Vol 2	118.58

NA - Screening criteria not available or does not apply
ND - nondetected

APPENDIX E-3

DATA TABLES FOR THE J-FIELD CONTROLLED BURN – APRIL 2000

Table E-18. J-Field Controlled Burn Air Samples - April 2000
Volatile Organic Compound Analysis Results from Summa Canisters

Analytes	Toxic Air Pollutant 1-Hour Screening Level Concentration (ug/m3)	EPA Region III Ambient Air RBCs Concentration (ug/m3)	OSHA PELs Concentration (ug/m3)	SP3		SP4 (Background)	
				Concentration (ppb)	Concentration (ug/m3)	Concentration (ppb)	Concentration (ug/m3)
Acetaldehyde *	450	0.81	360,000	2.21	3.98	ND	ND
Acetic Acid *	370	NA	25,000	ND	ND	1.07	2.63
Acetone *	17,820	37	2,400,000	6.05	14.37	3.29	7.82
Acetonitrile *	1,010	62	70,000	1.73	2.9	ND	ND
Benzene	80	0.22	3,195	6.44	20.57	0.746 J	2.38
Chloroethene	NA	0.21	2,556	0.332 J	0.849	ND	ND
Chloromethane	525	1.80	NA	1.65	3.41	0.757	1.56
Ethylbenzene	5,430	110	435,000	5.91	25.66	1.62	7.03
Ethylhexanol *	NA	NA	NA	1.88	10.01	ND	ND
Freon 12	NA	NA	NA	ND	ND	0.385 J	1.90
Furan *	NA	0.37	NA	3.08	8.58	ND	ND
Furfural *	NA	3.70	20,000	6.56	25.78	ND	ND
m-/p-Xylenes	6,510	730	435,000	3.43	14.89	0.967 J	4.2
Methylester Acetic Acid *	7,570	NA	NA	1.21	3.67	ND	ND
Methylfuran *	NA	NA	NA	2.49	8.36	ND	ND
Methylpropene *	NA	NA	NA	1.89	4.34	ND	ND
o-Xylene	6,510	730	435,000	0.335 J	1.45	ND	ND
Styrene	1,700	100	42,598	9.01	38.38	2.54	10.82
Toluene	NA	42	753,703	5.93	22.35	1.42	5.35
Unknown C8 Hydrocarbon *	-	-	-	1.92	-	0.973	-
Unknown C4 Alkene *	-	-	-	0.922	-	ND	ND
Unknown *	-	-	-	0.855	-	ND	ND
Unknown *	-	-	-	1.52	-	ND	ND
Total VOC				**62.477**		**11**	

* Analyte identified as a Tentatively Identified Compound (TIC)
NA - Screening criteria not available or does not apply
ND - nondetected
J - Estimate concentration. Target detected at greater than the detection limit, but less than the quatitation limit (I.e., detection limit x5)
Shadowed cells indicate detected concentrations above screening criteria

Table E-19. J-Field Controlled Burn Air Samples - April 2000
Pesticide Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP4 (Background)		Blank
				Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
alpha-BHC	NA	NA	NA	BQL	-	BQL	-	BQL
beta-BHC	NA	NA	NA	BQL	-	BQL	-	BQL
delta-BHC	NA	NA	NA	BQL	-	BQL	-	BQL
Lindane (gamma-BHC)	NA	NA	500	BQL	-	BQL	-	BQL
Heptachlor	NA	0.0014	500	BQL	-	0.078	0.0020	BQL
Aldrin	NA	0.00037	250	BQL	-	BQL	-	BQL
Heptachlor epoxide	NA	0.00069	NA	BQL	-	BQL	-	BQL
Endosulfan I	NA	2.2	NA	BQL	-	BQL	-	BQL
Dieldrin	NA	0.00039	250	BQL	-	BQL	-	BQL
4,4'-DDE	NA	0.018	NA	BQL	-	BQL	-	BQL
Endrin	NA	0.11	NA	BQL	-	BQL	-	BQL
Endosulfan II	NA	2.2	NA	BQL	-	BQL	-	BQL
4,4'-DDD	NA	0.026	NA	BQL	-	BQL	-	BQL
Endosulfan sulfate	NA	NA	NA	BQL	-	BQL	-	BQL
4,4'-DDT	NA	0.018	1,000	BQL	-	BQL	-	BQL
Methoxychlor	NA	1.8	1,500	BQL	-	BQL	-	BQL
Endrin ketone	NA	NA	NA	BQL	-	BQL	-	BQL
Endrin aldehyde	NA	NA	NA	BQL	-	BQL	-	BQL
alpha-Chlordane	NA	NA	500	BQL	-	BQL	-	BQL
gamma-Chlordane	NA	NA	500	BQL	-	BQL	-	BQL
Toxaphene	NA	0.0057	500	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	PUF9	47.59
SP4 (Background)	PUF4	39.52

NA - Screening criteria not available or does not apply
BQL - Below Quantitation Limit
Shadowed cells indicate detected concentrations above screening criteria

Table E-20. J-Field Controlled Burn Air Samples - April 2000

PCBs Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP4 (Background)		Blank
				Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
2,2',3,5'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2',5,5'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'3,4,4'5-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'3,4,5'-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'3,4,5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'3,5,5'6-Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'4,4'5,5'Hexachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,2'4,5,5'-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,3',4,4'-Tetrachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,3,3'4'6-Pentachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,3-Dichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2,4',5-Trichlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
2-Chlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
22'33'44'5-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
22'33'44'55'6-Nonachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
22'34'55'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
22'344'5'6-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL
22'344'55'-Heptachlorobiphenyl	NA	0.0031	500	BQL	-	BQL	-	BQL

Sampling Location	SamplerID	Total Air Flow (m^3)
SP1	PUF9	47.86
SP4 (Background)	PUF4	39.52

NA - Screening criteria not available or does not apply

BQL - Below Quantitation Limit

Table E-21. J-Field Controlled Burn Air Samples - April 2000

Explosives Analysis Results from PUF Samplers

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP4 (Background)		Blank
				Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)	Concentrations (ug/m^3)	Results (ug/PUF)
1,3,5-Trinitrobenzene	NA	11	NA	BQL	-	BQL	-	BQL
1,3-Dinitrobezene	NA	0.037	1,000	BQL	-	BQL	-	BQL
2,4,6-Trinitrotoluene	NA	0.21	1,500	BQL	-	BQL	-	BQL
2,4-Dinitrotoluene	50	0.73	1,500	BQL	-	BQL	-	BQL
2,6-Dinitrotoluene	NA	0.37	1,500	BQL	-	BQL	-	BQL
2-Amino-4,6-dinitrotoluene	NA	NA	NA	21.3	0.4570	BQL	-	BQL
2-Nitrotoluene	NA	NA	30,000	BQL	-	BQL	-	BQL
3-Nitrotoluene	NA	NA	30,000	BQL	-	BQL	-	BQL
4-Amino-2,6-dinitrotoluene	NA	NA	NA	5.9	0.1266	BQL	-	BQL
4-Nitrotoluene	NA	NA	30,000	BQL	-	BQL	-	BQL
HMX	NA	18	NA	BQL	-	BQL	-	BQL
Nitrobenzene	NA	0.22	5,000	BQL	-	BQL	-	BQL
RDX	NA	0.0057	NA	BQL	-	BQL	-	BQL
Tetryl	NA	3.7	1,500	BQL	-	BQL	-	BQL

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	PUF7	46.61
SP4 (Background)	PUF3	47.27

NA - Screening criteria not available or does not apply

BQL - Below Quantitation Limit

Shadowed cells indicated detected concentrations above screening criteria

Table E-22. J-Field Controlled Burn Air Samples - April 2000

Inorganics Analysis Results

Analytes	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP4 (Background)		Blank	Blank
				Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter)	Concentrations (ug/m^3)	Results (ug/filter) TSP	Results (ug/filter) HANDIVOL
Mercury	0.3	0.03	100 (acceptable ceiling)	0.1	0.00043	BQL	-	BQL	BQL
Silver	NA	1.8	10	0.1	0.0004	0.08	0.0009	BQL	BQL
Aluminum	NA	0.37	5,000	159	0.6802	80.8	0.8831	6.8	2.3
Arsenic	NA	0.00041	500	0.59	0.0025	BQL	-	BQL	BQL
Barium	NA	0.051	500	18.3	0.0783	2.6	0.0284	3.6	1.2
Beryllium	0.1	0.00075	2	BQL	-	BQL	-	BQL	BQL
Calcium	NA	NA	NA	1910	8.1711	187	2.0437	161	43.4
Cadmium	NA	0.00099	5	0.84	0.0036	0.05	0.0005	BQL	BQL
Cobalt	NA	22	100	0.21	0.0009	BQL	-	BQL	BQL
Chromium	NA	0.00015	500	0.82	0.0035	0.51	0.0056	0.52	0.13
Copper	NA	15	100	16.2	0.0693	11	0.1202	0.22	0.23
Iron	NA	110	NA	148	0.6332	63.7	0.6962	5.5	3.2
Potassium	NA	NA	NA	740	3.1658	26.1	0.2852	14.4	8.5
Magnesium	NA	NA	NA	321	1.3733	35.3	0.3858	17.1	6.2
Manganese	NA	0.0052	5000	128	0.5476	2.4	0.0262	0.19	0.1
Sodium	NA	NA	NA	618	2.6439	158	1.7268	413	131
Nickel	NA	7.3	1,000	0.95	0.0041	0.35	0.0038	BQL	BQL
Lead	NA	NA	50	7.6	0.0325	0.7	0.0077	BQL	BQL
Antimony	NA	0.15	500	BQL	-	BQL	-	BQL	BQL
Selenium	NA	1.8	200	0.52	0.0022	BQL	-	BQL	BQL
Thallium	NA	0.026	100	BQL	-	BQL	-	BQL	BQL
Vanadium	NA	2.6	500	0.6	0.0026	0.29	0.0032	BQL	BQL
Zinc	100	110	NA	30.9	0.1322	4	0.0437	0.48	0.61

Sampling Location	Sampler ID	Total Air Flow (m^3)	
SP1	TSP2	233.75	
SP1	TSP3	230.2	Mercury
SP4 (Background)	Handi Vol 5	91.5	
SP4 (Background)	Handi Vol 7	107.26	Mercury

NA - Screening criteria not available or does not apply

BQL - Below Quantitation Limit

Shadowed cells indicate detected concentrations above screening criteria

Table E-23. J-Field Controlled Burn Air Samples - April 2000
Chemical Agent Analysis Results

Chemical Agent	SP1		SP4	
	Concentration (ppb)	Concentration (ug/m^3)	Concentration (ppb)	Concentration (ug/m^3)
Sarin (GB)	ND	ND	ND	ND
Soman (GD)	ND	ND	ND	ND
VX	ND	ND	ND	ND
Mustard (HD)	ND	ND	ND	ND

ND - nondetected
Analysis provided by Edgewood Chemical Biological Center

Table E-24. J-Field Controlled Burn Air Samples - April 2000
Radiological Analysis Results

Pollutants	Toxic Air Pollutant 1-Hour Screening Level (ug/m^3)	EPA Region III Ambient Air RBCs (ug/m^3)	OSHA PELs Concentration (ug/m3)	SP1		SP4 (Background)	
				Results (pCi/filter)	Concentrations (pCi/m^3)	Results (pCi/filter)	Concentrations (pCi/m^3)
Gross Alpha	NA	NA	NA	ND	ND	ND	ND
Gross Beta	NA	NA	NA	ND	ND	ND	ND
Actinium-228	NA	NA	NA	ND	ND	ND	ND
Bismuth-212	NA	NA	NA	ND	ND	ND	ND
Bismuth-214	NA	NA	NA	ND	ND	ND	ND
Cesium-137	NA	NA	NA	ND	ND	ND	ND
Cobalt-60	NA	NA	NA	ND	ND	ND	ND
Lead-210	NA	NA	NA	ND	ND	ND	ND
Lead-212	NA	NA	NA	ND	ND	ND	ND
Lead-214	NA	NA	NA	ND	ND	ND	ND
Potassium-40	NA	NA	NA	ND	ND	ND	ND
Protactinium-231	NA	NA	NA	ND	ND	ND	ND
Protactinium-234	NA	NA	NA	ND	ND	ND	ND
Radium-223	NA	NA	NA	ND	ND	ND	ND
Radium-224	NA	NA	NA	ND	ND	ND	ND
Radium-226	NA	NA	NA	ND	ND	ND	ND
Uranium-235	NA	NA	NA	ND	ND	ND	ND
U-233/234	NA	NA	NA	ND	ND	ND	ND
U-235/236	NA	NA	NA	0.12	0.0005	ND	ND
U-238	NA	NA	NA	ND	ND	ND	ND

Sampling Location	Sampler ID	Total Air Flow (m^3)
SP1	TSP1	230.95
SP4 (Background)	Handi Vol 2	83.84

NA - Screening criteria not available or does not apply
ND - nondetected