



U.S. DEPARTMENT OF
ENERGY

ESHID-603975

National Nuclear Security Administration

Los Alamos Field Office
3747 West Jemez Road, A316
Los Alamos, New Mexico 87544
(505) 667-5105/Fax (505) 667-5948

Environmental Management

Los Alamos Field Office
1200 Trinity Drive, Suite 400P
Los Alamos, New Mexico 87544
(240) 562-1122

Date: October 6, 2026

Mr. JohnDavid Nance, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

**Subject: Response to Notice of Disapproval General Part A and B Permit Renewal
Application Los Alamos National Laboratory, EPA ID #NM0890010515, HWB-
LANL-20-001**

Dear Mr. Nance:

This letter transmits the response to the New Mexico Environment Department's (NMED) letter received on June 8, 2026 regarding the application submitted on July 11, 2025 by the U.S. Department of Energy (DOE) and its field offices, the National Nuclear Security Administration, Los Alamos Field Office (NA-LA) and the Environmental Management, Los Alamos Field Office (EM-LA), together with Triad National Security, LLC (Triad) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B), collectively the Permittees. The *Los Alamos National Laboratory General Part A Permit Application, Revision 11.0* and *Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 1.0* (Revised Permit Application) were submitted to the NMED in support of renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit.

The response document included as Enclosure 1 of this transmittal includes responses to NMED comments and descriptions of where requested information can be found in the revised Permit Application as well as depictions of those changes, as appropriate. Enclosure 2 consists of information provided in a separate envelope marked Unclassified Controlled Nuclear Information (UCNI) as defined by the Atomic Energy Act, Section 148 and 10 CFR §1017 that is not for public dissemination. It contains both information determined to be UCNI as well as other controlled unclassified information (CUI).

A meeting held on September 3, 2026, between NMED and the Permittees provided an opportunity to clarify and revise the responses to NMED's comments. These conversations also brought to light certain aspects of the application that could benefit from updates. These changes along with personnel changeover among the Permittees, bring on the need for additional time to compile *Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 2.0*, Volumes 1, 2, and 3 (Permit Renewal Application). The Permit Renewal Application will be submitted within 45 days of this response to allow for focused revision of responses and then focus on ensuring updates are complete. The Permittees recognize that it is important for NMED to receive a clean copy of a complete overall Part B application and commit to providing that document. The *Los Alamos National Laboratory General Part A Permit Application, Revision 11.0*, that includes the required

information described in 40 CFR § 270.13 was submitted to NMED on July 11, 2025. There were no changes to that portion of the application associated with the NMED comments and that portion of the application will not be resubmitted.

Three hard copies and one electronic copy (omitting the UCNI/CUI information) of this response submittal will be provided to the NMED. The hard copies include both enclosures discussed in this letter. The electronic copy, which will only be provided to NMED, contains a reproduction of the hard copy in portable document format (pdf) along with word processing files and other information utilized to prepare Enclosure 1.

If you have questions or comments for Triad concerning this submittal, please contact Dennis Svatos (NA-LA) at (505) 665-7640 or Naveen Chennubhotla (Triad) at (505) 629-7401.

If you have questions or comments for N3B concerning this submittal, please contact Brian Harcek (EM-LA) at (505) 692-4261 or Christian Maupin (N3B) at (505) 695-4281.

Sincerely,

PATRICK MOSS Digitally signed by
PATRICK MOSS
Date: 2026.10.06
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Michael Mikolanis
Manager
U.S. Department of Energy
National Nuclear Security Administration
Los Alamos Field Office

Sincerely,

STANLEY PYRAM Digitally signed by
STANLEY PYRAM
Date: 2026.10.05
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Stanley C. Pyram
Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

- Enclosures: 1) Response to June 8, 2026 NMED Technical Comments on Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 1.0
- 2) Unclassified Controlled Nuclear Information for the October 2026 Response to NMED Technical Comments on Los Alamos National Laboratory Part B Permit Application LA-CP-26-20686 (submitted to NMED only under a separate cover)

copy w/enclosures:

Laurie King, USEPA/Region 6, Dallas, TX, king.laurie@epa.gov
JohnDavid Nance, NMED-HWB, Santa Fe, NM, jd.nance@env.nm.gov
Brian Polgar, NMED-HWB, Santa Fe, NM, brian.polgar@env.nm.gov
Siona Briley, NMED-HWB, Santa Fe, NM, siona.briley@env.nm.gov
Catherine Lepp, NMED-HWB, Santa Fe, NM, catherine.lepp@env.nm.gov
Michael Mikolanis, NA-LA, michael.mikolanis@nnsa.doe.gov
Dennis R. Svatos, NA-LA, dennis.svatos@nnsa.doe.gov
Karen E. Armijo, NA-LA, karen.armijo@nnsa.doe.gov
W. Emmett Armour, NA-LA, emmett.armour@nnsa.doe.gov
Stephen Jochem, NA-LA, stephen.jochem@nnsa.doe.gov
Stanley C. Pyram, EM-LA, stanley.pyram@srs.gov

Brian G. Harcek, EM-LA, brian.harcek@em.doe.gov
Jeffrey D. Silvera, EM-LA, jeffrey.silvera@em.doe.gov
Renee K. Martinez, EM-LA, renee.martinez@em.doe.gov
John H. Evans, EM-LA, john.h.evans@em.doe.gov
Robert D. Reine, EM-LA, robert.reine@em.doe.gov
Mark E. Davis, Triad, DDOPS, mark.davis@lanl.gov
Aaron Menefee, Triad, DDOPS, menefee@lanl.gov
Liana M. Lovato, DDOPS, lianaa@lanl.gov
Steven A. Coleman, Triad, ALDESHQ, scoleman@lanl.gov
Jennifer E. Payne, Triad, ALDESHQ, jpayne@lanl.gov
Kacy C. Hopwood, Triad, ALDESHQ, khopwood@lanl.gov
Christopher D. Gamache, Triad, EPC-DO, cgamache@lanl.gov
Katherine J.W. Higgins, Triad, EPC-DO, kwurden@lanl.gov
Noel R. Ortiz, Triad, EPC-DO, noela@lanl.gov
M. Francesca Trujillo, Triad, EPC-DO, francesca@lanl.gov
Jessica L. Moseley, Triad, EPC-WMP, jmoseley@lanl.gov
James M. Eby, Triad, EPC-WMP, jeby@lanl.gov
Naveen K. Chennubhotla, Triad, EPC-WMP, naveenc@lanl.gov
Cecilia M. Trujillo, Triad, EPC-WMP, ceciliat@lanl.gov
Pablo Prando, Triad, GC-DO, pprando@lanl.gov
Maxine M. McReynolds, Triad, GC-DO, mcreynolds@lanl.gov
Timothy A. Dolan, GC-GL, tdolan@lanl.gov
Bradley Smith, N3B, bradley.smith@em-la.doe.gov
Christian Maupin, N3B, christian.maupin@em-la.doe.gov
Mark Lesinski, N3B, mark.lesinski@em-la.doe.gov
Silas DeRoma, N3B, silas.deroma@em-la.doe.gov
Robert Edwards III, N3B, robert.edwards@em-la.doe.gov
Jennifer von Rohr, N3B, jennifer.vonrohr@em-la.doe.gov
rcra-permitting@lanl.gov
rcra-prr@lanl.gov
eshq-dcrm@lanl.gov
locatesteam@lanl.gov
epccorrespondence@lanl.gov
RegDocs@EM-LA.DOE.GOV
n3brecords@em-la.doe.gov
lasomailbox@nnsa.doe.gov
emla.docs@em.doe.gov
interface@lanl.gov
N3Binterface@em-la.doe.gov



U.S. DEPARTMENT OF
ENERGY

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Received

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NMED Hazardous Waste Bureau

National Nuclear Security Administration

Los Alamos Field Office
3747 West Jemez Road, A316
Los Alamos, New Mexico 87544
(505) 667-5105/Fax (505) 667-5948

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ENCLOSURE 1

*Response to June 8, 2026 NMED Technical Comments on Part
B Permit Application for Renewal of the Los Alamos National
Laboratory Hazardous Waste Facility Permit, Revision 1.0*

Date: October 6, 2026

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October 2026

CERTIFICATION

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October 2026

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

STEVEN A.
COLEMAN
(Affiliate)

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A. COLEMAN (Affiliate)
Date: 2026.10.06 09:08:27
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10/6/2026

Steven A. Coleman

Associate Laboratory Director
Environment, Safety, Health, and Quality
Triad National Security, LLC
Operator

Date Signed

PATRICK
MOSS

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Date: 2026.10.06
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10/6/2026

Michael Mikolanis

Manager
National Nuclear Security Administration
Los Alamos Field Office
U.S. Department of Energy
Owner/Operator

Date Signed

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October 2026

Certification

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**BRADLEY
SMITH (Affiliate)**

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BRADLEY SMITH (Affiliate)
Date: 2026.09.28 10:48:52
-06'00'

9/28/2026

Bradley A. Smith
President
Newport News Nuclear BWXT-Los Alamos, LLC
Operator

Date Signed

**STANLEY
PYRAM**

Digitally signed by
STANLEY PYRAM
Date: 2026.10.05
13:11:49 -06'00'

10/5/26

Stanley C. Pyram
Acting Manager
Environmental Management
Los Alamos Field Office
U.S. Department of Energy
Owner/Operator

Date Signed

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Response to June 8, 2026 NMED Technical Comments on Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 1.0

Introduction

This document represents comments from the New Mexico Environment Department (NMED) received on June 8, 2026, and responses from the U.S. Department of Energy (DOE) and its field offices, the National Nuclear Security Administration, Los Alamos Field Office (NA-LA) and the Environmental Management, Los Alamos Field Office (EM-LA), together with Triad National Security, LLC (Triad) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B). These four parties are collectively the Permittees of the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit (Permit), EPA ID # NM0890010515. The comments and responses included in this document provide answers and responses to technical comments by NMED on the revised Permit Renewal Application submitted on July 11, 2025. On September 30, 2025, NMED issued an Administrative Complete decision on the Revised Permit Application. On December 11, 2025, Permittees paid the fee in full to NMED and NMED began its technical review. Comments were discussed between NMED and the Permittees on May 14, 2026, and formal comments were received by the Permittees on June 8, 2026. The Permittees and NMED held a meeting on September 3, 2026, to discuss the Permittees' responses to NMED's comments provided clarity for the responses included herein. The information provided in this document is intended to respond to NMED comments and communicate where requested information can be found in the Permit Renewal Application. *Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 2.0*, Volumes 1, 2, and 3 (Permit Renewal Application), will be submitted to NMED following this response document, as compilation of the document is completed, reviewed, and certified. It will be inclusive of all changes discussed herein as well as other updates needed due to time passing. Conversations during the September 30th meeting, and staff changeover among the Permittees, necessitate additional time to put together the Permit Renewal Application.

This response document outlines where changes to the application have been made and provides those specific changes as addendums to this response document. A separate enclosure (Enclosure 2), included under the same transmittal letter, consists of information provided in a separate envelope marked Unclassified Controlled Nuclear Information (UCNI) as defined by the Atomic Energy Act, Section 148 and 10 CFR §1017 that is not for public dissemination. It contains both information determined to be UCNI as well as other controlled unclassified information (CUI).

Enclosure 1 of this submittal includes the responses here and ten addendums with information that is directly relevant to the responses as well as appropriate revisions to the application. They are:

- Addendum 1: Revisions to Supplement 1-1, Permittees' Proposed Changes to Permit Parts 1-11
- Addendum 2: Revisions to the Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 1.0
- Addendum 3: Procedures and guidance documents for high volume air sampling



- Addendum 4: Revisions to Supplement 4-1, Assessment of Alternatives for Open Detonation and Open Burning Activities
- Addendum 5: Ash and sand waste analytical data from 2021, 2022, and 2026
- Addendum 6: Revisions to Supplement 4-2, Open Detonation Unit Groundwater Monitoring and Surface Drainage Information
- Addendum 7: Revisions to Appendix 1, Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit
- Addendum 8: Revisions to Supplement 1-2, Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions
- Addendum 9: Revisions to Supplement 1-4, Permittees' Proposed Changes to Attachment D, Contingency Plan
- Addendum 10: Revisions to Supplement 3-1, Permittees' Proposed Changes to Attachments G.1 through G.31, Closure Plans
- Addendum 11: Revisions to Supplement 1-7, Permittees' Proposed Changes to Attachment J, Hazardous Waste Management Units

Responses included in this document follow general central concepts that the Permittees have determined are important to highlight in support of Permit renewal. These central concepts are provided below.

Many of the comments received from NMED include language similar to that set forth within the agency-initiated permit modification to the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit published in April 2026. That permit modification is subject to an ongoing permitting process, and a final resolution or outcome of the contested permitting process has not yet been determined. Any changes proposed to the Permit associated with this agency-initiated permit modification to the WIPP Hazardous Waste Facility Permit by NMED are not incorporated into the Permit Renewal Application and are not addressed in response.

In its comments, NMED cites a U.S. Environmental Protection Agency (EPA) policy memo published in 2022 that reflected draft guidance for management and operation of open burning and open detonation thermal treatment units. Proposed revisions to the permitting rules for open burning and open detonation units have not been finalized by the EPA and the final rule will be dependent upon EPA's response to comments to the proposed rules. The Permittees feel that it is inappropriate to add permit conditions that are not based upon a finalized EPA rule for operation and management of thermal treatment units. It should be noted that since publication of draft EPA guidance in 2003, the Permittees had largely implemented the guidance provided in EPA's 2022 policy memo.

The Permittees also contend that NMED's comments regarding per- or polyfluoroalkyl substances (PFAS) are not necessary because proposed federal rules have not been finalized and rules that have been passed state-wide are incorporated by reference within the Permit.

Finally, the Permittees are also opposed to NMED comments that impose unique permit conditions to the Permit that are inconsistent with implementation at other New Mexico permitted facilities and have not been through the public comment and regulation development process. While the operations at LANL are unique, the application of hazardous waste requirements should not be different from other facilities if



they are not determined to be inconsistent with specific requirements of the Atomic Energy Act (42 U.S. Code § 6905).

NMED General Comments

1. Net Total Explosive Waste (NEW) Treated

NMED Comment: On June 7, 2022, the EPA published a policy memo Open Burning and Open Detonation (OB/OD) of Waste Explosives Under the Resource Conservation and Recovery Act (RCRA) (EPA 2022 Memo) that "Require detailed waste characterization for each waste stream proposed for OB/OD, that (1) confirms the waste has potential to detonate and is characteristic for reactivity/explosivity (D003); (2) ensures potential contaminants of concern are identified, and (3) enables an evaluation of safe alternative technologies. Such characterization would generally include: a description and amount of each waste; chemical composition, including additives; all applicable hazardous waste codes; net explosive weight (NEW); U.S. Department of Transportation (DOT) hazard class; etc. Such characterization may be based on process knowledge and, where needed, chemical and physical testing results."

In Tables 5-1 and 5-2 in Volume 2 and Supplement 4-1, it is unclear when the Permittees started collecting NEW measurements. The Permittees must revise the Permit Application to include a process to weigh the amounts of explosive wastes treated and modify the Table 5-1 and 5-2 to indicate which values are estimated and which values are exact NEW measurements. The Permittees must also ensure that the waste profile form includes the NEW measurements, and the hazardous waste numbers and DOT hazard classification codes as described in the EPA 2022 Memo. (40 CFR 270.41(a)(2)).

Permittee Response: The waste characterization techniques employed by the Permittees provide quality information necessary to meet the suggested requirements for data outlined in the Environmental Protection Agency's (EPA's) 2022 memo. Each of the waste stream profiles includes a determination that the waste stream is 1) detonable, 2) outlines the chemical constituents within the waste streams as appropriate to determine the hazardous waste status of the waste stream, and 3) provides the information necessary to include the waste stream within the overall assessment parameters of available treatment technologies. Waste stream profiles generated at the facility for explosives and explosives-contaminated waste streams are information provided by individual generating groups or organizations for specific operations across explosives testing, manufacturing, research and development, and decommissioning operations within overarching explosives operations at LANL. These individual waste stream profiles are then binned to form the waste streams represented in the proposed changes to Permit Attachment C, *Waste Analysis Plan* and included within the assessment of alternative technologies included as Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*, of the Permit Renewal Application.



The EPA 2022 Memo provides guidance for the development of an Alternative Technology Evaluation. As this document is a policy memo reflecting guidance from EPA, it lacks full force of law and any reference to a “requirement” under this memo is without legal merit. The Permittees voluntarily submitted alternative evaluations to NMED in previous permit applications. The robust and complete discussions of explosive and explosive-contaminated waste streams treated at LANL are included within the Permit Renewal Application Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*. Additionally, estimated emissions associated with these waste streams (i.e., discussions of the chemical make-up of these waste streams) are included within the Permit Renewal Application Supplement 4-3, *Hybrid Air Modeling Analysis and Ecological and Health Risk Assessment for Open Burning and Open Detonation Operations at Los Alamos National Laboratory*.

NMED’s request to “ensure that the waste profile form includes the NEW measurements, and the hazardous waste numbers and DOT hazard classification codes,” is not applicable at the waste stream profile level and, in many cases, not possible because of the nature of the treated waste streams. While all waste profile forms include all applicable EPA hazardous waste numbers, in most cases the NEW of explosives within each of the waste streams and for each treatment event must be estimated. There is no method to safely measure the exact quantity of explosives contamination on (1) combustible debris or (2) noncombustible debris. This inability to safely quantify the actual amount of explosives is a significant contributing factor to the need to treat onsite. In treatment of these debris waste streams, the quantity of explosives is estimated to be less than one pound. In the case of combustible debris and sand treatment events, the full weight of the waste being treated is tracked as the total treatment weight of the event. When noncombustible parts and equipment are treated, only one pound of explosive is considered the treatment quantity, because the treatment process does not destroy the metal components. Recently, the Permittees have begun recording both NEW and total weight for a third waste stream, explosives machining waste. The ability to better track both quantities for this waste stream is allowed by the ability to track weight of the component manufactured subtracted from the starting weight of explosive. The total weight of the waste treated at the Flash Pad will include both the discarded explosive weight as well as the weight of remaining contents of the waste (water, filtration material, etc.). This tracking is possible because this waste can be reliably and safely tracked during the part manufacturing process. The three waste streams discussed here are the most treated waste streams at the TA-16 Flash Pad. A similar process will be utilized for open detonation treatment events in the future.

DOT hazard classification codes are not identified at the waste profile level because that documentation includes waste characterization for a whole waste stream, which may include varied constituents. In general, DOT requirements are identified and implemented with waste containers as they are moved through the waste disposition process for shipment offsite. Waste profiles themselves do not carry DOT hazard classification codes as they are not shipped individually, but rather by shipment container. Waste treated onsite at the LANL thermal treatment units is not placed on public roads; therefore, DOT hazard classifications are not applicable.

There is also concern associated with the release of protected data within the NMED proposed requirements as it relates to providing details on waste characterization as well as the design, testing, and overall development of an alternative treatment technology specific to the needs of LANL explosives treatment. The Permittees assert as governed by the Atomic Energy Act and its implementing regulations,



detailed information relating to explosive research and development is limited to a need-to-know basis for qualified individuals. This protection ensures that sensitive information, including information about critical weapons components, is only shared with those who genuinely need it for their work. NMED's proposed documentation additions require disclosure of this same information, including precise compositions and chemical makeup and disclosure of all test methods, test results, and documentation for each waste stream. This information is not necessary to regulate the waste streams treated under RCRA through OB and OD at LANL.

2. Open Burn/Open Detonation (OB/OD) Risk

NMED Comment: NMED notes that soil samples have not been collected since 2018, and based on the information provided in Supplement 4-1, Table 5-1 that additional treatment activities have occurred at the Flash Pad (16-399) between 2018 and 2023. Additional soil samples must be collected from the flash pad and any OD units that have treated waste since the most recent soil sampling was conducted in 2018. The Permittees must commit to collecting soils samples from the OB and OD units within one calendar year of the Permit being approved and evaluate for risk to human health and environment.

Permittee Response: The Permittees commit to collecting soil samples at all three thermal treatment units that have been used for waste treatment since 2018 within one calendar year of Permit issuance. Constituents analyzed for each unit will be based on past concentration findings, and resulting analytical data will then be used to assess risk to human health and the environment associated with operations of each of the units. The Permittees' application has been revised to align both proposed Permit Sections 5.5.1 and 6.6.1, *Soil Monitoring Requirements*, to be consistent and reflect soil sample collection within the first year of permit issuance and propose a regular monitoring schedule thereafter. Changes have been made within Permit Renewal Application Supplement 1-1, *Permittees' Proposed Changes to Permit Parts 1-11*, included as Addendum 1 of this response. The Permittees determined that there are no necessary changes to Permit Renewal Application Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, to address this comment.

3. Per- and Poly-Fluorinated Alkyl Substances (PFAS)

NMED Comment: NMED notes that House Bill 140, which became effective June 20, 2025, amended the definition of hazardous waste in the New Mexico Hazardous Waste Act (HWA) to include per- or polyfluoroalkyl substances (PFAS). Sampling must be conducted at sites that may have used fire suppression foam containing perfluoroalkyl compounds (PFAS). The 2022 NMED Soil Screening Guidance (SSG) provides guidance to the Permittees on the screening levels associated with PFAS for the Permittees to be able to comply with House Bill 140 when evaluating hazardous waste on site.

As such, the Permittees must modify the Permit Application to include the definitions on PFAS and emerging contaminants of concern (on a later page) to be consistent with the new definition and other Hazardous Waste Permits.



The Permittees must evaluate documentation of use and include PFAS sampling where applicable into Permit Parts 1-11 and Attachment G Closure Plans. (40 CFR 270.41(a)(3))

Permittee Response: New Mexico House Bill (HB) 140 authorizes the New Mexico Environmental Improvement Board (EIB) to adopt rules for discarded aqueous film-forming foam (AFFF) containing intentionally added per- and poly-fluoroalkyl substances (PFAS) as hazardous waste. At this time, amended rules have not been codified into 20.4.1 of the New Mexico Administrative Code (NMAC). NMED petitioned the EIB to amend 20.4.1 NMAC on December 22, 2025, to adopt the requirements of HB 140. A public hearing on the proposed amendments to 20.4.1 NMAC was subsequently held on April 13, 2026. When these proposed amendments are adopted into 20.4.1 NMAC, they will be incorporated, as appropriate, into the requirements of the permit for reasons described in subsequent responses. The Permittees have determined that modifications to the Permit Renewal Application within the proposed changes to Permit Parts 1-11 and the Attachment G Closure Plans are not required. Further discussion is provided within response to Comment #s 14, 15, 23, 24, 25, 26, 27, and 28 below.

4. Legacy Waste

NMED Comment: The Permittees must define Legacy Waste and must provide a report to NMED on the total volume of hazardous legacy waste and mixed hazardous legacy waste in both cubic meters and pounds in addition to the biennial report and the Site Treatment Plan to ensure that legacy waste from LANL can be prioritized for shipment to WIPP. The report must describe actual volumes and pounds currently in storage based on the units listed in Attachment J-1, and include a table that provides detailed transuranic (TRU) waste volumes and a breakdown of remaining volumes for waste stored above ground and waste stored below ground. The table must have a column which identifies the material disposal area (MDA), pit, or general storage location each waste stream is located in, waste volume in cubic meters and pounds, and be updated annually on March 31 to reflect current data from the Annual Transuranic Waste Inventory Report. (40 CFR 270.41(a)(2) and 40 CFR 270.32(b)(2)).

Permittee Response: This NMED comment includes language similar to that set forth within the agency-initiated permit modification to the WIPP Hazardous Waste Facility Permit published in April 2026. That permit modification is subject to an ongoing permitting process, and a final resolution or outcome of the contested permitting process has not yet been determined. Changes proposed associated with this agency-initiated permit modification are not incorporated into the Permittees' Permit Renewal Application.

5. Public Notices

NMED Comment: While NMED understands the Permittees' position that there have not been spills or releases and the Permittees' assertion that the operations achieve complete combustion, but without site specific air monitoring, or post treatment sampling, these claims have not been demonstrated.



The Permittees cite that open burn and open detonation fall under "insignificant activities" under their Title V permit and NMAC 20.2.70.300(D)(6) with the NMED Air Quality Bureau. However, only open detonation activities are listed on Table 1.6-1 in the Title V permit for insignificant activities. Table 1.6-1 for open detonation units states that they are subject to Subpart X under RCRA. Open burn for hazardous waste is covered under NMAC 20.2.60.113, which states that it is subject to the New Mexico Hazardous Waste Act. The assertion that Title V provides coverage for these units, does not appear to be supported as RCRA regulations are cited for open burn and open detonation.

As previously discussed in NMED's administratively complete comments 2021-2025, the Permittees must revise Permit Attachment D, Section 3.2 to indicate how spills or off-site contamination from OB/OD operations will be monitored and reported to NMED and communicated to the public to prevent harm to human health or the environment as required by 40 CFR 270.32(b). Additionally, the definition for "insignificant activities" is contingent on the measured tons of emissions per year (TPY), so the Permittees must provide the emissions for the open burn and open detonations units in TPY in the revised permit application and must propose air monitoring that is specific to the units with the results provided in an annual report due to NMED every year on December 1.

Permittee Response: The Permittees agree with NMED that the air quality rules do not apply to the activities described in the Subpart X permit application. The Permittees do not track or account for any hazardous waste related to OB/OD in the Title V air permit. The final paragraph within Permit Renewal Application Section 2.7.6 has been removed. The revised Permit Renewal Application text is included within Addendum 2 of this response document.

While the Permittees incorrectly cited that thermal treatment activities fall under “insignificant activities,” the Permittees have also provided NMED with information on estimated emissions from each of the units in Supplement 4-3, *Hybrid Air Modeling Analysis and Ecological and Health Risk Assessment for Open Burning and Open Detonation Operations at Los Alamos National Laboratory*, within the Permit Renewal Application. From the supplement:

“AERMOD predicted that the CO, SO₂, Lead, annual PM_{2.5}, and annual NO₂ emissions result in insignificant impacts to the ambient air and did not require further analysis. The emissions of regulated pollutants 1-hour NO₂, 24-hour PM₁₀, and 24-hour PM_{2.5} resulted in significant impacts (exceedance of a SIL) for ambient air, and each pollutant required a cumulative impact determination. AERMOD analysis used an extensive receptor grid extending beyond 10 kilometers from the LANL property boundary, together with property boundary receptors, as well as receptors at public locations within the LANL boundary. The cumulative impacts for gaseous pollutants 1-hour NO₂, 24-hour PM₁₀, and 24-hour PM_{2.5} were determined by adding the NMED-recommended ambient monitor background to the ambient impact of each pollutant for each OB/OD site. The cumulative ambient impact for particulate emissions was determined by modeling all nearby permitted sources and combining this result with the maximum AERMOD OB and OD modeling results where a unitized emission rate was used. These were combined with



the recommended ambient monitor background to the model predicted ambient impact. PM_{2.5} also included an estimate of secondary emissions calculated based on NMED modeling guidance (NMED 2022).

Again, the dispersion model results predict that the OB and OD emissions of Pb, CO, NO₂, SO₂, PM₁₀ and PM_{2.5} comply with the air quality standards and do not cause or contribute to exceedance of the NAAQS or NMAAQs. Additionally, this study demonstrates that the cumulative impacts, when surrounding source emissions, background pollutant concentrations, and secondary formation for PM_{2.5} are included, do not cause or contribute to exceedance of NAAQS and NMAAQs.”

Monitoring technology for air emissions at the units is being explored but is still being researched. If implementation of any routine unit-specific air monitoring is determined to be effective or if one-off ambient air measurement opportunities are presented, the Permittees will communicate with NMED as it is planned, tested, and implemented. At this time, there is no benefit in the installation of additional Airnet stations to monitor ambient air specifically surrounding the units. Particulate monitoring is not an effective method of monitoring the operations at the LANL thermal treatment units, as it measures for only particulate size and metals, which are not the contaminants of concern.

The Permittees also previously proposed a section within Permit Attachment D, *Contingency Plan*, Section D.4.1.4. to include notification to the Department for unexpected events. This notification would also trigger a 5-day reporting requirement to NMED that would be posted to the LANL Information Repository and would trigger an email notification per Permit Section 1.13, *Public Notification Via Electronic Mail (E-Mail)*. These notifications/communications are the current established mechanisms within the Permit to NMED and the public. They sufficiently capture the most direct and effective communication practices while ensuring prompt response. It provides time to ensure that technically factual information is gathered and validated prior to notifications and that communications are conducted in that order of priority. It should be noted that Attachment Section D.4.1.4 would require the implementation of Permit Section 1.9.12, *24 Hour and Subsequent Reporting*, and that any spill or release from these treatment units would be applicable under this reporting requirement.

Specific Open Burn/Open Detonation Comments

6. Alternative Technology Evaluation

NMED Comment: Supplements 4-4 and 4-12 show results from air sampling at the open detonation units and the open burning treatment unit. NMED requests the Permittees to include the standard operating procedures (SOPs) used in the 2011 and 2022 air monitoring events for the open burn and open detonation units to review.

Permittee Response: The procedure used for high volume air sampler deployment and collection is included within Addendum 3 of this response document. It is updated from the 2011 and 2022 air monitoring events but is the same as the procedure utilized for those sampling events. For the samplers deployed to collect dioxin/furan analysis, the Compendium Method TO-9A guidance document and the

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Operations Manual for TE-1000 PUF Poly-Urethane Foam High Volume Air Sampler were utilized (also included within Addendum 3). There was no specific procedure drafted for these sample collection events.

7. Supplement 4-1, Executive Summary, page vii

NMED Comment: NMED does not concur with the Permittees' footnote number 1 in the Executive Summary for the flash pad (TA-16-388 unit) since it meets the existing definition of open burning in accordance with 40 CFR 260.10. The Permittees must remove the footnote as the Permittees are applying to permit it as an open burn unit.

Permittee Response: The footnote has not been removed but revised to reflect that while the thermal treatment units at LANL technically meet the definition of OB or OD, the treatment units feature safety and monitoring features that are an alternative to traditional OB and OD units of the past and include improvements to the older uncontrolled thermal treatment processes. Text revisions of Permit Renewal Application Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*, are included herein as Addendum 4.

8. Supplement 4-1, Data Sheets 7-1, Existing Treatment Technology: Flash Pad, page 25

Permittees' Statement: "Residual ash is contained within the lined burn area, collected, and analyzed for hazardous constituents; generally disposed as non-hazardous. Secondary thermal treatment provided, if necessary."

NMED Comment: The Permittees must include sampling data from ash residuals and expand on this statement for combustible debris and other wastes that contain polymer-bonded explosives (PBX), barium, and/or lead under open burn conditions.

Permittee Response: Analytical data from 2021, 2022, and 2026 for ash and sand waste generated at the TA-16 Flash Pad is included in Addendum 5.

9. Supplement 4-1, Section 1, Introduction, page 3

NMED Comment: While NMED agrees the consideration of toxic by-products is an important consideration, it should not automatically disqualify a technology if the emissions and effluents can be captured and treated to meet applicable standards. Also, in regard to monitorability as a factor for alternative technologies, the flash operations could be argued as not monitorable as there is no in-plume sampling during operations providing data by which limits are set and compliance is determined. The Permittees must revise the introduction, and applicable tables to provide additional information about capture and treatment of by-products and monitorability.

Permittee Response: There are no specific requirements for units permitted under 40 CFR Subpart X to directly monitor, capture, and treat by-products from a miscellaneous treatment unit. Also, alternative technologies that could capture and treat emissions and effluents were assessed within Permit Renewal



Application Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*. Assessment of alternatives at LANL followed a general hierarchy to include 1) pollution prevention and waste minimization activity identification, 2) review of waste streams to identify candidates for offsite treatment, and 3) evaluation of onsite treatment technologies that can safely and effectively treat LANL waste streams. For the third item, the Permittees followed a methodical approach and no technologies were disqualified by any single particular factor. These evaluations included an assessment of each available technology for the following considerations:

- waste stream treatment capability,
- principal capabilities and treatment limitations,
- permits required for the technology,
- safety risk considerations,
- human health and environmental impact considerations,
- energy resource demands of onsite operation,
- secondary waste streams generated,
- identification of uncertainties by operation, and
- the relative cost range associated with the technology.

The current primary potential for impact from the operating LANL thermal treatment units is deposition of by-products on to the soil surface from the air. Emissions to the air from each unit are evaluated within Permit Renewal Application Supplement 4-3, *Hybrid Air Modeling Analysis and Ecological and Health Risk Assessment for Open Burning and Open Detonation Operations at Los Alamos National Laboratory*. Conclusions of the evaluations indicate deposition would occur close to the units or be dispersed very quickly within the atmosphere and would not pose threat to receptors within the area, as the area is kept clear for the duration of the treatment event as well as a time after each treatment. Potential impact from by-products or deposition of emissions and dispersion products has been monitored and is proposed to be monitored by permit conditions to conduct regular soil sampling and risk evaluations associated with thermal treatment operations. Capture and treatment of by-products would require an enclosed containment or vessel, the use of which is infeasible at this time as detailed in the Alternatives Assessment (Supplement 4-1). As such, no revisions have been made to Supplement 4-1 associated with this comment.

10. Supplement 4-1, Section 9, Conclusions, pages 74-75

Permittees' Statement: "Therefore, any treatment technology that requires additional onsite storage and handling is necessarily unsafe because it introduces significant and unnecessary additional health and safety risks to workers, the public, facilities, and the environment."

NMED Comment: While NMED agrees increased handling may cause an increased safety risk, it is not clear how this risk differs compared to moving sensitive high explosive (HE) materials into an open burn unit. If additional storage is required by the alternative technology, then the technology's capacity was not designed to address the volume of waste it is meant to treat and should be re-designed to fit the needs of the facility.



Alternative treatment technologies and mobile treatment units can be scaled up based on the estimated size of the material or reactivity as described in the EPA's Compendium of Potential Alternative Technologies to Open Burning and Open Detonation of Hazardous Waste Explosives, as referenced by EPA 530-R25-002, dated January 3, 2025 and *Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic Hazardous Wastes, as referenced EA 530-R-19-007 and dated December 2019, Final*. The Permittees must either revise this statement since it is not supported, or the Permittees must provide documentation from manufacturers that the equipment cannot be scaled up to meet size or reactivity of LANL's waste stream.

Permittee Response: The quoted text from the conclusion of Permit Renewal Application Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*, is a summation of voluminous information. Treatment technologies that require additional onsite storage and handling are generally more unsafe than current practices because they introduce significant and unnecessary additional steps in the treatment process. Lessons learned from previous, historic waste handling incidents have been implemented at LANL to reduce the potential for accidents related to handling explosives. Increased waste handling by workers would be necessary for any enclosed treatment unit. When dealing with waste from explosives processing, the waste has indeterminate properties that are not fully identified because the explosive has been insulted. In these instances, a contained burn introduces an unknown and unacceptable risk to personnel due to unquantifiable physical hazards like pressure and heat. Other treatment technologies necessitate size reduction to enable treatment in quantities dictated by the size of the chamber or transportation container. This additional handling for size reduction may result in dangerous friction potential. Controlled flame in an unenclosed environment or controlled detonation are proven technologies for the safe treatment of explosives and explosives-contaminated wastes. These activities ensure complete detonation or burn destruction of the explosive components and can be monitored via camera or other method from a distance. In enclosed units, the inability to visually verify if the explosive has been fully treated prior to opening the chamber to the treatment unit presents an additional safety issue. Confinement of explosives within an enclosed treatment unit could additionally lead to a build-up of residual material from breakdown products within the unit — a potential explosion hazard. This hazard is not theoretical, and removal of explosive residue has, in history, led to a fatal accident at LANL. With respect to scaling, the Permittees must be able to treat waste items that are large, such as a machining press or a lathe; wastes that contain wetted explosives that have been through a machined cutting process; and material that is general research and development or preparation room debris. This waste can contain, to some degree, various sizes of ceramics, bags, fiber cloth, wrapping, and tubing; weigh boats; latex or nitrile gloves; glass or plastic vials; cardboard and paper; fiberboard containers; paper cleaning wipes, rags, and swabs; as well as plastic pieces. The overall quantity of thermally treated waste is small and varied, indicating that scalability for one waste stream is not applicable to the next waste stream. Lastly, safety and technical decision-making should rely on the knowledge of qualified explosives experts, rather than on manufacturers' scaling abilities.

Specific Comments on the Permit Application

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11. Section 4.18.2.1 (PDF 146)

Permittees' Statement: "The current LANL Storm Water Individual Permit expired on March 31, 2014, but it has been administratively continued, pending issuance of a new permit. The EPA issued LANL a draft Storm Water Individual Permit on November 30, 2019. A final Permit is expected following a public comment period, which ends on July 31, 2020."

NMED Comment: The Permittees must revise the information for the Storm Water Individual Permit to ensure that it is up to date.

Permittee Response: The Permittees have revised the information in Permit Renewal Application Section 4.18.2.1 to include the current status of the LANL Storm Water Individual Permit. The revised Permit Renewal Application text is included within Addendum 2 of this response document. Updates to the groundwater and storm water portions of the Permit Renewal Application are included in the following sections.

- Section 4.18.1.1, *Hydrogeology*
- Section 4.18.1.1.1, *Hydrogeology near and beneath the TA-36-8 Open Detonation Unit*
- 4.18.1.1.2, *Hydrogeology near and beneath the TA-39-6 Open Detonation Unit*
- 4.18.1.2, *Groundwater Monitoring and Reporting*
- 4.18.2.1, *Surface Water*
- 4.18.2.1.1, *Hydrologic Assessment and Surface Water Flow*
- 4.18.2.1.2, *Monitoring and Reporting*
- 5.16.1.2, *Existing Quality of Groundwater*
- 5.16.1.5, *Groundwater Monitoring and Reporting*
- 5.16.2.1, *Hydrologic Assessment and Surface Water Flow*

12. Volume 2, Supplemental 4-1, Table 5-1, *Annual Amount of Explosives Waste Treated at the Flash Pad from 2013-2023, by Waste Stream in Pounds (lbs.)*, page 14

NMED Comment: The Permittees must revise to provide Net Weight Explosive calculation in pounds.

Permittee Response: Table 5-1 within Permit Renewal Application Supplement 4-1, *Assessment of Alternatives for Open Detonation and Open Burning Activities*, has been revised to include an additional column for estimated explosives quantity per year. This table revision is included herein within Addendum 4. The narrative explaining how these estimations are conducted can be found in the Permittees' response to NMED Comment #1.

13. Supplement 4-2

NMED Comment: The Permittees' state in Section 4.18.2.2 of the permit application that copper and PCBs had exceedances for target action levels in stormwater, but that data is not found in Supplement 4-2. The Permittees must include the data with Supplement 4-2.

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Permittee Response: The Permittees have added a table within Permit Renewal Application Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*, included herein as Addendum 6.

Specific Comments on LANL Permit

Permit Parts 1-11

14. Permit Part 1.8, Definitions

NMED Comment: The Permittees must revise the definition section to include the following terms and references (not listed here in alphabetical order):

Contaminant means any substance in environmental media that is not otherwise a "hazardous waste" or a "hazardous constituent," for which investigation or cleanup is required under this Permit because it:

- 1) Exceeds a state or federal numeric standard (e.g., 20.6.2.3103 NMAC, MCLs at 40 CFR parts 141 and 143), or
- 2) Is identified by NMED under 40 CFR 264.1 (b)(2) as posing a threat to human health or the environment

Examples include, but are not limited to:

- a) Perchlorate, which is regulated by WQCC groundwater standards, but is not a hazardous waste or hazardous constituent; and,
- b) total petroleum hydrocarbons, which is addressed in NMED Risk Assessment Guidance, but is not a listed hazardous constituent

Emerging Contaminant means any substance, chemical, or compound that is not currently listed as a hazardous waste or constituent under 40 CFR Part 261 or 264 but is identified by EPA, NMED, or other authoritative source as posing a potential risk to human health or the environment. This includes substances for which regulatory standards or guidance are under development or anticipated, and for which corrective action may be required under this Permit.

Examples include, but are not limited to:

- Per- and polyfluoroalkyl substances (PFAS) not yet listed under the New Mexico Hazardous Waste Act or RCRA;
- Novel industrial chemicals;
- Pharmaceuticals and personal care products;
- Other contaminants identified through scientific research or regulatory action.
- Hazardous Waste, for the purposes of corrective action for solid waste management units and areas of concern conducted pursuant to 74-4-4.2(B) of the HWA, 40 CFR Part 264, Subpart F, or 40 CFR 270.32(b)(2), means a hazardous waste as defined in 74-4-3(K) of the HWA. Hazardous waste, for the purposes of corrective action, includes, without



limitation, any hazardous waste as defined in 40 CFR 261.3, any groundwater contaminant listed in the WQCC Regulations in 20.6.2.3103 NMAC, any toxic pollutant listed in 20.6.2.7.T(2) NMAC, and any substance identified as a hazardous constituent or as a contaminant under Section 1.12 of this Permit for corrective action purposes, or for which the EPA has promulgated a maximum contaminant level (MCL) at 40 CFR parts 141 and 143, perchlorate, total petroleum hydrocarbons, methyl tertiary butyl ether, polychlorinated biphenyls (PCBs), dioxins, furans, per- and polyfluoroalkyl substances (PFAS), rocket fuel constituents, waste military munitions, and munitions constituents as defined in 10 U.S.C. 2710(e)(3). Pursuant to 74-4-3(K)(2)(a), hazardous waste includes discarded aqueous film-forming foam containing intentionally added PFAS.

- This definition is consistent with EPA's February 8, 2024 proposed rule clarifying that the statutory definition of hazardous waste applies to corrective action for releases from solid waste management units (SWMUs), and with the RCRA Omnibus provision at 40 CFR 264.1(b)(2), which authorizes regulatory agencies to require corrective action for any substance that may pose a threat to human health or the environment.
- References
- U.S. EPA. Hazardous Waste Definition Applicable to Corrective Action for Solid Waste Management Units (SWMUs), Proposed Rule, 89 FR 8520 (Feb. 8, 2024)
- U.S. EPA. Listing of Nine Per- and Polyfluoroalkyl Substances (PFAS) as RCRA Hazardous Constituents, Proposed Rule, 89 FR 8606 (Feb 8, 2024)
- 40 CFR § 264.1(b)(2) RCRA Omnibus Provision.

Per- and Polyfluoroalkyl substances (PFAS) are large class of synthetic organic chemicals characterized by the presence of one or more fully fluorinated carbon atoms (e.g., -CF₃, -CF₂- groups). The carbon-fluorine bond is among the strongest in organic chemistry, resulting in extreme resistance to heat, chemical degradation, and environmental breakdown. PFAS vary widely in structure and function and have been used in numerous industrial, commercial, and firefighting applications.

PFAS includes both:

- perfluoroalkyl substances in which all hydrogens on the carbon chain are replaced with fluorine (fully fluorinated), and
- polyfluoroalkyl substances in which only some hydrogens are replaced with fluorine (partially fluorinated).

PFAS are commonly categorized by carbon-chain length:

- Long-chain PFAS include perfluorocarboxylic acids (PFCAs) with eight or more carbons (e.g., PFOA) and perfluorosulfonic acids (PFSAs) with six or more carbons (e.g. PFOS). These compounds are known to bioaccumulate and persist in humans and the environment.



- Short-chain PFAS include PFCAs with seven or fewer carbons and PFSAAs with five or fewer carbons. These compounds are less bioaccumulative but remain highly persistent and mobile in the environment.

PFAS also include precursor compounds, which contain partially fluorinated carbon chains and can transform into terminal PFAS -such as PFOA, PFOS, PFHxA, and related perfluoroalkyl acids (PFAAs) through environmental or biological processes. PFAAs are the terminal degradation products of many PFAS and include two major families:

- Perfluorocarboxylic acids (PFCAs)
- Perfluorosulfonic acids (PFSAs)

PFAS precursors are a significant component of many PFAS-related formulations, including fluorotelomer-based Aqueous Film Forming Foam AFFF. As a result, both terminal PFAS and PFAS precursors contribute to long-term environmental PFAS loading and are considered PFAS for the purposes of this Permit.

(PFAS definitions and precursor behavior derived from Interstate Technology & Regulatory Council (ITRC). PFAS Technical and Regulatory Guidance Document (PFAS-1). Updated January 2026. <https://itrcweb.org> PFAS)

- PFAS-Containing Class B Foams mean synthetic firefighting foams used to suppress flammable liquid fires. These include various formulations that contain PFAS such as AFFF, AR-AFFF, FFFP, AR-FFFP, FP, and AR-FP (defined below). All are considered fluorinated foams and may pose environmental and health risks due to PFAS persistence and mobility.
- Aqueous Film-Forming Foam (AFFF) means a fluorinated foam that contains per- and polyfluoroalkyl substances (PFAS). AFFF is a firefighting product intended for fighting high-hazard flammable liquid fires. AFFF products are synthesized by combining hydrocarbon foaming agents with fluorinated surfactants. There are three types of AFFF: Legacy PFOS AFFF (manufactured in the US from the late 1960s through 2002) Legacy fluorotelomer AFFF, which contains some long-chain PFAS (manufactured in the US from the 1970s until 2016) Modern fluorotelomer AFFF (short-chain PFAS became the predominant fluorochemicals used in manufacturing in response to USEPA 2010/2015 voluntary PFOA Stewardship Program)
- Film-Forming Fluoroprotein Foam (FFFP) is a synthetic firefighting foam that contains PFAS and combines protein-based components with fluorinated surfactants to form a film over flammable liquids. It was widely used prior to the adoption of AFFF and remains a concern in legacy contamination scenarios.
- Alcohol -Resistant Film-Forming Fluoroprotein Foam (AR-FFFP) is a variant of FFFP formulated to suppress fires involving polar solvents. It contains PFAS and includes



additional Polymers to resist alcohol breakdown while maintaining film-forming properties.

- Fluoroprotein Foam (FP) is a protein-based foam enhanced with fluorination surfactants to improve performance against hydrocarbon fires. Though it is less common today, it contains PFAS and may be present at legacy sites.
- Alcohol-Resistant Fluoroprotein Foam (AR-FP or FPAR) is a fluoroprotein foam modified to combat polar solvent fires. It contains PFAS and may appear in older inventories or historical use records.
- Alcohol-Resistant Aqueous Film-Forming Foam (AR-AFFF) is a formulation of AFFF designed to suppress fires involving polar solvents. It contains PFAS and includes polymers that enhance resistance to alcohol degradation.

(AFFF-specific information from ITRC. Aqueous Film-Forming Foam (AFFF) Fact Sheet. September 2023. <https://itrcweb.org> PFAS)

Severe Rusting is rusting on a container that may have an impact on the container integrity either due to the presence of pitting, corrosion, location on the seam, side, and/or base of the container, and/or any other rust that would cause the container to not meet DOT container shipment requirements.

Minor Rusting is any visible rust on container that is not severe.

Indoor Units means any building or structure that prevents containers from coming into contact from precipitation or wind events. Indoor unit should be able to maintain low moisture, e.g., less than 30% humidity, and free of holes/tears to the roof or walls.

Aisle Spacing means maintaining a minimum of two feet, to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the permitted units, and forklifts.

Legacy Waste "Legacy Waste" means transuranic or transuranic mixed waste generated prior to October 1, 1999, that is located above and/or below ground, and that excludes waste streams that contain a projected waste component.

Projected Waste is the part of the Annual Transuranic Waste Inventory Report (ATWIR) inventory that has not been generated (does not physically exist) but is estimated to be generated at some time in the future by the TRU waste generator/storage sites. TRU waste in projected waste streams includes waste from programs that have not come on-line as of the data cutoff date for the 2025 ATWIR report, as well as waste from ongoing projects and decontamination and decommissioning (D&D) waste that has not yet been packaged.

Permittee Response: The Permittees have determined that the addition of the following definitions to Permit Section 1.8, *Definitions*, to be inappropriate: “Contaminant,” “Emerging Contaminant” with added

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"Hazardous Waste" discussion, "Per- and Polyfluoroalkyl substances (PFAS)," "Severe Rusting," "Minor Rusting," "Indoor Units," "Aisle Spacing," "Legacy Waste" and "Projected Waste." The Permittees have not included these definitions within the proposed revisions to the Permit in the Permit Renewal Application for the following reasons:

- The definitions NMED provided are not useful in protecting the environment or providing for added human safety. Moreover, they appear to provide requirements that: (1) would be unique to the Permittees; (2) are not consistent with other facilities; and (3) have not been subject to public comment or promulgated in regulations. While operations at LANL are unique, hazardous waste requirements should not be different from other facilities.
- All the relevant references in the Permit to "contaminant" are already defined as specific to the treatment methodology prescribed, such as with macroencapsulation or as a "Hazardous Constituent or Hazardous Waste Constituent" as currently defined in Permit Section 1.8, *Definitions*. The Permittees and NMED carefully negotiated the definition of "Hazardous Constituent or Hazardous Waste Constituent" during the last permit renewal process to be specifically related to the closure and corrective action activities conducted at LANL and encompass any newly adopted regulatory requirements. The definition for "Hazardous Constituent or Hazardous Waste Constituent" was provided to be inclusive of 40 CFR Part 261 Appendix VII and VIII constituents as well as 40 CFR Part 264 Appendix IX for closure and corrective action at LANL. In fact, NMED has stated that the definition was designed to ensure "that 'hazardous waste constituents' in Appendix IX are included for purposes of monitoring and verification activities associated with closure, post-closure, and corrective action" (See Fact Sheet July 6, 2009, Intent to Issue a Hazardous Waste Facility Permit Under the New Mexico Hazardous Waste Act Los Alamos National Laboratory [LANL] Los Alamos County, New Mexico). RCRA does not define "Contaminant" but rather addressed it via the framework of hazardous constituents and hazardous waste characteristics. NMED's proposed definition confuses how "Contaminant" is addressed under RCRA and is outside NMED's regulatory scope. Furthermore, NMED provides no justification for the additional conflicting definitions presented in its disapproval letter, the definitions appear to be open-ended, and the Permittees cannot identify a need for these definitions that has not already been met by existing definitions in the Permit.
- During the issuance of the current Permit, the Permittees and NMED negotiated the definition for "Hazardous Waste" for purposes of corrective action that exists within Permit Section 1.8, *Definitions*. It incorporates reference to 74-4-3(K) of the HWA and all promulgated regulations by NMED (including any new requirements that are implemented in the future). While NMED states the proposed definition is "consistent with EPA's February 8, 2024, proposed rule clarifying that the statutory definition of hazardous waste applies to corrective action for releases from solid waste management units (SWMUs)," these rules were withdrawn by the EPA on May 8, 2026 (91 FR 25266).
- As noted in the response to NMED Comment #3, regulations regarding AFFF containing intentionally added PFAS have not been promulgated. Definitions in the Permit regarding



discarded AFFF and PFAS compounds potentially contained in discarded PFAS should either (1) are incorporated by reference under the definitions of “Hazardous Waste” and “Hazardous Constituent or Hazardous Waste Constituent”; or (2) mirror the applicable definitions from NMAC. Additionally, LANL is not a significant user or source of PFAS, and this language serves no purpose. Finally, incorporating full text definitions from regulations – once they have been promulgated – in the Permit is superfluous, as the Permit or regulations may be modified or amended, leading to potentially conflicting language.

- The definitions NMED provided for “Severe Rusting” and “Minor Rusting”: (1) are subjective; (2) do not clarify what each categorization looks like in practice; (3) are not defined in RCRA regulations (*see* 40 CFR § 260.10); and (4) are not defined in 20.4.1 NMAC. These definitions are inappropriate. In fact, when taken together, these definitions would describe almost all containers in storage that have been exposed to moisture. Further, the proposed language does not resolve the ambiguity in the regulation (40 CFR §261.171).
- While the Permittees agree that the structures included as part of Indoor Units and Outdoor Units should protect containers from precipitation and wind events, the definition NMED proposed for “Indoor Unit” is inconsistent with the existing conditions of the Permit. The definition for “Indoor Units” is (1) in Permit Section 9.1.2, *Indoor Units*; (2) applied in each of the closure plans in Permit Attachment G; and (3) included as descriptions within Permit Attachment J, Table J-1, *Active Portion of the Facility*. The Permittees also disagree that regulating the level of humidity within a structure is relevant to the apparent intent of NMED’s proposed definition of preventing containers’ contact with precipitation and wind events. The Permittees also offer that the Permit already requires the Permittees to: (1) remedy or mitigate any deterioration or malfunction of equipment or structures in Permit Section 2.6.2, *Repair of Equipment and Structures*; and (2) protect containers from contact with precipitation in Item (5) of Permit Section 3.5.1, *Storage Configuration and Minimum Aisle Space*.
- Aisle space is already defined in context in Permit Section 3.5.1, *Storage Configuration and Minimum Aisle Space*. This section of the Permit describes the purpose of required aisle space as well as the intent of the requirement: worker safety.
- NMED’s proposed definitions for “Legacy Waste” and “Projected Waste” include language similar to that set forth within the agency-initiated permit modification to the WIPP Hazardous Waste Facility Permit published in April 2026. That permit modification is subject to an ongoing permitting process, and a final resolution or outcome of the contested permitting process has not yet been determined. Changes proposed associated with this agency-initiated permit modification are not incorporated into the Permittees’ Permit Renewal Application.

15. Section 1.9.9.1, *Representative Sampling*

NMED Comment: The Permittees must add the following language to the Permit in regards to PFAS.

1.9.9.1 *Representative Sampling*



All samples and measurements taken by the Permittees under any condition in this Permit shall be representative of the medium, waste, or other material being sampled. To obtain a representative waste sample, the Permittees shall use an appropriate method from 40 CFR Part 261, Appendix I or an equivalent method approved by the Department. Laboratory methods must be those specified in the most current edition of Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), or an equivalent method, as specified in Attachment C (Waste Analysis Plan) and Permit Section 2.4.

The most current EPA-validated methods for PFAS shall be used for sampling and analysis of the applicable environmental media. Where EPA has validated matrix-specific PFAS methods (e.g. Methods 1633A or 1621), those methods shall be used for the corresponding media. EPA SW-846 Method 8327 is limited to aqueous matrices and shall not be used for non-aqueous media.

Permittee Response: As noted in response to NMED Comment #3, regulations regarding AFFF containing intentionally added PFAS constituents as hazardous waste have not been promulgated. Additionally, incorporating information into this section specifically related to PFAS sampling and analysis is not appropriate; sampling and analysis methods are already appropriately specified in Permit Section 1.9.9.1, *Representative Sampling*. No changes were made to the Permittees' Permit Renewal Application associated with this comment.

16. Permit Part 1.17.2, Demolition Activities

NMED Comment: NMED agrees with a request to reduce the reporting to twice a year for demolition notifications, however these notifications must also a status that includes the dates buildings have been demolished since the last notification or if the building is no longer planned to be demolished.

Permittee Response: The proposed language for Permit Section 1.17, *Notice of Demolition Activities*, has been updated to remove Permit Section 1.17.2 and incorporate a twice a year schedule for demolition reporting. Additionally, Permit Section 1.17.1, *Content and Format of Notice*, has been updated to include the dates buildings have been demolished since the last notification. The Permittees have revised the Permit Renewal Application to reflect these changes within Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit* and Supplement 1-1, *Permittees' Proposed Changes to Permit Parts I-II*. These documents are included as Addendums 1 and 7 of this response.

17. Permit Part 2.3.1., Hazardous Waste Shipment to WIPP (New Subsection)

NMED Comment: The Permittees must add the following language to the permit for legacy waste.

The Permittees shall ensure that legacy waste is being shipped to the Waste Isolation Pilot Plant (WIPP) through the following schedule:



- a. *From January 1, 2027, through December 31, 2031, the Permittees shall ship legacy waste from Los Alamos National Laboratory (LANL) to WIPP such that the Permittees are targeting legacy waste shipment volumes meeting the WIPP requirement that at least 55% of total volume of all waste being emplaced is from LANL.*
- b. *Beginning January 1, 2032, and until all LANL legacy waste has been emplaced at WIPP, the Permittees shall ship legacy waste from LANL such that the Permittees are targeting legacy waste shipment volumes meeting the WIPP requirement that at least 75% of total volume of all waste being emplaced is from LANL.*
- c. *Within 15 days of the last day of each month, the Permittees shall provide a written report and certification documenting all waste shipped to WIPP. The report shall distinguish between legacy and non-legacy waste.*
- d. *Legacy waste stored above-ground at LANL Material Disposal Area-G shall be shipped by July 1, 2028.*

Permittee Response: This NMED comment includes language similar to that set forth within the agency-initiated permit modification to the WIPP Hazardous Waste Facility Permit published in April 2026. That permit modification is subject to an ongoing permitting process, and a final resolution or outcome of the contested permitting process has not yet been determined. Changes proposed associated with this agency-initiated permit modification are not incorporated into the Permittees' Permit Renewal Application.

18. Section 3.2, Condition of Containers

NMED Comment: The Permittees must add the clarification to container management to address rusting and to ensure that containers are in good condition.

Section 3.2 CONDITION OF CONTAINERS

The Permittees shall ensure that all containers used to store hazardous wastes subject to this Permit are in good condition (e.g., no ~~severe~~ rusting or apparent structural defects) in accordance with 40 CFR § 264.171, which is incorporated herein by reference. If a container is not in good condition or begins to leak, the Permittees shall transfer the waste from such a container into a container that is in good condition within 24 hours of discovery of the problem, and in accordance with 40 CFR § 264.171.

The Permittee will address any rust (minor and severe) in a timely manner to prevent further deterioration of a container. The Permittee must address severe rust within 24 hours, and must make a determination on minor rust within a month of discovery for it if it needs to be treated by the facility or if it is not affecting the container. If the Permittees determine minor rust is not affect the container, the minor rust must be photographed, monitored, and noted in facility inspection records for a year to affirm that it is not becoming severe rust. The Permittee must document how rust has been addressed in the container's waste profile form and in the facility inspection records.



Permittee Response: As noted previously, the Permittees disagree with addition of definitions for Severe Rusting and Minor Rusting. Further, requiring documentation of all containers determined to have minor rusting (proposed by NMED to be “any visible rust on a container that is not severe”) via photographs is unreasonable and onerous. Most containers within permitted units are steel containers, almost all of which have minor oxidation. This proposed additional language would require the Permittees to photograph and continually monitor virtually every container in storage. This proposed additional language: (1) is onerous; (2) exceeds NMED’s regulatory authority under RCRA; (3) appears to provide requirements that would be unique to the Permit; (4) is not consistent with other facilities; (5) is not based on providing added protection to human health or the environment; and (6) bypasses the public comment and the process for promulgating regulations. No changes were made to the Permittees’ Permit Renewal Application associated with this comment.

19. Section 3.5.1, Management of Containers

NMED Comment: The Permittees must revise the permit to clarify aisle spacing must be at least two feet and must allow for a forklift to access a container.

The Permittees shall maintain adequate aisle space at all times, at a minimum two feet, to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the permitted units, and forklifts. Additionally, emergency egress aisles with a minimum aisle space of two feet must be maintained at all personnel doors (see 40 CFR § 264.35)

Permittee Response: Permit Section 3.5.1, *Storage Configuration and Minimum Aisle Space*, already requires aisle space of two feet and the Permittees accept the change to “at a minimum two feet” within the text provided. However, the Permittees have not included NMED’s proposed addition of “and forklifts”. The intent of aisle space is to allow for unobstructed movement in case of an emergency. It is not likely that hazardous waste management personnel will be utilizing forklifts during emergency operations. The Permittees and NMED agreed to the language regarding aisle space within Permit Section 3.5.1 prior to issuance of the current Permit. NMED has provided no technical data or risk analysis, and no analysis of the reduction of hazards to public health and the environment that could be realized by adding forklifts to this permit condition.

The Permittees’ application has been revised to reflect the addition of “at a minimum two feet” within Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit* and Supplement 1-1, *Permittees’ Proposed Changes to Permit Parts I-III*. These documents are included as Addendums 1 and 7 of this response.

20. Section 3.12.1, General Operating Conditions

NMED Comment: The Permittees must add language on evaluating the conditions of domes and scheduling repairs.

Section 3.12.1 General Operating Conditions



The Permittees shall ensure that storage of hazardous waste in containers at TA-54 occurs only in the permitted unit at Area L, the nine permitted units at Area G, the two permitted units at TA-54 West, and as identified in Attachment A (Technical Area Unit Descriptions) and Attachment J (Hazardous Waste Management Units). Permittees Triad and N3B co-operate different permitted units at TA-54. Triad co-operates two permitted units at TA-54 West and N3B co-operates ten permitted units at Areas G and L. The Permittees have a duty to meet the additional Permit requirements of this Section solely for their respective permitted units, as specified below.

The Permittees must evaluate the condition of the Domes on a yearly basis and must schedule preventative repairs or reskinning events. The criteria, findings, and scheduled repairs must be provided to NMED as report and is due to NMED by no later than June 30 annually.

Permittee Response: Inspecting dome integrity for permitted units at TA-54 is part of the weekly routine RCRA Facility Inspections (RFI). If a deficiency such as a tear, hole, or other damage is identified, the issue is noted as an action required (AR) item on the weekly RFI form. Compensatory measures to mitigate the impact (such as tarping or moving waste containers) are then implemented within 24 hours. The AR is tracked internally until repairs can be made. The time required for completing repairs can vary based on budget, availability of appropriate contractors to conduct the work, weather conditions, and other factors. The Permittees reject adding both: (1) NMED's proposed language cited here; and (2) the additional reporting requirement. There is no regulation requiring such measures, and this additional documentation would result in unnecessary paperwork and a redundant effort with no added value. No changes were made to the Permittees' Permit Renewal Application associated with this comment.

21. Permit Part 3.14, Tables 3.14.3.1, 3.14.3.2, and 3.14.3.3

NMED Comment: The Permittees must update screening levels be consistent with NMED's SSG VISLs.

Permittee Response: The Permittees' proposed revisions to Permit Part 3.14, *TA-63 Container Storage Requirements*, include comparing calculated soil vapor monitoring results to the Industrial Vapor Intrusion Screening Levels (VISLs) established in NMED's Risk Assessment Guidance for Site Investigations and Remediation Volume I Soil Screening Guidance for Human Health Risk Assessments, Table A-4 Vapor Intrusion Screening Levels (June 2022, as updated). No further changes have been determined to be necessary within the subsections to incorporate the NMED's comment.

22. Permit Part 6, Section 6.3.5, Routine Maintenance

NMED Comment: The Permittees must revise to include inspection of the concrete pad and 45-mil Hypalon liner. The inspection should identify any cracks and/or any deterioration, and any maintenance or repairs that are recommended and dates of maintenance activities in the facility inspection logs.

Permittee Response: The Permittees assert that inspection of the work surface (including the identification of cracks and deterioration) and other necessary inspections are performed during weekly

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inspections in fulfillment of the requirements in Permit Section 2.6, *General Inspection Requirements*, and that any needed repair would be identified and completed as outlined in Permit Section 2.6.2, *Repair of Equipment and Structures*. There is no need to provide for additional inspections within the proposed Permit Part 6, *Treatment by Open Burning*.

23. Section 11.4, Cleanup Levels

NMED Comment: The Permittees must also include the following clean up language for PFAS in the Permit:

11.4 CLEANUP LEVELS

The Department and the New Mexico Water Quality Control Commission (WQCC) have separately specified certain cleanup goals and methods of calculating cleanup levels. The Department has also specified certain reporting requirements for sites where corrective action is required in response to releases to the environment. In general, the Department has selected a human health target risk level of 10^{-5} for carcinogenic substances and a Hazard Index (HI) of 1.0 for non-carcinogenic substances as cleanup goals for establishing site-specific cleanup levels for one or more contaminants for which toxicological data are published. The Permittees shall follow the cleanup and screening levels described in this Permit Part in implementing the corrective action requirements of this Permit. In addition, cleanup levels for the protection of the environment shall address ecological risk consistent with the Department's guidance for assessing ecological risk as specified in Permit Section 11.5.

Permittee Response: Currently, the only proposed changes to 20.4.1 NMAC is regarding AFFF containing intentionally added PFAS chemicals. This would impact a very limited number of sites where AFFF containing PFAS has historically been stored and/or used. These proposed regulations would not invoke any type of site-wide sampling requirements for PFAS chemicals. However, these regulations are proposed – they have not been promulgated. Additionally, Permit Section 11.4 already specifies cleanup levels, screening levels, and use of NMED's guidance for assessing ecological risk that encompasses all promulgated regulations. Therefore, a separate section specifically for PFAS cleanup in the Permit is not included in the Permittees' Permit Renewal Application.

24. Permit Part 11, Section 11.4.4, Vapor Intrusion Cleanup Levels (NEW SECTION)

NMED Comment: The Permit must be revised to include vapor intrusion cleanup levels that were added to the NMED Soils Screening Guidance.

11.4.4 Vapor Intrusion Cleanup Levels

The NMED has specified vapor intrusion screening levels for volatile organic compounds that are based on a target total excess cancer risk of 10^{-5} and, for noncarcinogenic contaminants, a target HI of one (1.0) for residential and industrial land use scenarios. The target residential and industrial vapor intrusion screening levels for selected substances are listed in NMED's Soil Screening Guidance (SSG) (as updated). Vapor intrusion shall be evaluated for sites that meet the criteria specified in the SSG. If a hazardous constituent or other contaminant (as defined in



Section 1.12 of this permit) is not listed in NMED's SSG, the Permittee shall calculate the vapor intrusion screening level following the methodology specified in the SSG.

PFAS Cleanup Levels

For PFAS compounds such as PFOS and PFOA, EPA Regional Screening Levels (RSLs) are calculated at a target excess lifetime cancer risk of 10^{-6} , which is more protective than the 10^{-5} risk level used by NMED for other carcinogens. Where EPA has published updated toxicity values or screening levels for PFAS, those values shall be considered in evaluating site-specific cleanup levels, risk assessments, and remedial decisions. PFAS cleanup levels shall also account for precursor compounds and total PFAS loading, consistent with current guidance.

Permittee Response: As previously noted in other responses, no new regulations have been promulgated to regulate AFFF containing intentionally added PFAS constituents as hazardous waste. Additionally, the number of sites affected by such regulations – after they are promulgated – would be limited only to those sites which historically stored and/or used AFFF containing PFAS chemicals. Therefore, the Permittees have not incorporated the addition into the Permit Renewal Application.

25. Permit Part 11, Section 11.10, Methods and Procedures

NMED Comment: The Permittees must add language to this section, where applicable, about using laboratory-verified PFAS free equipment when sampling for PFAS.

Permittee Response: The Permittees will use current EPA validated methods for sampling and analysis of all sampling conducted for compliance with the Permit. The Permittees have not included additional information regarding AFFF in the Permit Renewal Application.

26. Permit Part 11, Section 11.10.2.15, Per-and Polyfluoroalkyl Substances (PFAS) Sample Collection (NEW SECTION)

NMED Comment: The Permittees must add language regarding PFAS sampling.

Section 11.10.2.15 Per-and Polyfluoroalkyl Substances (PFAS) Sample Collection
PFAS sampling and analytical methods are evolving and more effective and precise field and laboratory analytical methods will likely be developed in the future. As improved methods become accepted, the NMED will require use of such methods as applicable. At a minimum, the following practices shall be followed until improved methods become available:

The EPA SW-846 methods under development utilize PFAS-free, high-density polyethylene containers; whole sample preparation; and sample holding times of 28 days. EPA has also developed guidelines for field sampling, to minimize sample contamination and optimize data quality for site characterization and remediation. (USEPA, September 2018, Technical Brief Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), EPA/600/F-17/022d)

Due to the widespread use of PFAS, many materials normally used in field and laboratory operations contain PFAS. For example, polytetrafluoroethylene products (tubing, sample



containers, and sampling tools) are often used in sampling; however, since these products can contain PFAS, they cannot be used in sampling for PFAS. In addition, many consumer goods, such as water-resistant jackets or fast food wrappers, brought to a sampling site may contain PFAS that can contaminate samples. Proper field sampling and laboratory hygiene protocols are critical to ensuring that testing results reflect actual PFAS levels in the analyzed media. (USEPA, September 2018, Technical Brief Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), EPA/600/F-17/022d)

EPA developed Analytical Method 537 and has since developed more accurate methods for the determination of selected perfluorinated alkyl acids in media. Specific methods are required for PFAS sampling to avoid cross contamination and to collect representative samples. For example, Section 8, Sample Collection, Preservation, and Storage, of Method 537 describes the field sample collection procedure as follows (USEPA, September 2009, Method 537. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), EPA/600/R-08/092). Since PFAS sampling and analysis techniques are evolving, the Permittee must use the most updated methods when proposing and implementing PFAS sampling.

Permittee Response: NMED has not promulgated regulations regarding discarded AFFF containing intentionally added PFAS compounds as hazardous waste. Therefore, the NMED's proposed language is not added to the Permittees' Permit Renewal Application. Additionally, the Permittees are required to select an appropriate method for sampling and analysis as specified in Permit Section 1.9.9.1.

27. Permit Part 11, Section 11.10.3.6, Per- and Polyfluoroalkyl Substances (PFAS) Sampling and Analytical Methods (NEW SECTION)

NMED Comment: The Permittees must add language regarding PFAS sampling.

Section 11.10.3.6 Per-and Polyfluoroalkyl Substances (PFAS) Sampling and Analytical Methods
PFAS sampling and analytical methods have been evolving, more effective and precise field and laboratory analytical methods have been developed, and those will continue to be refined in the future. The NMED will require use of these improved, validated, and EPA approved methods. The Permittee must use the most current PFAS sampling and analytical methods specific to each matrix (media) when proposing and implementing PFAS sampling.

Sampling conducted for PFAS in various media is similar for other chemical compounds, however, there are several additional specific considerations and protocols. Due to the widespread use of PFAS, many materials normally used in field and laboratory operations contain PFAS. Proper field sampling and laboratory hygiene protocols are critical in ensuring that testing results reflect actual PFAS levels in the analyzed media (USEPA, September 2018, Technical Brief Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), EPA/600/F-17/022d). Several EPA Methods that analyze for PFAS have undergone multi-laboratory validation.



Permittee Response: NMED has not promulgated regulations regarding discarded AFFF containing intentionally added PFAS compounds as hazardous waste. Therefore, the NMED's proposed language is not added to the Permittees' Permit Renewal Application. Additionally, the Permittees are required to select an appropriate method for sampling and analysis as specified in Permit Section 1.9.9.1.

28. Permit Part 11, Section 11.11.3.1.1, PFAS-Specific Well Construction Materials (NEW SECTION)

NMED Comment: The Permittees must add language regarding PFAS sampling.

Section 11.11.3.1.1 PFAS-Specific Well Construction Materials

Monitoring wells installed for PFAS investigation or corrective action shall be constructed using materials and practices that minimize the potential for PFAS cross-contamination. Consistent with current EPA and ITRC guidance, fluoropolymer materials (including PTFE/Teflon) shall not be used in well casings, screens, risers, or permanent tubing. Preferred materials include stainless steel and high-density polyethylene (HDPE); PVC may be used where documented as compatible. PFAS-containing products such as Teflon tape, PFAS-based lubricants, waterproof markers and similar materials shall not be used in contact with monitoring wells or associated equipment.

Guidance References:

- 1. ITRC (2021, updated 2023). PFAS Technical and Regulatory Guidance Document. Sections on Investigation Methods, Well Construction Materials, and Cross-Contamination Prevention.*
- 2. EPA (2022-2024). PFAS Sampling and Analysis Guidance, including materials restrictions referenced in Draft Method 1633 and associated Best Practices for PFAS Sampling.*
- 3. EPA (2020). Interim Guidance on PFAS in Groundwater and Investigations, emphasizing avoidance of fluoropolymer materials and PFAS-containing field supplies.*

Permittee Response: The Permittees appreciate the importance of utilizing appropriate construction materials for monitoring wells that minimize interference with constituents being monitored. However, the references NMED lists are guidance documents. The Permittees reject the addition of NMED's suggested language; it is not appropriate to require these conditions within the Permit based on guidance documents.

Permit Attachments

29. Supplement 1-2, Attachment A, General Standards

NMED Comment: Stabilization is carried out at several permitted units, and in Attachment A of the permit, this process is done in containers greater than 0.1 m³ capacity (e.g., 55/85-gallon drums), which means the containers used are required to comply with control level 3 as per 40 CFR 264.1086(b)(2). The EPA exemption for RCRA storage and treatment requirements only applies to mixed low-level waste (MLLW). The Permittees must confirm none of these containers contain mixed transuranic waste and provide additional documentation to demonstrate that these containers comply to level 3 standards in 40 CFR 264.1086(e).



Permittee Response: 40 CFR § 264.1080(b)(6) excludes containers utilized for "radioactive mixed waste in accordance with all applicable regulations under the authority of the Atomic Energy Act and the Nuclear Waste Policy Act." This includes mixed transuranic waste. All the units that are approved for waste stabilization treatment activities within the Permit are used to treat mixed hazardous waste exclusively. Therefore, the requirements at 40 CFR §§ 264.1086(e) are not applicable and have not been added to the Permit Renewal Application.

30. Supplement 1-2, Attachment A, Proposed Section A.6.1.5, TA 54-32

Permittees' Statement: "These sump capacities exceed the amount necessary to hold 10% of the maximum storage capacity for TA-54-32."

NMED Comment: The Permittees did not state the maximum capacity for TA-54-32 as was done for the other units. The Permittees must provide the maximum storage capacity for TA-54-32 to show that the sump capacities are capable of containing 10% of the maximum storage capacity.

Permittee Response: The Permit Renewal Application has been revised to read: "These sump capacities exceed the volume necessary to hold 10% of the 17,160-gallon maximum storage capacity at TA-54-32." Changes are reflected in Permit Renewal Application in Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and Supplement 1-2, *Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions*, included as Addendums 7 and 8 within this submittal.

31. Supplement 1-2, Attachment A, Proposed Section A.6.2.2, Northwest Bay of Building 412

Permittees' Statement: "Containers holding hazardous or mixed waste with free liquids will be stored on portable spill pallets or pans which meet the secondary container requirement of 40 CFR 264.175."

NMED Comment: The Permittees must explain how the pallets and pans meet the secondary requirement of 40 CFR 264.175(b)(3).

Permittee Response: The Permit Renewal Application will be revised to read: "Containers holding hazardous or mixed waste with free liquids will be stored on portable spill pallets with sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater, to meet the requirements of 40 CFR 264.175(b)(3)." Changes are reflected in Permit Renewal Application in Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and Supplement 1-2, *Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions*, included as Addendums 7 and 8 within this submittal.

32. Supplement 1-3, Attachment C, Waste Analysis Plan

NMED Comment: The Permittees must include definitions for legacy waste in attachment C.

Permittee Response: This NMED comment requests inclusion of language similar to that set forth within the agency-initiated permit modification to the WIPP Hazardous Waste Facility Permit published in April

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2026. That permit modification is subject to an ongoing permitting process, and a final resolution or outcome of the contested permitting process has not yet been determined. Changes proposed associated with this agency-initiated permit modification are not incorporated into the Permittees' Permit Renewal Application.

33. Supplement 1-4, Attachment D, *Contingency Plan*

Permittees' Statement: "The Permittees shall implement the provisions of the Plan and the applicable provisions of Permit Part 2 (General Facility Conditions) immediately to minimize hazards whenever there is a fire, explosion, or release of hazardous ~~or mixed~~ waste or hazardous ~~or mixed~~ waste constituents that could threaten human health or the environment."

NMED Comment: The Permittees must add the following language from 40 CFR 264.52 to be consistent with Permit Part 2, "...~~any unplanned sudden or non-sudden~~ release of hazardous waste...".

Permittee Response: The Permittees have included the requested text within the introductory paragraph of Permit Attachment D, *Contingency Plan*. The revisions are included in Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and Supplement 1-4, *Permittees' Proposed Changes to Attachment D, Contingency Plan*, within Addendums 7 and 9 within this submittal.

34. Supplement 1-4, Attachment D, Section D.1.1, *Emergency Management*

NMED Comment: NMED does not agree with the change to not include the names, addresses, and telephone numbers of the current Primary and Alternate Incident Response Commanders. The information for the emergency coordinators is required by 40 CFR 264.52(d), and this requirement is consistent for other DOE facilities. To comply with 32 CFR 2002, the Permittees may exclude residential addresses for public dissemination but still must submit them to the New Mexico Environment Department's Hazardous Waste Bureau. However, the names and telephone numbers for the incident response commanders must remain in the permit so that the information is easily accessible. The Permittees must include this information in Attachment D and note that the residential addresses will be sent to Hazardous Waste Bureau in a separate unclassified controlled nuclear information (UCNI) submission.

Permittee Response: The Permittees have added the names of the Incident Commanders to the Permit Attachment D, *Contingency Plan* and indicated that addresses and phone numbers can be found in a separate submittal. The revisions are included in Supplement 1-4, *Permittees' Proposed Changes to Attachment D, Contingency Plan*, Addendum 9 of this submittal. The revised controlled unclassified information is included in Enclosure 2 of this submittal; this information is not approved for public dissemination but has been provided to NMED for their review.

35. Supplement 1-4, Attachment D, Section D.9.2, *Evacuation Plan*



NMED Comment: The Permittees must provide evacuation routes and alternative routes as required by 40 CFR 264.52(f), and this requirement is consistent for other DOE facilities.

Permittee Response: The Permittees have added a figure depicting site evacuation routes in Permit Attachment D, *Contingency Plan*. The revisions are included Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and Supplement 1-4, *Permittees' Proposed Changes to Attachment D, Contingency Plan*, within Addendums 7 and 9 of this submittal.

36. Supplement 3-1, Attachment G, Attachments G.2 and G.3, TA-36-8 Closure Plan and TA-39-6 Closure Plan

NMED Comment: The Permittees must update the closure plans for the open detonation units, in Attachments G.2 and G.3, with updated treated waste volumes and must also update the dates of operation before the Permit is finalized.

Permittee Response: The Permittees have updated the estimated maximum quantity treated within Section 3.0 of each closure plan in Attachments G.2 and G.3. The revised files are included within Addendum 10 of this submittal.

37. Supplement 3-1, Attachment G, Attachments G.2 and G.3, TA-36-8 Closure Plan and TA-39-6 Closure Plan

NMED Comment: Attachments G.2 and G.3 must be revised to reference 40 CFR 264 not 40 CFR 265. The Permittees must correct the references in these closure plans.

Permittee Response: The Permittees have corrected the references to 40 CFR Part 264 in Attachments G.2 and G.3. The revised files are included within Addendum 10 of this submittal.

38. Supplement 3-1, Attachment G, Attachments G.2 and G.3, TA-36-8 Closure Plan and TA-39-6 Closure Plan

NMED Comment: Attachments G.2 and G.3 reference financial assurance requirements in 40 CFR 264.143, however since Los Alamos National Laboratory (LANL) is a federal facility and exempt from 40 CFR Subpart H, this reference is not required. The Permittees must remove references to the 40 CFR 264.143 requirement.

Permittee Response: Within Section 8.0 in Attachments G.2 and G.3 have been revised to remove the sentences referencing 40 CFR § 264.143. The revised files are included within Addendum 10 of this submittal.

39. Supplement 3-1, Attachment G, Attachments G.23 and G.24, TA-55 Storage Tank Closure Plan and TA-55 Stabilization Treatment Closure Plan

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NMED Comment: The Permittees did not provide NMED with the following UCNI documents to review: Figure G.23-1 and Figure G.24-1. The Permittees must provide NMED with these documents for review.

Permittee Response: The information provided under separate cover for the Unclassified Controlled Nuclear Information portion of the application has been revised to include sampling location at each of the respective permitted units. The revised controlled figures are included within Enclosure 2 of this submittal; they are not approved for public dissemination but have been provided to NMED for their review.

40. Supplement 3-1, Attachment G, Attachment G.23, Table G.23-3, *Potential Waste Materials, Waste Types, and Disposal Options*

NMED Comment: This table includes low-level radioactive waste information and are not consistent with In Volume 1, Section 6.1 *U.S. v. Curry*, page 6-1, which states: "Attachment G, Closure Plans, Tables G.1 through G.31: deletion of text 'low-level radioactive solid waste' under column 'Waste Type'. The Permittees must correct or clarify the rationale for the inclusion of low-level radioactive solid waste.

Permittee Response: Attachment G, Attachment G.23, *Technical Area 55, Building 4 Indoor Storage Tank Unit Closure Plan*, has been revised to remove low-level radioactive solid waste from Table G.23-3, *Potential Waste Materials, Waste Types, and Disposal Options*. The revised file is included as Addendum 10 within this submittal.

41. Supplement 3-1, Attachment G, Attachment G.28, Section 1.0, *Introduction*

Permittees' Statement: "The information provided in this closure plan addresses the closure requirements specified in the Code of Federal Regulations (CFR), Title 40, Part 265, Subparts G and P for the thermal treatment units operated at the Facility under the Resource Conservation and Recovery Act (RCRA) and the New Mexico Hazardous Waste Act."

NMED Comment: Attachment G.28 references 40 CFR 265 Subpart G and Subpart P. The Permittees may retain the reference to 40 CFR 265 Subpart P, but must reference 40 CFR 264 Subpart G, which references permitted units. The Permittees must also correct other references to 40 CFR 265 throughout the report that are not in reference to Subpart P, and change them to 40 CFR 264 reference.

Permittee Response: The Permittees have corrected the references to 40 CFR Part 264 in Attachment G.28. The revised file is included as Addendum 10 within this submittal.

42. Supplement 3-1, Attachment G, Attachment G.28, Figure G.28-2, *Technical Area 16-388 Soil Sample Locations for Closure of Unit*



NMED Comment: The proposed sample locations for Figure G.28-2 do not cover the site as completely as the proposed sampling locations for Attachment G.2 and G.3. In Section 5.2.2 of Attachment G.28, the Permittees state that samples below the pad will determine if the concrete pad is removed, but this figure does not show any samples below the concrete pad. The Permittees must add a grid of proposed incremental sampling locations and add a location that is beneath the concrete pad.

Permittee Response: Removal of the concrete pad and liner beneath the concrete pad, if deemed necessary, has been included in Attachment G.28, Section 5.2.1, *Removal of Structures and Related Equipment*. Discussion of soil sample activities and disposal of the waste generated from these removals is in Section 6.1, *Sampling Activities*, and Table G.28-3, *Potential Waste Materials, Waste Types, and Disposal Options*. A sample location below the concrete pad is included on Figure G.28-2 and will be collected if the concrete pad and liner are removed as part of closure activities. The revised file is included as Addendum 10 within this submittal. Additionally, incremental sampling has not been determined to be as informative for open burning treatment units as it is for the open detonation units included within Attachments G.2 and G.3, due to dispersion depositional differences.

43. Supplement 3-1, Attachment G, Attachment G.28, Section 5.2.2, *Decontamination of Structures and Related Equipment*

NMED Comment: In this section, there is no discussion on the disposal of the liner beneath the concrete pad if the concrete pad is removed. The Permittees must add a paragraph discussing the possible disposal of the liner if the concrete pad is removed.

Permittee Response: Removal of the concrete pad and liner beneath the concrete pad, if deemed necessary, has been included in Attachment G.28, Section 5.2.1, *Removal of Structures and Related Equipment*. Discussion of soil sample activities and disposal of the waste generated from these removals is discussed in Section 6.1, *Sampling Activities*, and Table G.28-3, *Potential Waste Materials, Waste Types, and Disposal Options*. The revised file is included as Addendum 10 within this submittal.

44. Supplement 1-7, Attachment J, Table J-1, *Active Portion of the Facility*

NMED Comment: NMED does not support removing Area names from this table since these areas are also listed in RCRAInfo and it would make it more difficult to review site history without this information.

Permittee Response: These proposed deletions have been removed from the Permittees' Permit Renewal Application. Therefore, these changes are no longer reflected in Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, or Supplement 1-7, *Permittees' Proposed Changes to Attachment J, Hazardous Waste Management Units*. These changes will be reflected in *Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 2.0*, to be submitted at a later date, and changes to Supplement



1-7, *Permittees' Proposed Changes to Attachment J, Hazardous Waste Management Units*, are included as Addendum 11.

Typographical Comments

45. Volume 1, Section 2, Figures 2.4 and 2.5, *Groundwater Elevation Contour and Approximate Extent of 50 ppb Chromium Plume Map, Mortandad Canyon CY2020, Quarter 4* and *Map showing RDX extent and table contours for the upper perched-intermediate groundwater zone at TA-16*, pages 2-27 and 2-28

NMED Comment: These figures must be updated with current monitoring data, NMED notes that the figure for the RDX plume is dated 2015, and the chromium plume is dated 2021 and does not accurately depict plume boundaries. The Permittees must also revise the titles so that capitalization in figure titles is consistent.

Permittee Response: Figures 2.4 and 2.5 within the Permit Renewal Application have been updated for the RDX and chromium plumes. Figure titles have also been updated to have consistent capitalization. The revised figures are included within Addendum 2 of this submittal.

46. Attachment A, Section A.1.1.1, TA-3-29 Room 9010

Permittees' Statement: "Room 9010 measures 21 feet (ft) by 8 inches (in.) wide by 106 ft., 9 in. long..."

NMED Comment: The Permittees must correct the sentence to read: "21 feet (ft.), 8 inches (in.) wide by 106 ft., 9 in. long".

Permittee Response: This correction has been incorporated into the Permittees' application as revised redline included in Permit Renewal Application Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and Supplement 1-2, *Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions*, included as Addendums 7 and 8 within this submittal. The Permittees determined no changes were required to Permit Renewal Application Section 6.3, *Other Permit Changes*, associated with this change.

Addendum 1

Revisions to Supplement 1-1, Permittees' Proposed Changes to Permit Parts 1-11

~~1.11.3~~1.16.3 Enforceability against Transferee

The covenant required by CERCLA § 120(h)(3)(A)(ii), and the deed restriction described in Permit Section 1.16.2 (to the extent the property is not remediated for unrestricted use), are requirements within the meaning of CERCLA § 310(a)(1), 42 U.S.C. § 9659(a)(1). The contract of sale between the DOE and the transferee will state that the parties to the contract agree that the deed restriction to be set forth in the deed is a requirement within the meaning of CERCLA § 310(a)(1), 42 U.S.C. § 9659(a)(1). DOE shall ensure such statement within the Contract of Sale will survive the transfer of the deed. The deed transferring title from DOE to the transferee shall state that the restriction on land use set forth in the deed is intended to be an equitable servitude, that both the Department and the transferor are beneficiaries of the equitable servitude, that the parties intend for the restriction on land use to run with the land and to bind subsequent transferees, and that such restriction is enforceable by the Department and the transferor against any subsequent transferee that fails to comply with its terms. The deed shall be recorded in the appropriate recording office in the chain of title of the property to give notice of the use restriction to subsequent transferees of the property.

~~1.11.4~~1.16.4 EPA Institutional Controls Tracking System

For any deed transferring title from DOE to the transferee that contains a restriction on future land use, the Permittees shall, within 90 days of transfer of the property, notify EPA Region 6 of the transfer and identify for EPA the location of the property that is the subject of the transfer.

~~1.11.5~~1.16.5 Transfer of Facility Property to another Federal Agency

If the operational control of any portion of the Facility, subject to the requirements of this Permit, will be transferred from DOE to another agency, department, or instrumentality of the United States, the Permittees shall provide written notice of such operational transfer to the Department at least 120 days prior to the transfer. If, however, the Permittees learn of such decision fewer than 120 days prior to the transfer, the Permittees shall provide written notice under Permit Section 1.16 to the Department as soon thereafter as is reasonably practicable.

~~1.12~~1.17 NOTICE OF DEMOLITION ACTIVITIES

On or before September 30 of each year, the Permittees shall provide notice to the Department of buildings and other fixed structures that may contain hazardous material scheduled to be demolished in the following federal fiscal year (October 1 through September 30). This notice shall be provided at least 30 days prior to demolition of any such building or structure.

On or before March 31, every year, the Permittees shall update the scheduled list or shall notify the Department in writing that no such additional demolitions have been scheduled.

1.12.11.17.1 Content and Format of Notice

The Notice under this Permit Section shall include a list in the form of a table that contains the following general information for each building or fixed structure that may contain hazardous material to be demolished, to the extent it is available at the time it is submitted:

- (1) The Technical Area (TA) and building number;
- (2) A brief statement of current and historic uses of the building or fixed structure;
- (3) The approximate dates of operations of the building or fixed structure;
- (4) A list of any solid waste management units (SWMU) or Areas of Concern (AOC) within 50 feet of the footprint of the building or fixed structure;
- (5) The categories (*e.g.*, chemical residues, RCRA metals, asbestos, high explosives residues, mixed waste) of potential wastes expected to be present and the processes or conditions that may result in the presence of hazardous material in the building or fixed structure;
- (6) The date or the quarter in which the demolition is scheduled to begin or anticipated to begin; and
- (7) Any buildings or fixed structures provide the dates buildings have been demolished since the last notification or if the building is no longer planned to be demolished identified in the previous fiscal year that were not demolished.

The list shall be accompanied by an attachment that shall describe the processes or conditions that may result in the presence of hazardous material in each building or fixed structure.

~~1.12.2~~ Demolition Activities Update

~~On or before the last day of each quarter (December 31, March 30³¹, June 30, and September 30) every year, the Permittees shall update the list to include any additional buildings and fixed structures that may contain hazardous material scheduled for demolition, or shall notify the Department in writing that no such additional demolitions have been scheduled. In the event a demolition project is identified after the previous notice due date, but will occur prior to the next notice due date, the Permittees shall submit a supplemental notice conforming to Section 1.17.1 not less than 30 days prior to demolition.~~

~~1.12.3~~ 1.17.2 Actions

Based on the list, the Department may identify in writing those buildings or fixed structures for which it requires notice.

If a demolition completion report is prepared for any building or fixed structure identified by the Department, the Permittees shall provide to the Department a copy of the report within 30 days after such final report is written.

3.5.1 Storage Configuration and Minimum Aisle Space

- (1) The Permittees shall maintain adequate aisle space at all times, at minimum two feet, to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the permitted units. Additionally, emergency egress aisles with a minimum aisle space of two feet must be maintained at all personnel doors (*see* 40 CFR § 264.35).
- (2) The Permittees are authorized to stack containers greater than or equal to 30 gallons of hazardous waste to no more than three containers high. Stacked containers of this volume shall be palletized, and each layer shall be bound together (*see* 40 CFR § 270.32(b)(2)).
- (3) The Permittees shall ensure that hazardous waste containers stored outdoors are not stored within five feet of the perimeter (*i.e.*, permitted unit boundary) fence, within five feet of any permanent structure, or within five feet of a paved or unpaved roadway.
- (4) The Permittees shall store hazardous waste gas cylinders in cylinder racks, baskets, or on specially constructed pallets that provide support and restraint.
- (5) The Permittees shall ensure that hazardous waste containers that are stored outdoors and are not being actively managed are protected from contact with precipitation using weather protective equipment (*e.g.*, containment shell, secured tarp) or are protected by the design of the equipment (*e.g.*, transportainer, Transuranic Waste Package Transporter II container) (*see* 40 CFR § 270.32(b)(2)).

3.6 WASTE CONTAINER LABELING

- (1) The Permittees shall ensure that all containers storing hazardous waste have a “Hazardous Waste” label (*see* 40 CFR § 262.34(a)(3)) that lists the generator’s name, address, and EPA Identification number, the date the container was placed in storage at the permitted unit (*see* 40 CFR § 262.34(a)(2)), and all applicable EPA Hazardous Waste Number(s) (*see* 40 CFR § 268.50(a)(2)(i)). All containers holding mixed waste shall be labeled “Radioactive.” Records for all containers will be maintained in accordance with Permit Section 2.12.
- (2) The Permittees shall ensure that containers holding free liquids have a “free liquids” label. The free liquids reference may be included on a label identifying other waste characteristics (*see* 40 CFR § 270.32(b)(2)).

3.7 CONTAINMENT SYSTEMS

The Permittees shall store containers of hazardous waste in a manner that prevents contact with any accumulated liquids (*see* 40 CFR § 264.175(b)(2)).

- (1) Provide notification via telephone to the Department within 24 hours of an unexpected event at a treatment unit that results in the Permittees calling in emergency services.
- (2) Any unexpected release at a permitted treatment unit that the Permittees do not deem a threat to human health or the environment must be reported to the Department in accordance with Permit Section 1.9.13.
- (3) The Permittees shall ensure that any unexpected release of waste to the environment (e.g., soil, surface water, groundwater, atmosphere) that may endanger human health or the environment from a permitted treatment unit is reported to the Department within 24 hours of its detection in accordance with Permit Section 1.9.12. Within 5 days of detection of a release to the environment, the Permittees shall submit a written report to the Department containing the information required by Permit Section 1.9.12.2.

5.5 MONITORING REQUIREMENTS

5.5.1 Soil Monitoring Requirements

The Permittees shall conduct a soil sampling and analysis program to monitor for hazardous constituents released to soils during treatment events, and to ensure that any releases do not have an adverse effect on human health or the environment (see 40 CFR § 264.602). All sampling events described in this section shall commence within one year of the effective date of the Permit. The Permittees shall collect soil samples at a frequency of one, four and seven years after the inclusion of the unit within the Permit if the unit has been utilized for waste treatment since the last sampling event. The Permittees shall provide informal notification to the Department at least 30 days prior to commencing sampling activities.

The Permittees shall collect surface soil samples within the area and immediately surrounding the area where waste treatment is conducted. Samples shall be analyzed for total metals, explosives compounds, and semi volatile organic compounds utilizing the analytical methods identified within the Attachment C (Waste Analysis Plan). If no treatment was conducted at the unit between sampling events, the Permittees may propose an alternative sampling schedule. The Permittees shall certify in writing no later than July 31 of the scheduled sampling year that treatment was not conducted since the preceding sampling event.

The Permittees shall submit to the Department a sampling and analysis report for each sampling event summarizing all sampling activities and the results of the sample analyses by October 1 of each sampling year. The Permittees shall identify in the report any sample analytical results that exceed either the previous sampling event or any soil cleanup levels established in Permit Section 11.4.2.1, as applicable. Upon review of the report, the Department will determine if further action is needed. ~~The Permittees shall conduct a soil sampling and analysis program to monitor for hazardous constituents~~

~~released to soils during treatment events, and to ensure that any releases do not have an adverse effect on human health or the environment as required in 40 CFR § 264.602. All sampling events shall commence within one year of the effective date of the inclusion of the open detonation hazardous waste management units within the Permit. The Permittees shall collect soil samples at a frequency of one, four and seven years after the inclusion of the unit within the Permit. The Permittees shall submit a sampling plan to the Department at least 30 days prior to commencing sampling. The plan shall include locations for surface soil sample collection and analysis. Samples shall be analyzed for total metals, explosives compounds, and semi volatile organic compounds utilizing the analytical methods identified within the Attachment C (Waste Analysis Plan).~~

~~The Permittees shall submit to the Department a sampling and analysis report for each sampling event summarizing all sampling activities and the results of the sample analyses by October 1 of each sampling year. The Permittees shall identify in the report any sample analytical results that exceed either the baseline sampling event or any soil cleanup levels established in Permit Section 11.4.2.1, as applicable. Upon review of the report, the Department will determine if further action is needed.~~

5.6 ASSESSMENT OF ALTERNATIVE TECHNOLOGIES

The Permittees shall submit an open detonation alternative treatment technology assessment report to the Department no later than the 6th anniversary of the effective date of this Permit.

endanger human health or the environment from a permitted treatment unit is reported to the Department within 24 hours of its detection in accordance with Permit Section 1.9.12. Within 5 days of detection of a release to the environment, the Permittees shall submit a written report to the Department containing the information required by Permit Section 1.9.12.2.

6.5 TREATMENT RESIDUES

The Permittees shall inspect the unit and clean the waste containment devices of any treatment residues as close to 24 hours after a treatment event as possible. If the Permittees find any untreated explosives waste remaining in the residue during inspection of the unit after treatment, the Permittees shall re-treat the waste on that day subject to the restrictions of this Permit Part. If lightning occurs within 3 miles of the unit during residue collection, the Permittees shall cease collection, and resume no more than 4 hours after the storm passes. The residues shall be managed as waste and characterized in accordance with Attachment C (Waste Analysis Plan) Section C.3.1.2.5.

6.6 MONITORING REQUIREMENTS

6.6.1 Soil Monitoring Requirements

The Permittees shall conduct a soil sampling and analysis program to monitor for hazardous constituents released to soils during treatment events, and to ensure that any releases do not have an adverse effect on human health or the environment (see 40 CFR § 264.602). All sampling events described in this section shall commence within one year of the effective date of the Permit. The Permittees shall collect soil samples at a frequency of one, four and seven years after the inclusion of the unit within the Permit if the unit has been utilized for waste treatment since the last sampling event. The Permittees shall provide informal notification to the Department at least 30 days prior to commencing sampling activities.

The Permittees shall collect surface soil samples within the area surrounding the treatment unit in all directions. Samples shall be analyzed for total metals, explosive compounds, semi-volatile organic compounds, and dioxins/furans utilizing the analytical methods identified within the Attachment C (Waste Analysis Plan). If no treatment was conducted at the unit between sampling events, the Permittees may propose an alternative sampling schedule. The Permittees shall certify in writing no later than July 31 of the scheduled sampling year that treatment was not conducted since the preceding sampling event.

The Permittees shall submit to the Department a sampling and analysis report for each sampling event summarizing all sampling activities and the results of the sample analyses by October 1 of each sampling year. The Permittees shall identify in the report any sample analytical results that exceed either the previous sampling event or any soil cleanup levels established in Permit Section 11.4.2.1, as applicable. Upon review of the report, the Department will determine if further action is needed.~~The Permittees shall~~

~~implement a soil sampling and analysis program to monitor for hazardous constituents released to soils during open burning treatment events and to ensure that any releases do not have an adverse effect on human health or the environment (see 40 CFR § 264.602). All sampling events as described in this section shall commence no later than July 1 of the designated sampling year. Samples shall be collected and analyzed 2, 5, and 8 years after the effective date of this Permit. The Permittees shall provide oral and written notification to the Department of the scheduled sampling activities at least 15 days prior to commencing sampling activity.~~

~~The Permittees shall analyze the soil samples collected during each monitoring event for total metals, explosive compounds, semi-volatile organic compounds, perchlorate, and dioxins/furans. Sampling events shall include at a minimum the 0 to 2-inch depth interval at the locations that are determined by the Department and the Permittees to be representative of drainage locations and potential deposition areas around the unit. These locations will be sampled for all three monitoring events. If no treatment was conducted at the open burning unit between sampling events, the Permittees may propose an alternative sampling schedule. The Permittees shall certify in writing no later than July 31 of the scheduled sampling year that treatment was not conducted since the preceding sampling event.~~

~~The Permittees shall submit to the Department a sampling and analysis report for each sampling event summarizing all sampling activities and the results of sample analyses by December 15 of each sampling year. The Permittees shall identify in the report any sample analytical results that exceed concentrations detected in previous analyses of soil samples collected at the site.~~

Addendum 2

Revisions to the Part B Permit Application for Renewal of the Los Alamos National Laboratory Hazardous Waste Facility Permit, Revision 1.0

Worker education, training, and involvement in planning activities also provide safety measures. Along with the facility-wide safety program established at LANL during hazardous waste management activities, operations at hazardous waste management units have safety requirements associated with safety in radiological or nuclear facilities (all currently permitted units) and at the open burning and open detonation units explosives safety and fire protection requirements which are discussed in detail in Permit Application Sections 4 and 5. All personnel involved in waste treatment activities are required to have training appropriate for their work. Training requirements are presented in Permit Attachment F, *Personnel Training Plan*. Personnel are required to review job hazards prior to performing waste management or treatment activities. Additionally, hazard control plans (that address monitoring equipment), and work authorizations are required, in accordance with LANL safety procedures.

Personal protective equipment (PPE) appropriate for use during the waste management and treatment activities must be worn by all on-site personnel. Hard hats, safety shoes or boots, safety glasses, hearing protection and gloves are used, as appropriate based on Occupational Safety and Health Administration (OSHA) requirements depending on the associated work hazards identified in job-specific hazard control plans. The PPE will be compatible with the hazards present. The need for Personal Contamination Monitors (PCM, e.g., dosimeter, Draeger™ Tubes) will be established using the job hazard review process. All personnel that use PPE are trained and qualified to use the equipment properly.

Together, the established safety program, required training, plans, and work authorizations will help to prevent undue exposure to personnel.

2.7.6 Preventing Releases to the Atmosphere

The general information requirements for 40 CFR §270.14(b)(8)(vi) stipulate the part B permit application to “describe the procedures to prevent releases to the atmosphere.”

The Permittees do not propose any changes in the manner in which they prevent releases to the atmosphere for waste stored in tanks or containers, or treatment activities at the permitted hazardous waste management units. Permit Parts 3, 4, 7, and 8 all have provisions that containers, tanks, or other treatment activities are kept closed during handling and storage or contained while being treated (through glovebox operations or other containment).

In addition, this requirement is met through inspections as required by Permit Section 2.6 and Permit Attachment E, *Inspection Plan*. In summary, inspections are conducted to ensure the integrity of all stored containers and tanks. Hazardous waste stored in containers or tanks must meet requirements of 40 CFR Part 264, Subpart CC, *Air Emission Standards for Tanks, Surface Impoundments, and Containers*, ensuring that containers of hazardous waste be covered so that there are no detectable emissions of volatile organic compounds to the air. Compliance inspection and monitoring associated with container and tank monitoring are described in Permit Attachment E, *Inspection Plan*.

Because the three interim status units proposed for permitting in this Permit Renewal Application are open air treatment units, they will comply with the provisions of 40 CFR § 264, 40 CFR § 264.601 and § 270.14 by proper operation of the units in compliance with the terms of a Resource Conservation and Recovery Act (RCRA) permit issued by the NMED. Precautions and evaluations of the impact to the atmosphere by the operations at these units are included in Sections 4.7.6, *Preventing Releases to the Atmosphere*, and 5.7.6, *Preventing Releases to the Atmosphere*, of this Permit Renewal Application.

The Permittees monitor many different pathways in order to assess their impact on workers, the public, animals, and plants. The air around the Laboratory is monitored to ensure all operations at LANL are not affecting the air of nearby communities. The Permittees expect to emit certain chemical substances to the air based on the materials that are used at each facility. Like similar facilities, LANL has the potential to emit carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, and suspended particulate matter.

For more than a decade, monitoring reports have confirmed that the Laboratory is releasing no air emissions higher than regulations allow. The purpose of AIRNET, LANL's ambient air monitoring network, is to monitor locations where people live or work. The community of Los Alamos is downwind from LANL, so there are many monitoring stations in and around the town. Ambient monitoring is the systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air. AIRNET stations monitor 24 hours a day, 365 days of the year. Particulates are collected on a filter and analyzed every two weeks for identification of analytes and assessment of the potential impact on the public.

The Permittees operate under several air emission permits issued by the New Mexico Environment Department Air Quality Bureau as well as under approvals issued by the U.S. Environmental Protection Agency for construction of new facilities or operations involving radionuclide emissions. These permits and approvals have federally enforceable emission limits and require specific pollution-control devices, monitoring of emissions from stacks, and detailed recordkeeping and reporting.

The LANL site is authorized to use materials and operate equipment that produce some air pollutants under the conditions defined in our Title V Operating Permit. Our permitted emission sources include a steam plant, a combustion turbine, boilers and heaters, emergency generators, beryllium operations, chemical use, degreasers, data destruction (paper shredder), evaporative sprayers, and a small asphalt batch plant. Each source type has its own emission limits for criteria air pollutants and hazardous air pollutants. The Title V Operating Permit also includes facility-wide emission limits for criteria and hazardous air pollutants. As part of compliance with the Title V Operating Permit, emissions are reported and monitoring records are provided from the permitted sources twice a year to the NMED, which inspects the Laboratory periodically for compliance.

Particulate matter consists of smoke, dust, and other material that can be inhaled. Generally, it is not radioactive. Particulate matter can be harmful in high concentrations. The total amount of respirable particulate matter is monitored at two locations: near the intersection of New Mexico State Road 4 and Rover Boulevard in White Rock, and at the Los Alamos Medical Center in Los Alamos. During 2020, the particulate matter concentrations remained well below the U.S. Environmental Protection Agency standard of 35 micrograms per cubic meter for particulate matter smaller than 2.5 micrometers. Typical concentrations (>95 percent of the time) were less than 10 micrograms per cubic meter. The highest concentrations occurred during the spring from windblown dust and during the summer from wildfires.

~~Both open burning and open detonation activities at the LANL site fall well below the insignificant activity thresholds for Title V permitting under the New Mexico Administrative Code for Air Quality Operating Permits (20.2.70 NMAC). In Section 20.2.70.7.Q for Definitions, "insignificant activity" thresholds means those activities which have been listed by the department and approved by the administrator as insignificant based on size, emissions or production rate. The determination of insignificant activities for operating permits is based on the descriptions and methodology outlined in~~

~~the List of Insignificant Activities provided by the NMED–Air Quality Bureau for the Operating Permit Program dated March 24, 2005. Specifically open burning and open detonation determinations for emissions were evaluated based on Subsection D.6 of 20.2.70.300 NMAC (1.a and 1.b) as described in the NMED List of Insignificant Activities.~~

2.8 Ignitable, Reactive, and Incompatible Waste Precautions

The general information requirements for 40 CFR §270.14(b)(9) stipulate the part B permit application to describe procedures to “prevent accidental ignition or reaction of ignitable, reactive, and incompatible wastes.”

Permit Section 2.8, *Ignitable, Reactive, and Incompatible Waste*, addresses the requirements to prevent accidental ignition or reaction of ignitable, reactive, and incompatible hazardous wastes as required to demonstrate compliance with 40 CFR §264.17, including the requirements of 40 CFR §§264.17, 264.176, 264.177, 264.198, and 264.199. Documentation associated with the precautions taken for ignitable, reactive, or incompatible waste at the Facility is kept in accordance with Permit Section 2.12.2, *Facility Operating Record*, and as required by 40 CFR §264.17(c).

Permit Section 2.8 requires precautions to be in place at hazardous waste management units to prevent reactions during the treatment or storage of ignitable or reactive waste, and the mixing of incompatible waste. Permit Section 2.8.1 requires ignitable, reactive, or incompatible waste to be separated and protected from sources of ignition or reaction, including but not limited to the following: open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition (e.g., from heat-producing chemical reactions), and radiant heat. The Permittees recommend three changes to the requirements in Permit Section 2.8.1. The changes are summarized in Appendix 1, *Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit*, and detailed in Supplement 1-1, *Permittees’ Proposed Changes to Permit Parts 1-11*.

The proposed changes are associated with the use of non-sparking processes when non-sparking tools are not available, a clarification to the requirements for compatibility of a fire-suppression system, and the addition of the requirement to add "No Smoking" signs at a permitted unit where ignitable, reactive, or incompatible wastes are treated or stored. This change is suggested for completeness and to better mirror the language within the regulations.

Non-sparking tools are used for waste management operations wherever possible. If non-sparking tools are not available or are impractical for the activity, the activity will be evaluated and a “non-sparking process” will be planned and utilized. The Permittees propose the addition of this text to Permit Section 2.8.1(4). These practices have been successfully employed in the past in specific situations such as the addition of filters to mixed transuranic waste containers with nitrate salt waste. Careful evaluation will be conducted to ensure the safe management of any handling or opening of waste containers that hold ignitable and/or reactive waste.

A clarification regarding the fire suppression system compatibility is proposed to be added at Permit Section 2.8.1(9) and is also included in Supplement 1-1, *Permittees’ Proposed Changes to Permit Parts 1-11*. The added language associated with fire suppression systems is necessary to allow for mitigation when a waste is determined to be incompatible with the fire suppression system.

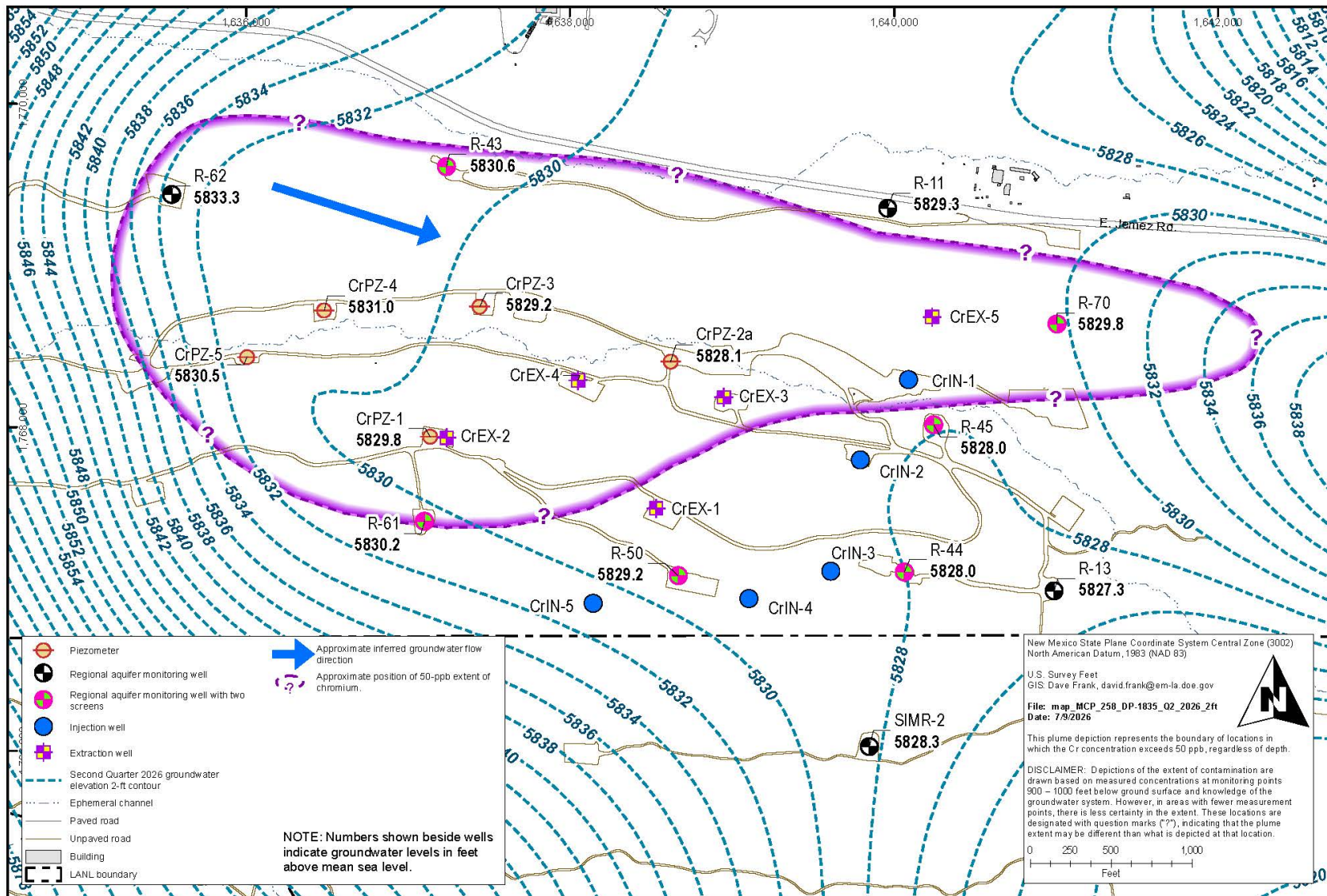


Figure 2-4. Groundwater Elevation Contour and Approximate Extent of 50 ppb Chromium Plume Map, Mortandad Canyon, ~~CY2020~~CY2026, Quarter 24

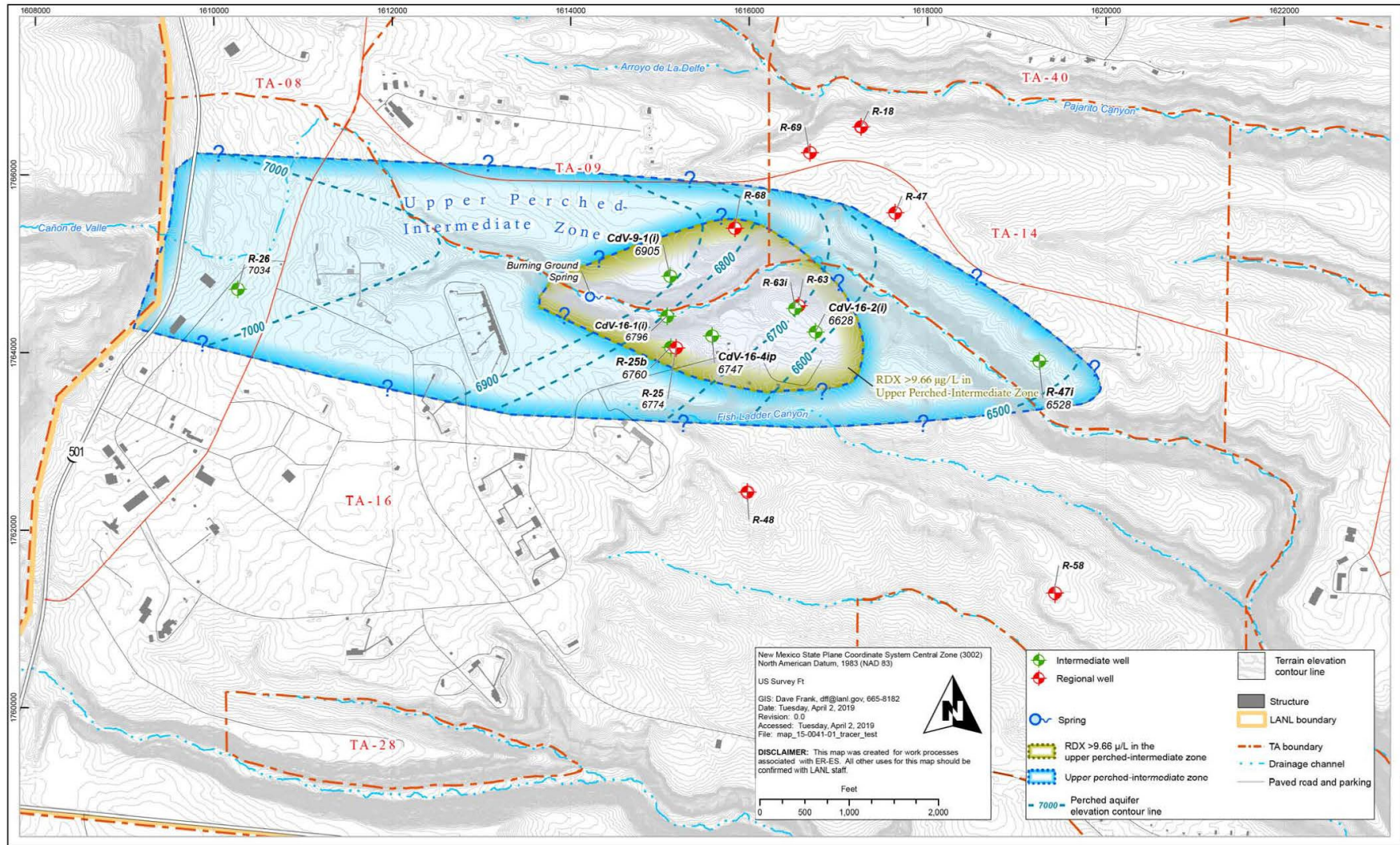


Figure 2-5. **Elevation Contour and Extent of Map showing RDX extent and water table contours for the Upper Perched-Intermediate Groundwater Zone at TA-16**

Note: Green inner zone is extent of RDX contamination >9.66 µg/L in the upper perched-intermediate groundwater

of the LANL Facility and land-use patterns in the Los Alamos area are discussed in Section 2.1, *General Facility Description*, and Section 2.10, *Facility Location Information*, of this Permit Renewal Application.

The open detonation units are designed to facilitate safe handling and treatment of wastes to prevent adverse human health and environmental impacts. Design information and waste management practices for the TA-36-8 open detonation unit and the TA-39-6 open detonation unit are detailed above.

4.18.1 Protection of Groundwater/Vadose Zone

As required by 40 CFR §264.601(a), the open detonation treatment units are operated in a manner that prevents releases that might have adverse effects to human health or the environment as a result of migration of waste constituents through the vadose zone to groundwater. The following sections provide information on the hydrogeology beneath the TA-36-8 open detonation unit and at the TA-39-6 open detonation unit, as well as describe monitoring and reporting conducted to assess the impact of open detonation operations on groundwater.

4.18.1.1 Hydrogeology

The TA-36-8 open detonation unit and the TA-39-6 open detonation unit are located in a mixed semiarid, temperate, and mountain climatic zone. ~~According From 1981 to 2010, the average annual precipitation in Los Alamos~~ Climatology 2021 Update was 18.97 is 17.36 inches and the average ~~annual snowfall is 43 was 57.5~~ inches (LANL 2021b2009a). Published precipitation data for TA-36 and TA-39-6 units do not exist; however, TA-49, located southwest of TA-36, has an historical annual precipitation of 22.27 ~~inches per year~~ (LANL 1998). The evaporation rate of freestanding water exceeds the average annual precipitation. A discussion of the hydrology beneath each of the open detonation units is included in the sections below. Pertinent locations for monitoring are included within figures in Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*, which lists the possible contaminants of concern and shows their monitoring frequency. Tables included within Supplement 4-2 are modified from the 2020 “Interim Facility-Wide Groundwater Monitoring Plan for the 2026 Monitoring Year, October 2025-September 2026, Revision 1” and include the analyte suite and the frequency of analysis (C = continuous, M=Monthly, Q = quarterly, S = semi-annual, and A = annual) conducted in 2019 for the constituents listed in the columns (LANL 2025LANL 2020a). Map 3 within the concurrent submittal of the LANL *General Part A Permit Application, Revision 11.0* (LANL 2025), shows the locations of all regional and alluvial wells used for data gathering at LANL, whereas the TA-36 and TA-39 topographic maps within the LANL General Part A Permit Application depict more detailed information about wells, surface water gaging stations, springs, and groundwater movement at and around each of the open detonation units. Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application contains monitoring data for alluvial, perched-intermediate, and regional groundwater zones near the open detonation units.

4.18.1.1.1 Hydrogeology near and beneath the TA-36-8 Open Detonation Unit

A detailed description of the hydrogeologic characteristics immediately below the TA-36-8 open detonation unit is not currently documented in published or internal reports. However, a discussion of surface water, the vadose zone, and groundwater specific to Operable Unit 1130, which includes TA-36, and a conceptual hydrogeologic model of the area are presented in Sections 3.5 and 3.6 of the RFI Work Plan for Operable Unit 1130 (LANL 1993a). Additional hydrologic information for the area north of the

TA-36-8 open detonation unit is presented in the Pajarito Canyon Investigation Report, Revision 1 (LANL 2009b).

The hydrologic conditions on the surface and within the dry-mesa setting such as that found at the TA-36-8 open detonation unit lead to slow unsaturated flow and transport (Birdsell et al. 2005). Dry mesas shed precipitation as surface runoff to the surrounding canyons, and most mesa-top infiltration occurs episodically following snowmelt. Much of the water that enters the soil zone is lost through evapotranspiration. Potential evapotranspiration was estimated to exceed precipitation at a climate station on the eastern portion of the plateau by a ratio of 6:1 (LANL 2003b). As a result, annual net infiltration rates for dry mesas are less than ten 10 millimeters per year (mm/yr.) and are more often estimated to be on the order of 1 mm/yr. or less (Kwicklis et al. 2006). Because the dry mesas generally consist of nonwelded to moderately welded tuffs with low water content, flow is matrix dominated. Travel times for contaminants migrating through mesas to the regional aquifer are expected to be several hundred to thousands of years (Newman 1996; Newman et al. 1997; Birdsell et al. 2000; Nylander et al. 2003).

The regional water table is approximately 1,000 ft. below the TA-36-8 open detonation unit. The only aquifer in the Los Alamos area capable of municipal and industrial water supply is the regional aquifer. The nearest supply well to the TA-36-8 open detonation unit, PM-2 is located 6,500 ft. to the northeast. PM-4 is 9,300 ft. north-northeast of the TA-36-8 open detonation unit. Upper levels of the regional aquifer on the Pajarito Plateau are predominantly under phreatic (unconfined) conditions (LANL 2009b). The deep portion of the regional aquifer is predominantly under confined conditions, and it is the portion of the regional aquifer influenced by Pajarito Plateau municipal supply pumping. The intensive pumping causes very small water-level fluctuations in the upper (phreatic) portions of the aquifer. Seasonal water-table fluctuations of approximately 0.5 ft. are observed at monitoring well R-27 (Koch and Schmeer 2010), located 2,400 ft. west of the TA-36-8 open detonation unit (Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*). These low-magnitude responses in the phreatic zone from municipal well pumping are in contrast to the larger responses at monitoring wells completed in deeper parts of the aquifer, indicating that the hydraulic communication is poor between the phreatic zone and deeper parts of the aquifer. The small-scale fluctuations in the phreatic zone may be from drawdowns and/or strata compaction. The small water-level fluctuations do not seem to affect the magnitudes and directions of groundwater flow. ~~Capture of contaminants by municipal supply wells, such as well PM-4, which is screened approximately 180 to 1,775 ft. below the regional water table (Koch and Schmeer 2010), is unlikely because of this poor vertical hydraulic communication. As a result, contaminant migration follows the ambient water-table gradients rather than diverting towards the pumping water supply wells, based on hydraulic data.~~ Based on water-table maps, the regional groundwater flow direction in the vicinity of the TA-36-8 open detonation unit is expected to range from east-northeast to east-southeast.

4.18.1.1.2 Hydrogeology near and beneath the TA-39-6 Open Detonation Unit

The TA-39-6 open detonation unit is located in a semiarid, temperate, mountain climate. ~~From 1981 to 2010, the~~ The average annual precipitation in Los Alamos ~~was 18.97~~ is 17.36 inches and the average annual snowfall ~~is 43~~ was 57.5 inches (LANL 2009a2021). Published precipitation data for TA-39 do not exist; however, TA-49, located west of TA-36, has an historical annual precipitation of 22.27 inches per year (LANL 1998). The evaporation rate of freestanding water exceeds the average annual precipitation.

A detailed description of the hydrogeologic characteristics immediately below the TA-39-6 open detonation unit is not currently documented in published or internal reports. However, a discussion of surface water, the vadose zone, and groundwater specific to Operable Unit 1132, which includes TA-39, and a conceptual hydrogeologic model of the area is presented in Section 3.7 of the RFI Work Plan for Operable Unit 1132 (LANL 1993b). Additional hydrologic information for the areas surrounding the TA-39-6 open detonation unit is presented in the Investigation Report for North Ancho Canyon Aggregate Area, Revision 1 (LANL 2010a).

Flow from Ancho Spring supports a short 0.5-mile perennial surface-water reach that typically goes dry before reaching the Rio Grande. However, Ancho Canyon is classified as a dry canyon, as described by Birdsell et al. (2005). Generally, on the Pajarito Plateau, dry canyons have relatively small catchment areas (less than 13 square kilometers), experience infrequent surface flows, and have limited or no saturated alluvial systems. The hydrologic conditions yield little down canyon, near-surface contaminant migration and are characterized by very slow unsaturated water flow from the surface to the regional aquifer. Because surface-water flow is infrequent and shallow alluvial groundwater is not common, contaminants largely remain near their original sources, predominantly in soil and sediment. Net infiltration beneath dry canyons is low, with rates generally believed to be less than tens of mm/yr. and commonly on the order of 1 mm/yr. or less. Finally, transport times to the regional aquifer beneath dry canyons are expected to exceed hundreds of years.

The only aquifer in the Los Alamos area capable of municipal and industrial water supply is the regional aquifer. There are no municipal supply wells downgradient of the TA-39-6 open detonation unit. The regional water table is approximately 560 ft. below the TA-39-6 open detonation unit. Upper levels of the regional aquifer on the Pajarito Plateau are predominantly under phreatic (unconfined) conditions (LANL 2009b). The deep portion of the regional aquifer is predominantly under confined conditions, and it is the portion of the regional aquifer influenced by Pajarito Plateau municipal supply pumping. The intensive pumping causes very small water-level fluctuations in the upper (phreatic) portions of the aquifer. Seasonal water-table fluctuations of less than 0.5 ft. have been observed at monitoring well R-31 (Koch and Schmeer, 2010), located 1,550 ft. southeast of the TA-39-6 open detonation unit. These low-magnitude responses in the phreatic zone from municipal well pumping are in sharp contrast to the much larger (10 to 20 ft.) responses at monitoring wells completed in deeper parts of the aquifer (e.g., well R-20 screen 3 in Pajarito Canyon near PM-2), indicating that the hydraulic communication is poor between the phreatic zone and deeper parts of the aquifer. The small-scale fluctuations in the phreatic zone may be from drawdowns and/or strata compaction. The small water-level fluctuations do not seem to affect the magnitudes and directions of groundwater flow. Capture of contaminants by municipal supply wells is unlikely because of this poor vertical hydraulic communication. Additionally, the small hydraulic response observed at well R-31 is attributable to pumping at the nearest municipal supply well PM-2, which is located 14,775 ft. north of the TA-39-6 open detonation unit. As a result, contaminant migration follows the ambient water-table gradients rather than diverting towards the pumping water supply wells, based on hydraulic data. Based on water table maps, regional groundwater flow in the vicinity of the TA-39-6 open detonation unit is expected to be towards the southeast.

4.18.1.2 *Groundwater Monitoring and Reporting*

LANL has an established groundwater monitoring network to assess the quality of groundwater in the Los Alamos area. The monitoring network includes monitoring wells, water-supply wells, surface-water

sampling stations, and springs located both inside and outside the LANL boundary. Three groundwater zones—alluvial, perched-intermediate, and regional groundwater—are monitored as part of the monitoring network. Sample locations, analytical suites, and sampling schedules for the monitoring network are identified in the most recent version of the IFGMP (~~LANL-2020a~~LANL 2025), a document updated annually with approval by NMED-HWB in accordance with the June 2016 Compliance Order on Consent as revised in 204 (New Mexico 2016). These water-quality data are used for characterization purposes, to support corrective-measures work conducted at sites around the Facility, and to support general surveillance. Map 3 within the concurrent submittal of the *LANL General Part A Permit Application, Revision 11.0* (LANL 2025), shows the locations of all wells sampled as part of the IFGMP. The TA-36 topographic map within the LANL General Part A Permit Application shows the locations of IFGMP wells pertinent for monitoring groundwater downgradient of the TA-36-8 open detonation unit. The TA-39 topographic map within the LANL General Part A Permit Application shows the locations of the IFGMP wells pertinent for monitoring the TA-39-6 open detonation unit. These topographic maps also include wells upgradient of the TA-36-8 and the TA-39-6 open detonation units that provide baseline information about groundwater quality entering the site.

The locations of routinely monitored wells that are downgradient of the TA-36-8 and the TA-39-6 open detonation units are shown on figures within Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*. The monitoring schedule for these wells is also included within Supplement 4-2. Details can be found in the most current version of the IFGMP. Groundwater is also monitored, annually, directly downgradient of the TA-36-8 and TA-39-6 units at seven spring locations (Spring 5, Spring-5B, Ancho Spring, Spring 6, Spring 6A, Spring 8A, Spring 9, and Spring 9A) located in White Rock Canyon along the Rio Grande. Surface and groundwater samples collected under the IFGMP are routinely analyzed for potential contaminants and other water-quality parameters. Figures and summary of the data from 2000 to present for the monitoring locations are provided in Supplement 4-2 of this Permit Renewal Application. The data indicate that no constituents related to the operations at these units have impacted groundwater at levels exceeding applicable standards. The sampling results are also published in periodic groundwater-monitoring reports submitted to the NMED-HWB and in the Facility's annual environmental reports. Tables and figures are located in Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*.

4.18.2 Protection of Surface Water/Wetlands/Soil Surface

As required by 40 CFR §264.601(b), the open detonation units are located in a remote area and are operated in a manner that prevents any releases that might have adverse effects on human health or the environment as a result of migration of waste constituents in surface waters, wetlands, or on the soil surface. General operation of these units includes incorporating best management practices, such as the following: spill prevention and response; control of storm water run-on and runoff; installation of erosion and sediment controls; personnel training; and good housekeeping practices.

4.18.2.1 Surface Water

Storm water discharges from both of these units are regulated under the Clean Water Act by the National Pollutant Discharge Elimination System (NPDES) permit program. Prior to the issuance of the current-first LANL Storm Water Individual Permit in 2010, these open detonation units were regulated under the Multi-Sector General Permit (MSGP) for Storm Water Discharges Associated with Industrial Activity. The LANL Storm Water Individual Permit (NM0030759) issued by the EPA, Region 6, became

effective on November 1, 2010. ~~The current LANL Storm Water Individual Permit and~~ expired on March 31, 2014, ~~but it has been~~. This initial permit ~~waste~~ administratively continued, ~~pending issuance of a new permit. The EPA until the current issued LANL a draft Storm Water Individual Permit was issued by EPA Region 6 on June 29, 2022. The current LANL Storm Water Individual Permit became effective on August 1, 2022, and will expire November 30, 2019. A final Permit is expected following a public comment period, which ends on July 31, 20272020.~~ Additional historic surface water compliance information and Permit applicability is included in Section 2.3.2, "Protection of Surface Water/Wetlands," of the Los Alamos National Laboratory Permit Modification Request for Open Detonation Units at Technical Areas 36 and 39 (TA-36-8 and TA-39-6), Revision 0 (LANL 2011).

The LANL Storm Water Individual Permit contains nonnumeric technology-based effluent limitations, coupled with a comprehensive, coordinated monitoring program and implementation of corrective actions where necessary, to minimize pollutants in LANL's storm water discharges from SWMUs and AOCs. LANL must implement site-specific control measures (including best management practices) to address the nonnumeric technology-based effluent limits contained in the LANL Storm Water Individual Permit, followed by confirmation monitoring against New Mexico water-quality criteria-equivalent target action levels to determine the effectiveness of the site-specific measures. If target action levels are exceeded, corrective actions detailed in the LANL Storm Water Individual Permit are initiated and additional confirmation monitoring is conducted following completion of corrective actions. Monitoring of storm water under the LANL Storm Water Individual Permit has been ongoing since 2011.

4.18.2.1.1 Hydrologic Assessment and Surface Water Flow

Net annual precipitation for the Los Alamos area, including the open detonation units, is low. Surface waters within LANL ~~are limited to~~ primarily consist of ephemeral or intermittent flows in the canyon bottoms that result from rainfall or snowmelt. On LANL property there are four spring-fed perennial reaches located in Pajarito Canyon, Canon de Valle, Water Canyon, and Ancho Canyon (fed by Ancho Spring). Effluent supported perennial flow on LANL property is limited to Sandia Canyon. The locations of these surface waters, including intermittent streams, at each of the open detonation units are located on figures within Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*.

The TA-36-8 open detonation unit is located near the headwaters of Fence Canyon, which connects geographically to Potrillo Canyon but does not discharge into it. Drainage from this unit flows east to Fence Canyon (receiving water). The stream flow in Fence Canyon and Potrillo Canyon is ephemeral and occurs ~~only~~ as the result of rainfall or snowmelt. Currently, LANL Storm Water Individual Permit monitoring is conducted below the point of discharge from the TA-36-8 open detonation unit, prior to entering Fence Canyon. Surface waters from the upstream portion of the Potrillo Canyon watershed do not contribute to flows that reach the Rio Grande through Water Canyon (LANL 1993a). Canyon bottom surface waters from Potrillo Canyon downstream of the TA-36-8 open detonation unit eventually flow into Water Canyon. A gaging station (E267) in Potrillo Canyon, located 3 miles upstream of the Rio Grande, recorded ~~no flow for 16 days of flows and a total volume of 1.94 acre-feet during~~ water year ~~2019~~2025.

The TA-39-6 open detonation unit is located in a tributary of the north branch of Ancho Canyon. All runoff from the TA-39-6 open detonation unit eventually flows to the main Ancho Canyon watercourse. ~~Pervious~~Impervious surfaces ~~comprise~~cover 99% of the ~~200.42~~197-acre watershed that comprises the

site monitoring area (SMA). The stream flow from Ancho Spring supports a short perennial reach in lower Ancho Canyon but the majority of Ancho Canyon is ephemeral and occurs ~~only~~ as the result of rainfall or snowmelt. Canyon bottom surface waters from the north branch of Ancho Canyon eventually flow into the main channel of Ancho Canyon. A gaging station (E275) in Ancho Canyon, located approximately 2 miles upstream of the Rio Grande, recorded ~~two~~three days of flow ~~for E275~~ in water year ~~2019~~2025. Total flows of 11.13 acre-feet and, with a recorded maximum daily flow ~~for water year~~ of ~~1368.9~~ cubic feet per second were recorded at E275 during water year 2025.

4.18.2.1.2 Monitoring and Reporting

The open detonation units were historically permitted under the National Pollutant Discharge Elimination System MSGP for Storm Water Discharges Associated with Industrial Activity. This permit coverage was replaced by the LANL Storm Water Individual Permit when it first became effective in 2010. Baseline storm water controls and other measures, including collection of storm water samples, have been implemented at both open detonation units, in accordance with applicable LANL Storm Water Individual Permit requirements.

LANL Storm Water Individual Permit controls incorporated into the TA-36-8 open detonation unit [identified as AOC 36-004(c)] include established vegetation, earthen and rock berms, earthen channel/swales, a water bar, riprap, an infiltration basin, a coir log, and rock check dams to control run-on and runoff of storm water and erosion and movement of sediment from the site.

LANL Storm Water Individual Permit controls incorporated into the TA-39-6 open detonation unit [identified as SWMU 39-004-(c)] include established vegetation, berms, swales, riprap, ~~and~~ rock check dams, and rock caps, the combination of which control storm water run-on and runoff, erosion, and movement of sediment from the site, as discussed in Section 4.12.1, *Containment Systems*.

For both units, these controls are designed to prevent pollutant migration that could affect surface water quality. Stormwater runoff monitoring at both open detonation units has been underway since the implementation of the LANL Storm Water Individual Permit in 2011.

Stormwater discharge from TA-36-8 open detonation unit is monitored from LANL Storm Water Individual Permit Site Monitoring Area F-SMA-2. Following the installation of baseline control measures, a baseline storm water sample was collected on August 15, 2011. Analytical results from this sample yielded the following target action level exceedances:

- Aluminum (dissolved) concentration of 866 micrograms per liter (µg/L) (maximum target action level is 750 µg/L)
- Copper (dissolved) concentration of 72.5 µg/L (maximum target action level is 4.3 µg/L)
- Gross-alpha activity of 140 picocuries per liter (pCi/L) (average target action level is 15 pCi/L).

Following the installation of enhanced control measures at F-SMA-2, corrective-action storm water samples were collected on July 15, 2014, and July 31, 2014. Analytical results from these corrective-action monitoring samples yielded the following target action level exceedances:

- Copper (dissolved) concentrations of 10.8 µg/L (maximum target action level is 4.3 µg/L)
- Gross-alpha activities of 112 pCi/L and 58.9 pCi/L (average target action level is 15 pCi/L).

Following the 2015 installation of enhanced control measures at F-SMA-2, a corrective-action stormwater sample was collected on August 26, 2021. Analytical results from this sample yielded the following target action level exceedances:

- Aluminum (dissolved) concentration of 839 µg/L (exceeded the maximum target level of 750 µg/L)
- Copper (dissolved) concentration of 8.87 µg/L (exceeded the maximum target action level of 4.3 µg/L)
- Gross-alpha activity of 37.2 pCi/L (exceeded the average target action level of 15 pCi/L)
- Selenium (total) concentration of 6.91 µg/L (exceeded the average target action level of 5 µg/L).

A second corrective-action confirmation-monitoring sample was collected on July 27, 2022. Analytical results from this sample yielded the following target action level exceedances:

- Aluminum (total) concentration of 120000 µg/L (exceeded the maximum target action level of 1241 µg/L)
- Copper (dissolved) concentration of 10.7 µg/L (exceeded the maximum target action level of 6.69 µg/L)
- Selenium (total) concentration of 14.2 µg/L (exceeded the average target action level of 5 µg/L).

In the initial Sample Implementation Plan for the 2022 Individual Permit, F-SMA-2 was screened into Long-term Stewardship status in accordance with Part 1.C.3 of the Individual Permit, effective July 5, 2023. No stormwater monitoring has been conducted at F-SMA-2 since 2022.

Site history and shallow (i.e., less than 3 ft. below ground surface) soil-sampling data (where available) are used to determine whether the target action level exceedance constituent(s) may be related to historical industrial activities.

Copper was likely associated with industrial materials historically managed at this site. Copper was detected in 5 of 14 soil samples at maximum concentration 2.9 times the sediment's background value.

Alpha-emitting radionuclides are known to be associated with industrial materials historically managed at AOC 36-004(c)/TA-36-8. Consent Order samples were not analyzed for gross-alpha radioactivity but were analyzed using gamma spectroscopy, which can detect americium-241 and uranium-235, and for uranium isotopes, all of which are alpha-emitting radionuclides. Alpha-emitting radionuclides managed by the Permittees are exempt from regulation under the Clean Water Act and are excluded from the definition of adjusted gross-alpha radioactivity.

Target action level exceedances were also evaluated against the appropriate storm water background value, that is, ~~“Bandelier Tuff background” for undisturbed SMAs or “site specific and derived from the percent pervious (undeveloped) and impervious (developed) background” for urban settings areas within the drainage area.~~ Background values are expressed as ~~the 90th percentile upper tolerance limits using the approved EPA method to calculate background values included in Appendix C to the LANL Storm Water Individual Permit. Upper tolerance limits for undisturbed SMAs were derived from storm water runoff containing entrained sediments derived from Bandelier Tuff. Upper tolerance limits developed for urban settings were derived from runoff from developed landscapes on the Pajarito Plateau, including buildings, parking lots, roads, and associated features.~~ Monitoring location F-SMA-2 is 1% impervious and 99% pervious. F-SMA-2 receives storm water run-on from developed environments,

including paved parking lots, roads, and buildings, as well as locations with sediment derived from Bandelier Tuff. Metals including copper are associated with building materials, parking lots, and automobiles. Gross alpha in Bandelier Tuff is associated with naturally occurring radioactive uranium- and thorium-bearing minerals.

- Copper— ~~The composite copper's upper tolerance limit from developed landscape storm water run-on is 32.3 µg/L; copper background threshold value for F-SMA-2 for copper is 3.2 µg/L storm water upper tolerance limit from locations with sediment derived from Bandelier Tuff is 3.43 µg/L. The copper results from 2011, 2014, 2021, and 2022 are is greater than both values, whereas the 2014 results are between these two values this value.~~
- Gross alpha— ~~The composite background threshold value for F-SMA-2 for the gross-alpha is 57.1 background upper tolerance limit for locations with sediment derived from Bandelier Tuff is 1490 pCi/g (result is SCC normalized) L, and the gross-alpha background storm water upper tolerance limit for storm water run from a developed landscape is 32.5 pCi/L. The 2011 and 2014 samples did not collect suspended sediment concentration and cannot be compared to the background threshold value. The 2021 and 2022 gross-alpha results were below the background threshold value are between these two values.~~

Stormwater discharge from TA-39-6 open detonation [identified by the LANL Storm Water Individual Permit as SWMU 39-004(c)] is monitored from LANL Storm Water Individual Permit Site Monitoring Area A-SMA-3 along with another site [AOC 39-002(b)]. Following the installation of baseline control measures, including vegetation, a rock berm and rock check dams, a baseline storm water sample was collected on July 25, 2013. ~~Silver is reported as a nondetectable result equal to or greater than the target action level. This value is reported at the practical quantitation level; however, the maximum target action level for this analyte is below the target action level.~~ Analytical results from this sample yielded the following target action level exceedances:

- Aluminum (dissolved) concentration of 997 µg/L (maximum target action level is 750 µg/L)
- Copper (dissolved) concentration of 245 µg/L (maximum target action level is 4.3 µg/L)
- Mercury (total) concentration of 9.04 µg/L (average target action level is 0.77 µg/L)
- Selenium (total) concentration of 12.1 µg/L (average target action level is 5 µg/L)
- Gross-alpha activity of 136 pCi/L (average target action level is 15 pCi/L)
- Polychlorinated biphenyl concentration of 3060 ng/L (average target action level is 0.6 ng/L)

Following the installation of enhanced control measures (redi-rock berms, earthen channel and rock channel swale, riprap and rock cap) at A-SMA-3, a corrective action storm water sample was collected on August 10, 2018. Analytical results from this corrective action monitoring sample yielded the following target action level exceedances:

- Copper (dissolved) concentration of 50.2 µg/L (maximum target action level is 4.3 µg/L)
- Gross-alpha activity of 90.8 pCi/L (average target action level is 15 pCi/L)
- PCB concentration of 3400 ng/L (average target action level is 0.6 ng/L)

A partial volume monitoring sample was collected on September 14, 2023, which yielded no target action level exceedances. Confirmation-monitoring samples were collected on August 26 and September 5, 2024. The August sample contained a copper concentration of 6.94 µg/L, which exceeded the

maximum target action level of 5.29 µg/L. The September sample yielded no target action level exceedances.

Site history and shallow (i.e., less than 3 ft. below ground surface) soil-sampling data (where available) are used to determine whether the target action level exceedance constituent(s) may be related to historical industrial activities. Regarding SWMU 39-004(c)/TA-39-6:

- Aluminum is known to be associated with industrial materials historically managed at the site. Aluminum, however, was not detected above background value in 45 shallow (i.e., less than 3 ft. below ground surface) soil samples collected during the 2009 Consent Order investigation and 1995 RFI.
- Copper is known to be associated with industrial materials historically managed at the site. Copper was detected above background value in shallow Consent Order and RFI soil samples. Copper was detected above the soil background value in 15 of 45 shallow samples, with a maximum concentration 180 times the soil background value.
- Mercury is known to be associated with industrial materials historically managed at the site. Mercury was only detected above the soil background value in 2 of 45 shallow samples, with a maximum concentration 85 times the soil background value.
- Selenium is not known to be associated with industrial materials historically managed at the site. Selenium was not detected above background value in 45 shallow Consent Order and RFI soil samples.
- PCBs are known to have been associated with industrial materials historically managed at this site. Three PCB mixtures (Aroclor-1248, Aroclor-1254, and Aroclor-1260) were detected in shallow Consent Order samples. Aroclor-1248 was detected in 32 of 43 shallow samples, with a maximum concentration 3930 times the residential soil screening level. Aroclor-1254 was detected in 1 of 4 shallow samples, with a maximum concentration 52% of the residential soil screening level. Aroclor-1260 was detected in 2 of 4 shallow samples, with a maximum concentration 3.14 times the residential soil screening level.
- Thorium and uranium are known to have been associated with industrial materials historically managed at this site. RFI and Consent Order samples were not analyzed for gross-alpha radioactivity but were analyzed for plutonium, thorium, and uranium isotopes, all of which are alpha-emitting, as well as total uranium, which has alpha-emitting isotopes. Alpha-emitting radionuclides managed by the Permittees are exempt from regulation under the Clean Water Act and are excluded from the definition of adjusted gross-alpha radioactivity.

Target action level exceedances were also evaluated against the appropriate storm water background value, that is site specific and derived from the percent pervious (undeveloped) and impervious (- "Bandelier Tuff background" for undisturbed SMAs or "developed) area within the drainage area background" for urban settings. Background values are expressed as the 90th percentile upper-tolerance limits using the approved EPA method for calculating background values included in Appendix C to the LANL Storm Water Individual Permit. The A-SMA-3 drainage area is classified as 100% pervious therefore the undeveloped background threshold value has been used for comparison at A-SMA-3: Upper-tolerance limits for undisturbed SMAs were derived from storm water runoff containing entrained sediments derived from Bandelier Tuff. Upper tolerance limits developed for urban settings were derived from runoff from developed landscapes on the Pajarito Plateau, including buildings, parking lots, roads, and associated features. Most of the A-SMA-3 drainage area is located on Bandelier

~~Tuff, and there is no run-on from developed facilities (e.g., buildings, parking lots, and pavement). Therefore, the Bandelier Tuff background upper tolerance limit was compared with aluminum, copper, PCBs, and gross-alpha storm water exceedances. Mercury and selenium do not have a sufficient number of detected results to determine the upper tolerance limit background value.~~

- Aluminum—aluminum is a major component of Bandelier Tuff. Aluminum's undeveloped 90th percentile background threshold value upper tolerance limit for storm water containing sediments derived from Bandelier Tuff is 29502210 µg/L; the result from 2013 is less than this value.
- Copper—copper is associated with trace minerals in Bandelier Tuff. Copper's undeveloped 90th percentile background threshold value upper tolerance limit for storm water containing sediments derived from Bandelier Tuff is 3.123.43 µg/L. The copper results from the storm water confirmation samples in 2013 and 2018 are above this value.
- PCBs—the PCB undeveloped 90th percentile background threshold value upper tolerance limit for storm water containing sediments derived from Bandelier Tuff is 12.211.7 ng/L. The average target action level exceedances in the storm water confirmation samples in 2013 and 2018 are greater than the storm water baseline upper-tolerance limit.
- Gross alpha—gross-alpha activity is associated with naturally occurring radioactive uranium- and thorium-bearing minerals in Bandelier Tuff. The gross-alpha undeveloped 90th percentile background threshold value is 57.2 pCi/g (the background threshold value is normalized to SSC); the result from the upper tolerance limit for storm water containing sediments derived from Bandelier Tuff is 1490 pCi/L; the results from 2013 confirmation sample did not collect suspended sediment concentration and cannot be compared to the background threshold value. The -and-2018, 2023, and 2024 confirmation samples wereare below the background thresholdthis value.

Tables and figures are located in Supplement 4-2, *Open Detonation Unit Groundwater Monitoring and Surface Drainage Information*.

4.18.2.2 Soil Surface Monitoring

The texture of the soils in Los Alamos County range from very fine clay and sandy loams to gravelly, sandy loams and stony, clay loams. Soil erosion by storm water or winds could potentially transport contaminants from the open detonation units to surrounding areas. Natural sediment storage features created by surface water runoff, such as stream bank and bar deposits or drainage channels, could contain heavy metals or explosives residues redistributed from the units.

Operational procedures for the open detonation units have been developed (described in previous sections) and are followed using careful assessment to limit the amount of contamination that may enter or remain in the soil. Preventative measures include implementing good housekeeping procedures, using a sufficient charge to ensure complete destruction, and performing effective treatment of the waste.

To meet the requirements of 40 CFR §264.601(b), the firing sites are operated in a manner that minimizes or prevents releases that might have adverse effects to human health or the environment as a result of migration of waste constituents on the soil surface. The following information assesses the potential for adverse effects to human health or the environment as a result of operations at the open

The following sections provide information on the hydrogeology beneath the TA-16-388 Flash Pad and describe monitoring and reporting conducted in and around the area that can be used to assess the impact of open burning operations on groundwater. Tables and figures regarding groundwater flow and monitoring are located in Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application.

5.16.1.1 Hydrogeology in the Vicinity of the TA-16-388 Flash Pad

The TA-16-388 Flash Pad is located in the southwestern portion of LANL in a semiarid, temperate, mountain-climate setting. General geologic and hydrologic characteristics of LANL and land use patterns in the Los Alamos area are discussed in Appendix 1 of the Los Alamos National Laboratory General Part B Permit Application (LANL 2003b).

The TA-16 Burn Ground, where the TA-16-388 Flash Pad is located, is situated on a mesa top within TA-16. A hydrologic conceptual model for TA-16, including the area of the TA-16 Burn Ground, is presented in the TA-16 Well Network Evaluation and Recommendations (LANL 2012b). That document ranks different sources at TA-16 by their potential to impact groundwater. High- and moderate-ranking sources were characterized by significant hydrologic drivers, i.e., either large outfall volumes released to canyons or ponds located on mesa tops. Sources were also characterized in terms of the release of large inventories or high contaminant concentrations. Both of these conditions are necessary to consider an area to have a high or moderate impact to groundwater. The TA-16 Burn Ground area was ranked as a low-priority source for its potential to impact groundwater, because it lacks both a large contaminant inventory and a large volume of water to provide a hydrologic driving force for contaminant infiltration.

5.16.1.2 Existing Quality of Groundwater

~~From 1981 to 2010, the~~The average annual precipitation in Los Alamos County ~~is 17.36~~~~was 18.97~~ inches and the average annual snowfall ~~is 43~~~~was 57.5~~ inches (LANL 2021~~LANL 2012a~~). The evaporation rate of freestanding water exceeds the average annual precipitation. Infiltration is limited and generally occurs in canyons or on mesas at sites that release large volumes of water (LANL 2011a; LANL 2012b). The topographic map for TA-16 within the concurrent submittal of the *LANL General Part A Permit Application, Revision 11.0* (LANL 2025), and the table within Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application, present the locations of all monitored springs and wells (regional, intermediate, and alluvial) that are pertinent to the TA-16 Burn Ground to evaluate potential impacts from the TA-16-388 Flash Pad. The table also contains monitoring data for groundwater contaminants in alluvial, perched-intermediate, and regional groundwater zones near the TA-16 Burn Ground that are equal to or exceed applicable regulatory screening levels.

Discharges from past explosives-manufacturing activities at TA-16 (high- and moderate-ranking sources, particularly at the nearby TA-16-260 outfall) are believed to be the dominant sources of the constituents found in deep groundwater (LANL 2011a; LANL 2012b). Contaminants are present in groundwater collected from springs and groundwater monitoring wells located at TA-16. It is believed that the spring contamination may be the result of ponded water on the mesas (e.g., historical and current ditches and ponds) and potentially the presence of fractures as infiltration pathways. The wells showing the highest contaminant concentrations are downgradient of higher priority TA-16 sources. However, those wells are located along infiltration pathways that are not downgradient of the TA-16-388 Flash Pad.

5.16.1.3 Quantity and Direction of Groundwater Flow

The only aquifer in the Los Alamos area capable of municipal and industrial water supply is the regional aquifer. The regional water table is approximately 1,200 ft. below the TA-16 Burn Ground. This aquifer occurs primarily within the poorly to semi-consolidated basin-fill sediments of the Santa Fe Group. The total thickness of the Santa Fe Group beneath the Pajarito Plateau is poorly defined. The deepest well on the plateau (PM-5), with a depth of 3,110 ft., does not fully penetrate the base of the basin-fill sediments. Estimates of the total thickness of these sediments range from 6,650 ft. in the central basin to as much as 9,000 to 10,000 ft. in the central and western parts of the basin (Broxton and Vaniman, 2005). Given the average long term water level declines on the order of 1.2–1.3 ft./yr., the aquifer should meet projected water demands for hundreds of years.

Water supply well PM-5, the nearest water-supply well to the TA-16-388 Flash Pad, is located approximately 16,000 ft. (3 miles) to the northeast. Water-supply well PM-4 is located approximately 19,000 ft. (3.6 miles) east of the TA-16-388 Flash Pad, and PM-2 is located approximately 21,000 ft. (4 miles) southeast of the unit. Upper levels of the regional aquifer on the Pajarito Plateau are predominantly under phreatic (unconfined) conditions (LANL 2011a).

5.16.1.4 Current and Potential Groundwater Users

The deep portion of the regional aquifer is predominantly under confined conditions, and it is the portion of the regional aquifer influenced by Pajarito Plateau municipal supply pumping (note: neither the alluvial or perched groundwater systems are influenced by municipal water supply pumping). At TA-16, water-supply pumping does not cause any obvious water-level responses in either shallow or deep aquifer screens for those regional aquifer wells near the TA-16-388 Flash Pad (LANL 2011a). As a result, potential contaminant migration follows the ambient water-table gradients rather than diverting towards the water supply wells. Based on hydraulic data, capture of potential contaminants near the water table by municipal supply wells is unlikely. Based on water table maps, the regional groundwater flow direction in the vicinity of the TA-16 Burn Ground is expected to range from east-northeast to east-southeast. Because the TA-16-388 Flash Pad has a low likelihood of impacting groundwater beneath TA-16, impact at the water-supply wells is even less likely. Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application, includes figures that show the locations of groundwater monitoring wells and springs that are pertinent for evaluating potential impacts of the TA-16-388 Flash Pad and data tables with groundwater monitoring information.

5.16.1.5 Groundwater Monitoring and Reporting

LANL has established a groundwater monitoring network to assess the quality of groundwater in the Los Alamos area. The monitoring network includes monitoring wells, water-supply wells, surface-water sampling stations, and springs located both inside and outside the LANL boundary. Three groundwater zones (alluvial, perched-intermediate, and regional groundwater) are monitored as part of the monitoring network. Sample locations, analytical suites, and sampling schedules for the monitoring network are identified in the IFGMP (~~LANL 2025~~~~LANL-2020a~~). The IFGMP is updated annually with approval by NMED-HWB, in accordance with the June 2016 Compliance Order on Consent, referred to as the Consent Order (New Mexico 2016 (modified 2024)). The groundwater monitoring points provide information regarding potential impacts to groundwater from contaminant sources upgradient of the TA-16-388 Flash Pad.

A summary of the data from 2000 to the present for locations both upgradient and downgradient of the TA-16 Burn Ground is provided in Supplement 4-11. The table shows the frequency of detections above the listed regulatory standards for constituents potentially related to operations at the TA-16-388 Flash Pad. A key confounding factor regarding the groundwater monitoring data is that constituents of concern are common across TA-16 and are predominantly attributable to sources other than those at TA-16-388 Flash Pad, many of which have substantially higher amounts of contamination associated with releases to the environment. Therefore, Supplement 4-11 includes data from groundwater monitoring locations that are upgradient of the TA-16 Burn Ground to provide local baseline groundwater conditions for comparison to groundwater data collected to monitor the TA-16-388 Flash Pad. The sampling results are also published in periodic groundwater monitoring reports submitted to the NMED-HWB and in the Facility's annual environmental reports.

5.16.2 Protection of Surface Water/Wetlands/Soil Surface

As required by 40 CFR §264.601(b), the TA-16-388 Flash Pad is operated in a manner that prevents any releases that might have adverse effects on human health or the environment caused by migration of hazardous waste constituents in surface waters or wetlands. There are no permanent surface-water bodies within the confines of the Flash Pad and the unit operations will not utilize water. However, as discussed within this section, surface-water runoff from the Flash Pad has the potential to flow and impact Fishladder Canyon, which in turn is a tributary to Cañon de Valle. As used in this section, "surface waters" includes storm water runoff and snowmelt runoff that can create sheet flow across the site. In addition, there is a wetland located approximately 1,500 ft. away from the TA-16-388 Flash Pad.

The following factors were considered in the surface-water analysis discussed below:

- The volume and physical and chemical characteristics of the waste in the unit.
- The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration.
- The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit.
- The patterns of precipitation in the region.
- The quantity, quality, and direction of groundwater flow.
- The proximity of the unit to surface waters.
- The current and potential uses of nearby surface waters and any water quality standards established for those surface waters.
- The existing quality of surface waters and surface soils, including other sources of contamination and their cumulative impact on surface waters and surface soils.
- The patterns of land use in the region.
- The potential for health risks caused by human exposure to waste constituents.
- The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.

5.16.2.1 Hydrologic Assessment and Surface Water Flow

Located in the southwestern portion of LANL, TA-16 occupies portions of the Water Canyon, Cañon de Valle, and S-Site Canyon watersheds. The TA-16-388 Flash Pad is located on the mesa top in TA-16's northeastern corner, which lies within the Cañon de Valle watershed. This watershed extends east-

southeast across LANL from TA-16 to its confluence with Water Canyon at the boundary between TA-15 and TA-37. Surface water in TA-16 consists of storm water runoff, snowmelt runoff, and perennial spring flow that drains in small drainages or by sheet flow into Cañon de Valle. Surface water in Cañon de Valle to the north of the TA-16 Burn Ground is perennial from Burning Ground Spring to a stream gage (E256) below MDA P, which is a SWMU on the northern portion of the mesa top for which corrective actions are complete. From the southern portion of the TA-16 Burn Ground, where the TA-16-388 Flash Pad is located, intermittent surface water occurs from natural and anthropogenic sources from gage station (E257) to the Cañon de Valle confluence with Water Canyon.

Surface-water runoff from the TA-16-388 Flash Pad flows southwest to a small tributary to Fishladder Canyon, which in turn is a tributary to Cañon de Valle. Fishladder Canyon is located between the main channel of Cañon de Valle and S-Site Canyon, with a drainage length of approximately 3.5 kilometers (2.2 miles) and a drainage area of approximately 1.2 square kilometers (0.4 square miles). Surface water in the vicinity of the TA-16 Burn Grounds consists of storm water and snowmelt runoff that may flow by small drainages or sheet flow into Fishladder Canyon. Fishladder Seep is located in a hanging valley approximately 800 ft. southeast of the Burning Ground. Alluvial groundwater occasionally discharges at Fishladder Seep, although the prevalence of surface flow in Fishladder Seep has decreased significantly in recent years. Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application, contains a figure of drainage (Figure 4.11-1) near the open burning unit.

The US Army Corps of Engineers has identified and delineated a small wetland in this area (ACOE 2005). Wetland 16-1 is approximately 70 ft. long and 20 ft. wide, with an area of 0.03 acres. The wetland is more than 1500 ft. away from the TA-16-388 Flash Pad and is unlikely to be impacted by activities at the open burning unit.

Surface water within the Cañon de Valle watershed has been detrimentally impacted by two severe forest fires (LANL 2011a). In May 2000, the Cerro Grande fire burned the headwaters of Cañon de Valle and Water Canyon west of LANL, and also burned a large part of the Water Canyon watershed within LANL, including areas in TA-08, TA-09, TA-11, TA-14, TA-15, TA-16, TA-28, and TA-37. Various naturally occurring inorganic chemicals (e.g., barium, cobalt, and manganese) and anthropogenic fallout radionuclides (e.g., cesium-137, plutonium-239 and -240, and strontium-90) were concentrated in Cerro Grande ash at levels exceeding that of background sediment before the fire, and the transport of ash has resulted in elevated levels of these analytes in post-fire sediment deposits in some canyons.

In June 2011, the Las Conchas fire burned the headwaters of Cañon de Valle and Water Canyon west of LANL. The upper Cañon de Valle watershed was burned more severely than the upper Water Canyon watershed: 60% of the Cañon de Valle watershed within the burn perimeter was classified as high or moderate severity. Floods in July and August 2011 transported ash from the burn area onto LANL; it is expected that various inorganic chemicals and fallout radionuclides will be elevated in these media similar to the baseline samples collected from post-Cerro Grande fire runoff.

5.16.2.2 Surface Water Monitoring and Reporting

Protection of surface water is established by implementation of a Clean Water Act National Pollutant Discharge Elimination System storm water individual permit associated with industrial activities from certain SWMUs and AOCs (referred to as the "LANL Storm Water Individual Permit") (NPDES Permit No.

NM0030759). The first LANL Storm Water Individual Permit was initially effective on November 1, 2010, ~~and. The LANL Storm Water Individual Permit expired on March 31, 2014, and has been. This permit waste~~ administratively continued until the current Individual Permit became effective on August 1, 2022, and will expire pending issuance of a new permit. A draft permit was issued by the EPA on November 30, 2019. A final permit is expected following a public comment period, which ended on July 31, 20272020. The 2005 Consent Order (New Mexico 2005) designated the TA-16-388 Flash Pad as SMWU [16-010(c)], regulated under the LANL Storm Water Individual Permit. However, under the 2016 Consent Order (New Mexico 2016 (modified 2024)), the unit is identified as a permitted unit and is regulated by the 2010 Permit. A request to remove the TA-16-388 Flash Pad from the LANL Storm Water Individual Permit is currently pending with the EPA. Until the unit is removed from the LANL Storm Water Individual Permit, it will be monitored in compliance with that permit.

The LANL Storm Water Individual Permit contains non-numeric technology-based effluent limitations, coupled with a comprehensive, coordinated monitoring program and corrective action where necessary, to minimize pollutants in storm water discharges from sites. LANL is also required to implement site-specific control measures (including best management practices) to address the non-numeric technology-based effluent limits contained in the LANL Storm Water Individual Permit, followed by confirmation monitoring against New Mexico water-quality-criteria-equivalent target action levels to determine the effectiveness of the site-specific measures. If target action levels are exceeded, corrective actions detailed in the LANL Storm Water Individual Permit are initiated and additional confirmation monitoring is conducted, following completion of corrective actions. ~~The LANL Storm Water Individual Permit designates SWMU 16-010(c) as a Moderate Priority Site with a corrective action deadline of October 31, 2015.~~

Installation of baseline control measures at CDV-SMA-2.5 (Cañon de Valle-Site Monitoring Area-2.5) were completed on December 15, 2010, and certified on January 12, 2011 (LANL 2011b). The active control measures are listed in the 2025 update 2020 Individual Permit Annual Report (LANL 2020b) and the 2019 update to the Individual Permit Site Discharge Pollution Prevention Plan (LANL 2026 [EMID-704311] LANL 2020c). The control measures include established vegetation, an earthen berm, ~~straw wattles~~ a rock berm, riprap-lined channels/swales, and rock check dams that function as run-on, runoff, erosion, and/or sediment controls.

The pollutants of concern to be monitored for each SMA are specified in the Sampling Implementation Plan (LANL 2026, EMID-704370). Storm water monitoring is not currently required at CDV-SMA-2.5. At a minimum, all SMAs must be initially monitored for metals, gross-alpha radiation, Ra-226 + Ra-228, and cyanide (weak acid dissociable). The storm water monitoring requirement for CDV-SMA-2.5 also includes high explosives and SVOCs. Baseline confirmation monitoring at CDV-SMA-2.5 started in May 2011 at station SS090420, which is collocated with the E257 station (shown on Figure 4.11-1 within Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*). Baseline confirmation samples were collected on September 1, 2011, and October 12, 2012. No target action level exceedances were observed. However, the SVOC results from the 2012 sample were rejected as an outcome of data validation and are not usable for confirmation sampling assessment. A second sample was collected on July 26, 2013, and analyzed for SVOCs. No target action level exceedances were observed, thereby completing baseline confirmation monitoring.

~~Because this SWMU is an active hazardous waste management treatment unit, it is no longer subject to the Consent Order. A request to remove this site from the LANL Storm Water Individual Permit is currently pending with the EPA. Until this site is removed from the LANL Storm Water Individual Permit, it will be monitored in compliance with that permit.~~ Supplement 4-11, *Open Burning Unit Groundwater Monitoring and Surface Drainage Information*, of this Permit Renewal Application, contains a figure of drainage near the open burning unit.

5.16.2.3 Soil Surface Monitoring

The following paragraphs detail soil monitoring efforts at the TA-16-388 Flash Pad, in accordance with the requirements in 40 CFR §264.602(b). Description of modeling associated with the potential for soil deposition as a result of modeled air impacts at the TA-16-388 Flash Pad is included in Supplement 4-3, *Hybrid Air Modeling Analysis and Ecological and Health Risk Assessment for Open Burning and Open Detonation Operations at Los Alamos National Laboratory*, of this Permit Renewal Application. This modeling is discussed in the next section.

In 2009, 2012, and 2013, soil sampling occurred using grab sampling to collect soil samples to measure soil constituent levels at the TA-16-388 Flash Pad. A summary of the soil laboratory analytical results for the 2012 and 2013 sample collection events and a comparison of those results to the 2009 data are included in Attachment F of *Class 3 Permit Modification Request for Addition of an Open Burning Unit at Technical Area (TA) 16 to the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit*, EPA ID No. NM0890010515 (LANL 2013).

The most recent soil-sampling event occurred on September 2018, to continue to monitor and assess soil constituents at the TA-16-388 Flash Pad site. Sample locations were selected based on areas where deposition from air to soil is likely to occur and at locations of storm water runoff. Soil samples were collected from the ground surface to 2 inches below the ground surface and analyzed for constituents of concern. The laboratory soil analytical results were compared to established background values and New Mexico residential soil screening limits. The soil analytical results demonstrate that the majority of constituents analyzed for were nondetect. Soil sample concentrations were measured above their background values for eight inorganic constituents, but the concentrations did not exceed the soil screening levels. Supplement 4-14, *2018 Soil Sampling Results Summary Report for the Open Burning Unit at Technical Area (TA) 16-388 Flash Pad*, of Appendix 4 of this Permit Renewal Application, includes the most current soil analytical summary for the open burning unit and provides more detailed information regarding the soil sampling and analytical results.

5.16.2.4 Assessment of Potential Health Risks

Using the 2018 soil-sampling analytical results, risk assessment analyses were conducted to assess the potential for risk to human and ecological receptors from the open burning treatment unit. The assessments are included as Supplement 4-15, *Technical Area 16 - Open Burn/Open Detonation (OB/OD) Area - Technical Area 16-388 Flash Pad Human Health and Ecological Risk Screening Assessments*, of this Permit Renewal Application. The human health risk assessment concluded that there are no unacceptable risks associated with the constituents measured within the soil. The ecological risk assessment concluded that there is a minimal risk to ecological receptors. The detected concentrations of barium above background levels presents a potential risk to plants. However, no effects on plants were noted during a site visit. The calculation of risk presented by the detected concentrations of dioxins/furans in the soils demonstrates that the low-effect ecological screening level for mammals and

Addendum 3

Procedures and guidance documents for high volume air sampling

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**Environment, Safety, Health, and Quality Directorate****Environment Protection and Compliance – Compliance Programs Group****Technical Procedure****Using High Volume Air Samplers**

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EPC-CP Reviewer:	Organization:	Signature:	Date:
Dave Fuehne, RAEM Team Leader	EPC-CP	Signature on File	10-24-2023
EPC-CP RLM:	Organization:	Signature:	Date:
Sarah Holcomb, Acting Group Leader	EPC-CP	Signature on File	10-24-2023

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REVISION HISTORY

Document Number and Revision <i>[Include revision number, beginning with Revision 0]</i>	Effective Date <i>[Document Control Coordinator inserts effective date]</i>	Description of Changes <i>[List specific changes made since the previous revision]</i>
ESH-17-240, R0	2/20/01	New document
RRES-MAQ-240, R1	12/1/03	Update descriptions and process steps, add steps to require marking of extension cords that power samplers.
ENV-MAQ-240, R2	2/4/05	Revision of Attachment 1 Hazard Control Plan to Hazard Review.
SOP-5174, R0	4/16/09	New document number and reformatted for WES division. Formerly ENV-MAQ-240.
SOP-5174, R1	10/05/2010	Added equipment list, changed to ESH&Q directorate, added step for cleaning filter holder and wearing nitrile gloves, added specific records generated.
EPC-CP-SOP-5174, R2	04/20/2017	Added sections for operation, calibration verification, and 15 point calibration of the HVP-5200AFC samplers, and for operation of remote start hi-volume samplers. This document replaces SOP-5174 R1.
EPC-CP-TP-5174, R0	10/22/2020	This document replaces EPC-CP-SOP-5174.R2. This update includes updating appropriate sections to reflect regulations and organizational changes. Implements new EPC-CP template. Portions of ENV-EAQ-145 have been incorporated into this document.
EPC-CP-TP-5174, R1	10/24/2023	This document supersedes EPC-CP-TP-5174, R0. Triennial review – updated references throughout, minor editorial corrections throughout, and updates to language in Sections 1, 2, 5, and 6 to standardize it across procedures. Also updated the analytical laboratory reference in Section 3.1.2 number 2.

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1.0 INTRODUCTION

Emissions of airborne radionuclides from Los Alamos National Laboratory (LANL) are regulated by the U.S. Environmental Protection Agency (EPA) and the Department of Energy (DOE). Routine measurement and reporting of radionuclide concentrations in the ambient air is required. LANL's ambient air sampling network (Airnet) is administered by the Radioactive Air Emissions Management (RAEM) team within the Environmental Protection & Compliance Division (EPC), Compliance Programs Group (EPC-CP). A full description of the program is available in [EPC-CP-PIP-5140](#), *Radiological Air Sampling Network*.

1.1 Purpose

This EPC-CP Technical Procedure (TP) describes the steps used to operate LANL's total suspended particulate (TSP) air samplers. These TSP samplers supplement routine Airnet operations during emergencies, wildfires, or other times when specialized sampling is needed.

1.2 Scope

This TP covers the process and steps to be taken to calibrate, deploy, and use the high-volume TSP air samplers. The following models of TSP samplers are specifically addressed, but the general concepts herein can be used for any type of sampler.

- CF-1003BRL High-Flow sampler
- Hi-Q HVP-3000BRL TSP sampler
- HVP5200AFC

1.3 Applicability

This procedure applies to personnel performing work for the RAEM Team within EPC-CP, including but not limited to Triad employees, subcontractors and suppliers at all tiers (in accordance with subcontract documents), students, guests, and associates.

2.0 PRECAUTIONS AND LIMITATIONS

The work described in this procedure is **Moderate Hazard** field work and has been analyzed by a subject matter expert (SME), the RAEM team leader, and the responsible line manager (RLM) to be moderate-hazard work consistent with LANL procedure [P300](#), *Integrated Work Management (IWM)*. An approved Integrated Work Document (IWD) must be used with this procedure for tasks performed at LANL operating facilities. Work activities must be coordinated with the appropriate Facility Operations Director (FOD).

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

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3.0 PREREQUISITE ACTIONS

In addition to training to this TP, the following activities are also required before performing this procedure:

- Obtain approval from facility management before beginning work to locate a monitor in a Facility Management Unit (FMU). Facility management must also have knowledge of your presence and activity for their plan of the day during subsequent normal operations.
- Ensure you have completed all facility-specific training requirements.

3.1 Planning and Coordination

3.1.1 Background Information

1. **Description of the System** - The high-volume air samplers are portable, maintenance-free systems used for continuous or intermittent sampling. They typically operate at a flow rate of 40 cubic feet per minute (CFM) but can be adjusted to sample at various flow rates up to 50 CFM. These units consist of a pump, flow control panel, and filter media housing. The filter media of choice is 8" x 10" rectangular media. For general environmental sampling purposes, polypropylene media is used due to its low background content of natural uranium. For other sampling, specific media may be preferred, such as glass-fiber media with minimal depth-of-burial concerns that will streamline effective analysis of the filter using hand-held instruments or direct alpha spectroscopy.

Airnet project members maintain and deploy the samplers, and the units are sometimes referred to as TSP samplers or high volume samplers. Specific models of samplers in use at the present time include:

- CF-1003BRL - This unit comes standard with a 4 in. diameter round filter holder. The sampler can accommodate an 8 in. x 10 in. holder by simply threading on a Hi-Q filter holder model number CFPH 810.
- Hi-Q HVP-3000BRL - TSP Sampler (2 stage pump). Some HVP-3000BRL units are equipped with remote start capabilities, which are discussed in Section 4.7 of this TP.
- Hi-Q HVP-3300BRL - TSP Sampler (3 stage pump). Some HVP-3300BRL units are equipped with remote start capabilities, which are discussed in Section 4.7 of this TP.
- Hi-Q HVP-5200AFC - This unit features flow control to compensate for filter loading and also has flash memory capability to record flow rates at predefined intervals.

Collection media in use for sampling for the RAEM team from Hi-Q Environmental include:

- Sample media
 - Polypropylene: FP5300-810 (produced by Monadnock)
 - Glass Fiber: FP5211-810
- Glassine collection envelopes to store media
 - Model G-8X10

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2. **Chain of Custody Forms** - Chain of Custody (COC) forms are used to document sampler location, sample time and results of field analysis. A sample of the COC form is included in Attachment 1. Section 3.1.3 describes COC requirements.
3. **Sampler Run Duration** - Sampling is intended to be a continuous sampling effort for the duration of a specific project or event. Filters are exchanged one to three times per week, depending on anticipated dust loading. The RAEM Team Leader or Airnet project leader will determine the sample duration.
4. **Field Analysis** - Filters can be field-analyzed with hand-held instrumentation or delivered to LANL's Health Physics Analytical Laboratory (HPAL) for analysis. Analysis by RAEM team members in the field will be done using a hand-held radioactivity meter (See Section 3.3). See the user manuals for guidance. Users must receive appropriate training from Radiation Protection (RP) personnel prior to using these meters. Measurements are typically performed using the "alpha" channel (α) and on the "scaler" setting to get 1-minute counts when looking for airborne actinides. Consult the RAEM Team Leader for specific analyses to be performed.

3.1.2 Laboratory Analysis of Filters

1. **Normal Protocol** – Normally, the only analyses on the filters will be the hand-held count on the day of analysis and again one week later to allow for radon decay. Under certain circumstances, however, it may be desired to have the filters analyzed with different methods.
2. **Laboratory Analysis Options** – HPAL can perform analysis of the full 8x10 filter using hand-held instruments or perform alpha spectroscopy on a 2-inch analytical sample cut from the 8x10 filter. Multiple 2-inch samples can be cut from a single filter, allowing for multiple analyses or sample sharing.

Off-site radiochemical analysis can be performed by a variety of vendors; one currently in use by LANL's Airnet program is GEL Laboratories, LLC located in Charleston, South Carolina.
3. **Analytical Trigger Events** – The following events may cause additional laboratory analyses to be performed.
 - Field analyses of the high-volume filters show elevated levels and follow-up analysis is desired.
 - An Airnet sample indicates elevated radiological air concentrations and analysis is desired to appropriately determine the time frame of release.
 - A workplace continuous air monitor or other air sample alarms and resulting off-site dose concentrations are desired.
 - An event occurs at the work site, such as an alarm, fire, or explosion, and further analysis is desired.
 - Laboratory management or the FOD requests laboratory analyses.

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4. **Data from Laboratory Analysis** – Due to the infrequent nature of laboratory analysis, there are no current plans to maintain the high-volume air sampling data in the RADAIR database or similar database. Calculations and air concentration information will be maintained on the EPC-CP file server and reported in memos to stakeholders.

3.1.3 Chain-of-Custody for Samples

1. Verify that the possession and handling of samples is traceable at all times. A sample is physical evidence collected from a facility or the environment. The COC must be documented for all samples used to demonstrate compliance. A sample is considered in custody if it is one of the following:
 - a. in one's physical possession,
 - b. in one's view after being in one's physical possession,
 - c. in one's physical possession and then locked up so that no one can tamper with it, or
 - d. kept in a secure area where access is restricted to authorized and accountable personnel only.

NOTE

A secured area is an area that is locked, such as a room, cooler, vehicle, or refrigerator. If the area cannot be secured by locking, use a custody seal to secure the area or the sample container.

2. Complete the "relinquished by/received by" and "date" sections of the COC Record (Attachment 1, *Chain-of-Custody for High-Volume Air Samples*) whenever samples are transferred into the custody of another person (other than an Airnet field team member) or organization. These sections of the form must provide a complete history of custody of the samples from collection to transfer to the analytical laboratory.
3. Whenever there is a break in the COC of a sample, document the failure and report it to the RAEM Team Leader.

3.2 Performance Documents

- [Hi-Q Environmental HVP-3000BRL/-3300BRL Manual](#), *Remote Start High Volume Pump Control User's Manual*
- [Hi-Q Environmental HVP-5300AFC Operations Manual](#), *HVP-5300AFC Brushless, Automatic Flow Control Outdoor Hi-Vol Air Sampler for Continuous Use*
- Airnet Field Logbook
- Remote Start High Volume Pump Control User's Manual

3.3 Special Tools, Equipment, Parts, and Supplies

- High-volume (TSP) sampler, models are discussed in 3.1.1

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- Flow calibrator HFC-50C (for calibration activities only)
- Ground fault circuit interrupter (GFCI) extension cord; this is only needed if the outlet in use is not equipped with a GFCI
- Thermo Eberline E-600 portable survey meter *or* RadEye SX survey meter; collectively referred to as the “meter” or “radioactivity meter” in this procedure
- 8 x 10 inch filter paper
- Nitrile gloves
- Glassine envelopes
- Zip lock bags
- Fantastik® spray cleaner
- Paper towels
- Permanent markers (Sharpies)
- COC forms
- COC tape or other tamper-indicating tape
- Tweezers
- Airnet Field Notebook
- Safety Cones

4.0 PROCESS DESCRIPTION

4.1 Setting up the CF-1003BRL High-Flow Sampler or Hi-Q HVP-3000BRL/3300BRL TSP Sampler

The RAEM Team Leader or the Airnet project leader performs the following steps:

- [1] Determine the location for the sampler to be deployed.

Field team members perform the following steps:

- [2] Ensure the sample analysis is planned. Some special event filters are analyzed internally by HPAL, others will be sent to an offsite analytical laboratory. Contact the project leader for assistance. Samples may need to be planned in the Environmental Information Management (EIM) database for offsite analysis.
- [3] Ensure the sampler’s calibration is current and that the calibration was performed using the same filter media as will be used for sample collection. If it is not, calibrate the sampler following Section 4.4, and ensure the calibrators are current in accordance with [EPC-CP-QP-5156](#), *Airnet - Using the Roots Meter to Calibrate Air Flow Calibrators*, and [P330-2](#), *Control and Calibration of Measuring and Test Equipment (M&TE)*.

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- [4] Set up the station securely, with sandbags if needed. Some stations are pre-deployed in the field.
- [5] Remove the top outer frame of the filter holder.
- [6] Clean the filter holder with Fantastik® spray cleaner and a paper towel.
- [7] Place the sample filter onto the holder and reinstall the filter holder top frame. Be sure to pull the protective covering off of both sides of the polypropylene filter material prior to installation.
- [8] Connect the sampler to a GFCI equipped power source or use a GFCI extension cord. Double-check the connections before energizing the equipment. Use only outdoor rated extension cords.
- [9] Mark the location of the extension cord with safety cones or similar markings so it is visible to others (e.g., personnel mowing grass).
- [10] Turn the power switch on the sampler to on.
- [11] Adjust the flow rate control knob to 40 CFM or the flow rate requested by the project leader.
- [12] Reset the sample timer.
- [13] Record the start information on the COC form or in the field notebook.

4.2 Setting Up an HVP-5200AFC Sampler

The RAEM Team Leader or Airnet project leader performs the following steps:

- [1] Determine the location for the sampler to be deployed.

Field team members perform the following steps:

- [2] Ensure the sample analysis is planned. Some special event filters are analyzed internally by HPAL; others will be sent to an offsite analytical laboratory. Contact the project leader for assistance. Samples may need to be planned in EIM for offsite analysis.
- [3] Ensure the sampler's calibration is current, and that the calibration was performed using the same filter media as will be used for sample collection. If it is not, calibrate the sampler following Section 4.4, and ensure the calibrators are current in accordance with [EPC-CP-QP-5156](#) and [P330-2](#).
- [4] Set up the station securely, with sandbags if needed. Some stations are pre-deployed in the field.
- [5] Remove the top half of the filter holder.
- [6] Clean the filter holder with Fantastik® spray cleaner and a paper towel.

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- [7] Place the sample filter onto the holder and reinstall the top bracket of the filter holder. Be sure to pull the protective covering off both sides of the polypropylene filter material prior to installation.
- [8] Connect the sampler to a GFCI equipped power source or use a GFCI extension cord. Double-check the connections before energizing equipment. Use only outdoor rated extension cords.
- [9] Mark the location of the extension cord with safety cones or similar markings so it is visible to others (e.g., personnel mowing grass).
- [10] Turn the power switch on the sampler to on.
- [11] Clear the timer and the flow volume totals on the display by pressing “3” to “Reset System” on the Main Menu.
- [12] Activate the keypad by pressing Enter (shown as ↵ or ← on the keypad). Type in the password “250”. Press Enter again to accept.
- [13] Press F2 from the following screen to reset the totalizer and elapsed timer to zero. The display should return to the Main Menu after completion.
- [14] Press “1” to “Monitor.”
- [15] Turn the rotary dial to “Continuous.”
- [16] Adjust the set point to approximately 32 standard cubic feet per minute (SCFM) or 40 actual cubic feet per minute (ACFM) by pressing the up or down arrows as appropriate. Keep adjusting the set point up or down until the Flow Rate in ACFM is steadily reading 40.
- [17] Refer to the [Hi-Q Environmental HVP-5300AFC Operations Manual](#) for more information on using flash memory or operations.

4.3 Collecting Filters after a Sampling Period

Field team members perform the following steps:

- [1] When a sample time is complete, record the final timer reading and final flow rate readings on the COC form. When using a digital automatic flow control unit, record the total flow in actual CFM for the sample period. Record the date and time the sample is collected.
- [2] Turn off the sampler.
- [3] If collecting a field analysis reading using the hand-held radioactivity meter, collect a one-minute background reading and record the value on the COC. While slowly moving the meter about ½ inch over the sample filter, collect a one-minute reading and record the value on the COC. Alpha or beta readings or both may be requested by the REAM team leader.

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- [4] Wearing clean nitrile gloves and using tweezers cleaned with Fantastik®, remove the filter and place it in a glassine envelope.
- [5] Seal the glassine envelope with COC tape.
- [6] Label the envelope with the sample ID number, date collected, and time collected.
- [7] Place the sealed glassine envelope into a zip lock bag for protection from moisture or damage for transporting or shipping. More than one glassine envelope may be placed into one zip lock bag.
- [8] Complete the COC form to document the sample collection.
- [9] Follow the instructions of the RAEM Team Leader for field analyzing or submitting the collected filter samples. Include the original COC form with the sample and keep a copy for the Airnet files.
- [10] Document the field collection activities in the field notebook.
- [11] Bring the station back to the Airnet office if the sampling is complete and the station is not to remain in the field. Stations that remain in the field while not in use need to be shielded or covered to avoid nesting birds or rodents.

4.4 Calibration of a CF-1003BRL High-Flow Sampler, or HI-Q HVP-3000BRL/-3300BRL TSP Sampler

Field team members perform the following steps:

- [1] Before each use, ensure the sampler has been calibrated within the past year using the same sample filter media as will be used for sample collection. If not, follow the steps below to calibrate the sampler.
- [2] Install clean filter media into the filter holder.

IMPORTANT

Ensure you are using the same filter media as will be used for sample collection.

- [3] Connect the Hi-Q Environmental Products air flow calibrator HFC-50C to the filter holder adapter. Ensure the HFC-50C is in calibration by checking the logbook or the calibration label. Ensure the plate is clamped down tight.
- [4] Turn the power switch to “on.”
- [5] Adjust the flow on the flow meter to 40 ACFM.
- [6] Read the flow rate on the flow meter. It should be the same as the calibrator flow rate within 5% of the full scale (2.5 ACFM). If not, adjust the flow meter by turning the small brass needle valve located near the top of the flow meter on the sampler so that the flow meter is reading the same as the calibrator within 5% of the full scale.

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NOTE

To access the brass needle valve on the CF-1003BRV, the dust cover must be removed. Remove the front panel screws and separate the front panel from the housing. Unplug the power cord while disassembling the panel.

If the flow is reading within 5%, or has been adjusted to within 5%, move to Step 7. If the flow cannot be adjusted to match the calibrator, clearly mark the sampler as being “out of calibration, do not use”, and attempt to repair the sampler or replace the flow meter.

- [7] Repeat Steps 5 and 6 for flow rates of 50, 45, 35, 30, 25, and 20 CFM. If any adjustments are made to the sampler flow meter at any flow rate, the other rates must be rechecked and read within 2.5 ACFM.

- [8] If all flow rates read within 2.5 ACFM of the reading on the calibrator, place a calibration sticker on the sampler that indicates the date calibrated, the date calibration will expire, and the initials of the person who performed the calibration.

If flows are not linear, for example if the sampler reads correctly at one flow rate but not at another, place a sticker on the sampler that reads “out of calibration, do not use.”

Instruments in use that are marked as meeting current calibration requirements but that are determined to be out of calibration must be identified as nonconforming and be addressed per procedure [P330-6](#), *Nonconformance Control and Reporting*.

4.5 Calibration Verification of an HVP-5200AFC

Field team members perform the following steps:

- [1] Before each use, ensure the sampler has been calibrated within the past year. If not, follow the steps below to verify calibration of the sampler.
- [2] Install clean filter media into the filter holder.

IMPORTANT

Ensure you are using the same filter media as will be used for sample collection. If the sample will be collected using a different filter than what was used for calibration, the sampler must be re-calibrated. The motor speed will change depending on the thickness of the filter.

- [3] Connect the Hi-Q Environmental Products airflow calibrator HFC-50C to the filter holder adapter. Ensure the HFC-50C is in calibration by referring to the logbook or calibration label on the unit. Ensure the plate is clamped down tight.
- [4] Turn the power switch to “on.”
- [5] Press “1” to select “Monitor” from the Main Menu.

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- [6] Turn the rotary switch to “Continuous.”
- [7] Adjust the flow rate by pressing the up or down arrow keys to reach a stable flow rate of 40 ACFM.
- [8] Compare the flow rate on the HFC-50C to the ACFM flow rate on the sampler. Rates should be within 5% of the full scale (2.5 ACFM).
- [9] If flows are within 2.5 ACFM, continue checking flow rates of 45, 35, 30, 25, and 20 ACFM.
- [10] If any check points do not coincide within 2.5 ACFM, perform a 15-point calibration as described in Section 4.6.

Instruments in use that are marked as meeting current calibration requirements but that are determined to be out of calibration must be identified as nonconforming and be addressed per procedure [P330-6](#).

- [11] If all flow rates coincide within 2.5 ACFM, mark the sampler with a calibration sticker indicating the date calibration verification was performed and the date calibration will expire, which is one year from the date of verification.

4.6 15 Point Calibration of an HVP-5200AFC

Field team members perform the following steps:

- [1] If the sampler does not pass the calibration verification as described in Section 4.5 or the sampler needs to be recalibrated due to a change of filter media, then recalibrate the sampler following the steps below. Try to perform the calibration in a stable temperature environment. Sometimes this is not possible, but results will be easier to obtain, and the process will be faster if temperatures are not fluctuating.
- [2] Install clean filter media into the filter holder.

IMPORTANT

Ensure you are using the same filter media as will be used for sample collection.

- [3] Connect the Hi-Q Environmental Products airflow calibrator HFC-50C to the filter holder adapter. Ensure the HFC-50C is in calibration by checking the logbook or the calibration label on the unit. Ensure the plate is clamped down tight.
- [4] Turn the power switch to “on.”
- [5] Press “2” to select “Calibrate” from the Main Menu.
- [6] Turn the rotary switch to “Continuous.”
- [7] Press Enter (shown as ↵ or ← on the keypad) to activate the keypad and enter the password “250.” Press Enter to accept the password.

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- [8] Press “3” for “Flow” on the menu.
- [9] Press “F2” to select “Manual Calibration.” You can press ESC at any time during calibration to retain the previous calibration.
- [10] To initiate the manual calibration process:
 - [a] Press Enter to activate the keypad.
 - [b] Use the arrows to select the proper units for calibration.
The Flow Rate Calibration Unit should be CFM, and the “Actual or STP” should be set to “Actual.” **This is a critical step.**
 - [c] Press Enter when the proper selections have been made.
- [11] A screen saying “SET FLOW TO ZERO AND PRESS F2” will be displayed. Allow the blower to be off for at least 30 seconds, then press “F2”.
- [12] For “Calibration Point 1”, the sampler will display the desired flow rate and this rate will be highlighted. Calibration Point 1 should be 10 CFM.
- [13] To adjust the flow rate:
 - [a] Press the right arrow to highlight the blower speed.
 - [b] Press Enter to activate the keypad.
 - [c] Press and hold the up arrow to increase the blower speed until the HFC-50C is reading 10 ACFM.

For some samplers, this will take at least 3000 on the blower speed. Numbers can be entered into the blower screen field rather than holding the arrow key to save time.
- [14] When the reading on the HFC-50C is matching the flow rate on the screen, press “F2” to accept the calibration point.
- [15] Repeat steps 12-14 to continue with the remaining calibration points (points #2-15); replace “10 CFM” with the desired flow rate for each point.
- [16] After calibration of point 15, the sampler will return to the Main Menu and calibration is complete.
- [17] Verify calibration by performing the steps in Section 4.5.
- [18] Record all calibration information in the logbook and update the calibration tracking spreadsheet with the new expiration dates.

4.7 Operation of Remote Start Hi-Volume Samplers

Field team members perform the following steps:

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There are seven pre-deployed HVP-3000BRL/-3300BRL units at the locations listed in the following table. More detailed information about the system can be found in the [Hi-Q Environmental HVP-3000BRL/-3300BRL Manual](#), *Remote Start High Volume Pump Control User's Manual*.

Airnet ID	Cell Phone #	IP Address	Location
151	505-412-1238	63.42.20.235	Royal Crest Trailer Park
167	505-412-1172	63.42.20.236	WR Fire Station
211	505-412-1772	63.42.20.237	Los Alamos Medical Center
290	505-412-1901	63.42.20.238	LA Airport
291	505-412-1763	166.241.161.144	Knights of Columbus
324	505-412-0937	166.241.161.148	Hillside 138
392	505-412-0929	166.253.161.194	WR Lower Pajarito Road

- [1] Filters should be pre-deployed at the above listed stations. Filters need to be replaced approximately every 3 months. If it has been longer than 3 months since the filters have been replaced, replace them prior to starting the sampler. The date of the filter replacement should be recorded in the Airnet field notebook.
- [2] Test the pump function every time a filter is changed out by running the sampler for approximately five minutes and verifying the flow is steady at 40 CFM. Perform the pump test prior to exchanging the filter and discard the used filter at the end of the test.
- [3] The power switch should be left in the “on” position after replacing the filter, so the station is configured for remote start capabilities.
- [4] To start a station remotely, determine the station’s IP address by referring to the table above.
- [5] Open a Firefox browser on your computer. Internet Explorer, Chrome, Edge, or other browsers will NOT function properly for this process.
- [6] Enter the station’s IP address as the URL into **Firefox** as follows:
https://(ip address):9443. For example, <https://63.42.20.235:9443> for Station 151.
- [7] Sometimes Firefox will say it is an unsafe web site but will have an **Advanced Settings** button that will allow you to connect to the web page.
- [8] Verify that the station’s modem web page responds with an “Acemanager” LOGIN page.
 - [a] The UserName will be provided by the RAEM Team Leader.
 - [b] The password will be provided by the RAEM Team Leader.
- [9] Left click on the I/O tab.

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- [10] To turn the pump on:
 - [a] Change the Relay Output 1 drop-down box to “Off.”
 - [b] Verify the drop-down box is highlighted in yellow.
 - [c] Left click the “Apply” button.
- [11] You will receive a message box stating, “Applied the changes successfully. Please reboot the device when all the changes are complete.” Click the OK button; you do not need to reboot the device.
- [12] Log Off if the pump will stay on.
- [13] Record the date and time the pump was activated for the sample COC.
- [14] The pump should stay on until the sample is collected in order for the end flow and timer reading to be recorded. Collect the filter as instructed in Section 4.3.
- [15] To stop the pump remotely:
 - [a] Switch the Relay Output 1 to Derived Active Low.
 - [b] Click Apply.
 - [c] Log Off.

5.0 TRAINING

The training method for this procedure is **mentored** training by a previously trained employee or the RAEM team leader and is documented in accordance with [P781-1, Conduct of Training](#). Mentoring is documented in accordance with procedure [EPC-CP-QP-0149, Demonstration of Performance for RAEM Personnel](#). Annual retraining is required and will be by self-study (“required reading”) of this procedure. All training must be assigned and tracked using the institutional training system, UTrain.

6.0 RECORDS

EPC-CP is the Office of Record for this document and must be maintained in accordance with [P1020-1, Laboratory Records Management](#) and [ESHQ-AP-006, Records Management Procedure](#). Records generated by this document will be submitted to the Records Management designated point of contact or document manager for document management.

Below are records generated as a result of implementing this procedure that are identified by title and type.

Record Title	QA Record	Non-QA Record
Airnet Field notebook entries	☐	☒
Calibration logbook entries	☒	☐
Chain-of-Custody Records	☒	☐

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7.0 DEFINITIONS AND ACRONYMS

7.1 Definitions

See LANL [Definition of Terms](#).

High-volume sampler – An air sampling unit which operates at flow rates much greater than the human breathing rate; samplers typically operate at flows of 40 cubic feet per minute.

Field analysis – Use of hand-held radiation detection instruments to measure amounts of radioactive material collected by the sampler.

7.2 Acronyms

α	Alpha Radiation
ACFM	Actual Cubic Feet per Minute
Airnet	Ambient Air Sampling Network
ALS	Analytical Laboratory Services, an analytical laboratory used by LANL
CFM	Cubic Feet per Minute
COC	Chain-of-Custody
DOE	Department of Energy
EIM	Environmental Information Management (Locus Technologies cloud based database used for sample planning and processing)
EPA	Environmental Protection Agency
EPC	Environmental Protection & Compliance Division
EPC-CP	Compliance Programs Group
FMU	Facility Management Unit
FOD	Facility Operations Director
GFCI	Ground Fault Circuit Interrupter
HPAL	Health Physics Analysis Laboratory
IWD	Integrated Work Document
IWM	Integrated Work Management
LANL or the Laboratory	Los Alamos National Laboratory
RAEM	Radioactive Air Emissions Management Team
RLM	Responsible Line Manager
RP	Radiation Protection
SCFM	Standard Cubic Feet per Minute

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SME	Subject Matter Expert
TP	Technical Procedure
TSP	Total Suspended Particulate

8.0 REFERENCES

[P300](#), *Integrated Work Management*

[P330-2](#), *Control and Calibration of Measuring and Test Equipment (M&TE)*

[P330-6](#), *Nonconformance Control and Reporting*

[P781-1](#), *Conduct of Training*

[P1020-1](#), *Laboratory Records Management*

[ESHQ-AP-006](#), *Records Management Procedure*

[EPC-CP-QP-0149](#), *Demonstration of Performance for RAEM Personnel*

[EPC-CP-PIP-5140](#), *Radiological Air Sampling Network*

[EPC-CP-QP-5156](#), *Airnet - Using the Roots Meter to Calibrate Air Flow Calibrators*

[Hi-Q Environmental HVP-3000BRL/-3300BRL Manual](#), *Remote Start High Volume Pump Control User's Manual*

[Hi-Q Environmental HVP-5300AFC Operations Manual](#), *HVP-5300AFC Brushless, Automatic Flow Control Outdoor Hi-Vol Air Sampler for Continuous Use*

9.0 APPENDICES

None.

10.0 ATTACHMENTS

Attachment 1: Chain of Custody for High-Volume Air Samples

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Attachment 1: Chain-of-Custody for High-Volume Air Samples

Sample Exchange Record

Site ID	Sample Installation				Sample Removal					Comments
	Date	Time	Flow Rate	Initials	Date	Time	Flow Rate	Timer Reading	Initials	

Field Analysis Record N/A (circle) Instrument Calibration OK ☐ Battery Power OK ☐

Site ID	Day-of-Removal Count				7-Days-Later Count			
	Date & Time	Background	Count (dpm)	Initials	Date & Time	Background	Count (dpm)	Initials

Chain-of-Custody [Print & Sign Name when relinquishing or accepting custody]

Relinquished by...	Date & Time	Relinquished by...	Date & Time	Relinquished by...	Date & Time	Relinquished by...	Date & Time
Accepted by...		Accepted by...		Accepted by...		Accepted by...	

**Compendium of Methods
for the Determination of
Toxic Organic Compounds
in Ambient Air**

Second Edition

Compendium Method TO-9A

**Determination Of Polychlorinated,
Polybrominated And
Brominated/Chlorinated
Dibenzo-p-Dioxins And Dibenzofurans In
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Method TO-9A

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Author(s)

- Bob Harless, U.S. EPA, NERL, RTP, NC
- William T. "Jerry" Winberry, Jr., EnviroTech Solutions, Cary, NC
- Gil Radolovich, Midwest Research Institute, KC, MO
- Mark Horrigan, Midwest Research Institute, KC, MO

Peer Reviewers

- Audrey E. Dupuy, U.S. EPA, NSTL Station, MS
- Greg Jungclaus, Midwest Research Institute, KC, MO
- Stan Sleva, TRC, RTP, NC
- Robert G. Lewis, U.S. EPA, NERL, RTP, NC
- Lauren Drees, U.S. EPA, NRMRL, Cincinnati, OH

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Method TO-9A

Determination Of Polychlorinated, Polybrominated And Brominated/Chlorinated Dibenzo-p-Dioxins And Dibenzofurans In Ambient Air

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METHOD TO-9A

Determination Of Polychlorinated, Polybrominated And Brominated/Chlorinated Dibenzo-p-Dioxins And Dibenzofurans In Ambient Air

1. Scope

1.1 This document describes a sampling and analysis method for the quantitative determination of polyhalogenated dibenzo-p-dioxins and dibenzofurans (PHDDs/PHDFs) in ambient air, which include the polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDDs/PCDFs), polybrominated dibenzo-p-dioxins and dibenzofurans (PBDDs/PBDFs), and bromo/chloro dibenzo-p-dioxins and dibenzofurans (BCDDs/BCDFs). The method uses a high volume air sampler equipped with a quartz-fiber filter and polyurethane foam (PUF) adsorbent for sampling 325 to 400 m³ ambient air in a 24-hour sampling period. Analytical procedures based on high resolution gas chromatography-high resolution mass spectrometry (HRGC-HRMS) are used for analysis of the sample.

1.2 The sampling and analysis method was evaluated using mixtures of PHDDs and PHDFs, including the 2,3,7,8-substituted congeners (1,2). It has been used extensively in the U.S. Environmental Protection Agency (EPA) ambient air monitoring studies (3,4) for determination of PCDDs and PCDFs.

1.3 The method provides accurate quantitative data for tetra- through octa-PCDDs/PCDFs (total concentrations for each isomeric series).

1.4 Specificity is attained for quantitative determination of the seventeen 2,3,7,8-substituted PCDDs/PCDFs and specific 2,3,7,8-substituted PBDD/PBDF and BCDD/BCDF congeners.

1.5 Minimum detection limits (MDLs) in the range of 0.01 to 0.2 picograms/meter³ (pg/m³) can be achieved for these compounds in ambient air.

1.6 Concentrations as low as 0.2 pg/m³ can be accurately quantified.

1.7 The method incorporates quality assurance/quality control (QA/QC) measures in sampling, analysis, and evaluation of data.

1.8 The analytical procedures also have been used for the quantitative determination of these types of compounds in sample matrices such as stack gas emissions, fly ash, soil, sediments, water, and fish and human tissue (5-9).

1.9 The method is similar to methods used by other EPA, industry, commercial, and academic laboratories for determining PCDDs and PCDFs in various sample matrices (10-25). This method is an update of the original EPA Compendium Method TO-9, originally published in 1989 (26).

1.10 The method does not separately quantify gaseous PHDDs and PHDFs and particulate-associated PHDDs and PHDFs because some of the compounds volatilize from the filter and are collected by the PUF adsorbent. For example, most of the OCDD is collected by the filter and most of the TCDDs are collected by the PUF during sampling. PCDDs/PCDFs may be distributed between the gaseous and particle-adsorbed phases in ambient air. Therefore, the filter and PUF are combined for extraction in this method.

1.11 The sampling and analysis method is very versatile and can be used to determine other brominated and brominated/chlorinated dioxins and furans in the future when more analytical standards become available for use in the method. A recent modification of the sample preparation procedure provides the capability required to determine PCDDs, PCDFs, PCBs, and PAHs in the same sample (27).

2. Summary of Method

2.1 Quartz-fiber filters and glass adsorbent cartridges are pre-cleaned with appropriate solvents and dried in a clean atmosphere. The PUF adsorbent plugs are subjected to 4-hour Soxhlet extraction using an oversized extractor to prevent distortion of the PUF plug. The PUF plugs are then air dried in a clean atmosphere and installed in the glass cartridges. A 50 microliter (μL) aliquot of a 16 picogram/microliter ($\text{pg}/\mu\text{L}$) solution of $^{37}\text{Cl}_4$ -2,3,7,8-TCDD is spiked to the PUF in the laboratory prior to field deployment. (Different amounts and additional $^{13}\text{C}_{12}$ -labeled standards such as $^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDF may also be used if desired.) The cartridges are then wrapped in aluminum foil to protect from light, capped with Teflon® end caps, placed in a cleaned labeled shipping container, and tightly sealed with Teflon® tap until needed.

2.2 For sampling, the quartz-fiber filter and glass cartridge containing the PUF are installed in the high-volume air sampler.

2.3 The high-volume sampler is then immediately put into operation, usually for 24 hours, to sample 325 to 400 m^3 ambient air.

[Note: Significant losses were not detected when duplicate samplers were operated 7 days and sampled 2660 m^3 ambient air (1-4).]

2.4 The amount of ambient air sampled is recorded at the end of the sampling session. Sample recovery involves placing the filter on top of the PUF. The glass cartridge is then wrapped with the original aluminum foil, capped with Teflon® end caps, placed back into the original shipping container, identified, and shipped to the analytical laboratory for sample processing.

2.5 Sample preparation typically is performed on a "set" of 12 samples, which consists of 9 test samples, a field blank, a method blank, and a matrix spike.

2.6 The filter and PUF are combined for sample preparation, spiked with 9 $^{13}\text{C}_{12}$ -labeled PCDD/PCDF and 4 PBDD/PBDF internal standards (28), and Soxhlet extracted for 16 hours. The extract is subjected to an acid/base clean-up procedure followed by clean-up on micro columns of silica gel, alumina, and carbon. The extract is then spiked with 0.5 ng $^{13}\text{C}_{12}$ -1,2,3,4-TCDD (to determine extraction efficiencies achieved for the $^{13}\text{C}_{12}$ -labeled internal standards) and then concentrated to 10 μL for HRGC-HRMS analysis in a 1 mL conical vial.

2.7 The set of sample extracts is subjected to HRGC-HRMS selected ion monitoring (SIM) analysis using a 60-m DB-5 or 60-m SP-2331 fused silica capillary column to determine the sampler efficiency, extraction efficiency, and the concentrations or the MDLs achieved for the PHDDs/PHDFs (28). Defined identification criteria and QA/QC criteria and requirements are used in evaluating the analytical data. The analytical results along with the volume of air sampled are used to calculate the concentrations of the respective tetra- through octa-isomers, the concentrations of the 2,3,7,8-chlorine or -bromine substituted isomers, or the MDLs. The concentrations and/or

MDLs are reported in pg/m^3 . The EPA toxicity equivalence factors (TEFs) can be used to calculate the 2,3,7,8-TCDD toxicity equivalents (TEQs) concentrations, if desired (18).

3. Significance

3.1 The PHDDs and PHDFs may enter the environment by two routes: (1) manufacture, use and disposal of specific chemical products and by-products and (2) the emissions from combustion and incineration processes. Atmospheric transport is considered to be a major route for widespread dispersal of these compounds in stack gas emissions throughout the environment. The PCDDs/PCDFs are found as complex mixtures of all isomers in emissions from combustion sources. The isomer profiles of PCDDs/PCDFs found in ambient air are similar to those found in combustion sources. Isomer profiles of PCDDs/PCDFs related to chemical products and by-products are quite different in that only a few specific and characteristic isomers are detectable, which clearly indicate they are not from a combustion source.

3.2 The 2,3,7,8-substituted PCDDs/PCDFs are considered to be the most toxic isomers. Fortunately, they account for the smallest percentage of the total PCDD/PCDF concentrations found in stack gas emissions from combustion sources and in ambient air. The 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), 1 of 22 TCDD isomers and the most toxic member of PCDDs/PCDFs, is usually found as a very minor component in stack gas emissions (0.5 to 10 percent of total TCDD concentration) and is seldom found in ambient air samples. All of the 2,3,7,8-substituted PCDDs/PCDFs are retained in tissue of life-forms such as humans, fish, and wildlife, and the non 2,3,7,8-substituted PCDDs/PCDFs are rapidly metabolized and/or excreted.

3.3 Attention has been focused on determining PHDDs/PHDFs in ambient air only in recent years. The analyses are time-consuming, complex, difficult, and expensive. Extremely sensitive, specific, and efficient analytical procedures are required because the analysis must be performed for very low concentrations in the pg/m^3 and sub pg/m^3 range. The MDLs, likewise, must be in the range of 0.01 to 0.2 pg/m^3 for the results to have significant meaning for ambient air monitoring purposes. The background level of total PCDDs/PCDFs detected in ambient air is usually in the range of 0.5 to 3 pg/m^3 , and the PBDFs is in the range of 0.1 to 0.2 pg/m^3 (2,3,14). Because PCDDs/PCDFs, PBDDs/PBDFs, and BCDDs/BCDFs can be formed by thermal reactions, there has been an increasing interest in ambient air monitoring, especially in the vicinities of combustion and incineration processes such as municipal waste combustors and resource recovery facilities (19,20). PBDDs/PBDFs can be created thermally (22,23), and they may also be formed in certain chemical processes (21). BCDDs/BCDFs have been detected in ash from combustion/incineration processes (9). The sampling and analysis method described here can be used in monitoring studies to accurately determine the presence or absence of pg/m^3 and sub pg/m^3 levels of these compounds in ambient air (26,27).

4. Safety

4.1 The 2,3,7,8-TCDD and other 2,3,7,8-chlorine or bromine substituted isomers are toxic and can pose health hazards if handled improperly. Techniques for handling radioactive and infectious materials are applicable to 2,3,7,8-TCDD and the other PHDDs and PHDFs. Only highly trained individuals who are thoroughly versed in appropriate laboratory procedures and familiar with the hazards of 2,3,7,8-TCDD should handle these substances. A good laboratory practice involves routine physical examinations and blood checks of employees working with 2,3,7,8-TCDD. It is the responsibility of the laboratory personnel to ensure that safe handling procedures are employed.

4.2 The toxicity or carcinogenicity of the other penta-, hexa-, hepta-, and octa-PHDDs/PHDFs with chlorine or bromine atoms in positions 2,3,7,8 are known to have similar, but lower, toxicities. However, each compound should be treated as a potential health hazard and exposure to these compounds must be minimized.

4.3 While the procedure specifies benzene as the extraction solution, many laboratories have substituted toluene for benzene (28). This is due to the carcinogenic nature of benzene. The EPA is presently studying the replacement of benzene with toluene.

4.4 A laboratory should develop a strict safety program for working with these compounds, which would include safety and health protocols; work performed in well ventilated and controlled access laboratory; maintenance of current awareness file of OSHA regulations regarding the safe handling of chemicals specified in the method; protective equipment; safety training; isolated work area; waste handling and disposal procedures; decontamination procedures; and laboratory wipe tests. Other safety practices as described in EPA Method 613, Section 4, July 1982 version, EPA Method 1613 Revision A, April 1990, Office of Water and elsewhere (29,30).

5. Applicable Documents

5.1 ASTM Standards

- Method D1365 *Definitions of Terms Relating to Atmospheric Sampling and Analysis*.
- Method E260 *Recommended Practice for General Gas Chromatography Procedures*.
- Method E355 *Practice for Gas Chromatography Terms and Relationships*.

5.2 EPA Documents

- *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II*, U. S. Environmental Protection Agency, EPA 600/R-94-038b, May 1994.
- *Protocol for the Analysis of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin by High Resolution Gas Chromatography-High Resolution Mass Spectrometry*, U. S. Environmental Protection Agency, EPA 600/40-86-004, January 1986.
- "Evaluation of an EPA High Volume Air Sampler for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans," undated report by Battelle under Contract No. 68-02-4127, Project Officers Robert G. Lewis and Nancy K. Wilson, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina.
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-9, Second Supplement*, U. S. Environmental Protection Agency, EPA 600/4-89-018, March 1989.
- *Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air*, U. S. Environmental Protection Agency, EPA 600/4-83-027, June 1983.
- "Analytical Procedures and Quality Assurance for Multimedia Analysis of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans by High Resolution Gas Chromatography - Low Resolution Mass Spectrometry," U. S. Environmental Protection Agency/OSW, SW-846, RCRA 8280 HRGC-LRMS, January 1987.
- "Analytical Procedures and Quality Assurance for Multimedia Analysis of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans by High Resolution Gas Chromatography - High Resolution Mass Spectrometry," U. S. Environmental Protection Agency/OSW, SW-846, RCRA 8290 HRGC-HRMS, June 1987.

- Harless, R., "Analytical Procedures and Quality Assurance Plan for the Determination of PCDDs and PCDFs Ambient Air near the Rutland, Vermont Municipal Incinerator," Final Report, U. S. Environmental Protection Agency, AREAL, RTP, NC, 1988.
- *Feasibility of Environmental Monitoring and Exposure Assessment for a Municipal Waste Combustor: Rutland, Vermont Pilot Study*, U. S. Environmental Protection Agency, EPA 600/8-91/007, March 1991.
- "Method 23, Determination of Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Dibenzofurans (PCDFs) from Stationary Sources." *Federal Register*, Vol. 56, No. 30, February 13, 1991.
- *Method 1613 Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC-HRMS*, U. S. Environmental Protection Agency, Office of Solid Waste, Washington, DC, April 1990.

5.3 Other Documents

- "Operating Procedures for Model PS-1 Sampler," Graseby/General Metal Works, Inc., Village of Cleves, OH 45002 (800-543-7412).
- "Chicago Air Quality: PCB Air Monitoring Plan, Phase 2," IEAP/APC/86-011, Illinois Environmental Protection Agency, Division of Air Pollution Control, April 1986.
- "Operating Procedures for the Thermo Environmental Semi-volatile Sampler," Thermo Environmental Instruments, Inc. (formerly Wedding and Associates), 8 West Forge Parkway, Franklin, MA 02038 (508-520-0430).

6. Definitions

[Note: Definitions used in this document and any user-prepared Standard Operating Procedures (SOPs) should be consistent with those used in ASTM D1356. All abbreviations and symbols are defined within this document at the point of first use.]

6.1 Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs)—compounds that contain from 1 to 8 chlorine atoms, resulting in a total of 75 PCDDs and 135 PCDFs. The structures are shown in Figure 1. The numbers of isomers at different chlorination levels are shown in Table 1. The seventeen 2,3,7,8-substituted PCDDs/PCDFs are shown in Table 2.

6.2 Polybrominated dibenzo-p-dioxins (PBDDs) and polybrominated dibenzofurans (PBDFs)—compounds that have the same structure and contain from 1 to 8 bromine atoms, resulting in a total of 75 PBDDs and 135 PBDFs. The structures and isomers are the same as those of the PCDDs/PCDFs shown in Figure 1 and Tables 1 and 2.

6.3 Brominated/chlorinated dibenzo-p-dioxins (BCDDs) and brominated/chlorinated dibenzofurans (BCDFs)—compounds with the same structures and may contain from 1 to 8 chlorine and bromine atoms, resulting in 1550 BCDD congeners and 3050 BCDF congeners.

6.4 Polyhalogenated dibenzo-p-dioxins (PHDDs) and polyhalogenated dibenzofurans (PHDFs)—dibenzo-p-dioxins and dibenzofurans substituted with 1 or more halogen atoms.

6.5 Isomer—compounds having the same number and type of halogen atoms, but substituted in different positions. For example, 2,3,7,8-TCDD and 1,2,3,4-TCDD are isomers. Additionally, there are 22 isomers that constitute the homologues of TCDDs.

6.6 Isomeric group—a group of dibenzo-p-dioxins or dibenzofurans having the same number of halogen atoms. For example, the tetra-chlorinated dibenzo-p-dioxins.

6.7 Internal Standard—is an isotopically-labeled analog that is added to all samples, including method blanks (process and field) and quality control samples, before extraction. They are used along with response factors to measure the concentration of the analytes. Nine PCDD/PCDF and 4 PBDD/PBDF internal standards are used in this method. There is one for each of the chlorinated dioxin and furan isomeric groups with a degree of halogenation ranging from four to eight, with the exception of OCDF.

6.8 High-Resolution Calibration Solutions (see Table 3)—solutions in tridecane containing known amounts of 17 selected PCDDs and PCDFs, 9 internal standards ($^{13}\text{C}_{12}$ -labeled PCDDs/PCDFs), 2 field standards, 4 surrogate standards, and 1 recovery standard. The set of 5 solutions is used to determine the instrument response of the unlabeled analytes relative to the $^{13}\text{C}_{12}$ -labeled internal standards and of the $^{13}\text{C}_{12}$ -labeled internal standards relative to the surrogate, field and recovery standards. Different concentrations and other standards may be used, if desired. Criteria for acceptable calibration as outlined in Section 13.5 should be met in order to use the analyte relative response factors.

6.9 Sample Fortification Solutions (see Table 4)—solutions (in isooctane) containing the $^{13}\text{C}_{12}$ -labeled internal standards that are used to spike all samples, field blanks, and process blanks before extraction. Brominated standards used only when desired.

6.10 Recovery Standard Solution (see Table 5)—Recovery Standard Solution (see Table 5)—an isooctane solution containing the $^{13}\text{C}_{12}$ -1,2,3,4-TCDD ($^{13}\text{C}_{12}$ -2,3,7,8,9-HxDD optional) recovery standards that are added to the extract before final concentration for HRGC-HRMS analysis to determine the recovery efficiencies achieved for the $^{13}\text{C}_{12}$ -labeled internal standards.

6.11 Air Sampler Field Fortification Solution (see Table 6)—an isooctane solution containing the $^{37}\text{Cl}_4$ -2,3,7,8-TCDD standard that is spiked to the PUF plugs prior to shipping them to the field for air sampling.

6.12 Surrogate Standard Solution (see Table 7)—an isooctane solution containing 4 $^{13}\text{C}_{12}$ -labeled standards that may be spiked to the filter or PUF prior to air sampling, to the sample prior to extraction, or to the sample extract before cleanup or before HRGC-HRMS analysis to determine sampler efficiency method efficiency or for identification purposes (28). Other standards and different concentrations may be used, if desired.

6.13 Matrix Spike and Method Spike Solutions (see Table 8)—isooctane solutions of native (non-labeled) PCDDs and PCDFs and PBDDs and PBDFs that are spiked to a clean PUF prior to extraction.

6.14 Sample Set—consists of nine test samples, field blank, method blank, and matrix spiked with native PHDDs/PHDFs. Sample preparation, HRGC-HRMS analysis, and evaluation of data is performed on a sample set.

6.15 Lab Control Spike—standard that is prepared during sample preparation and that contains exactly the same amounts of all of the labeled and unlabeled standards that were used in extraction and cleanup of the sample set for HRGC-HRMS analysis.

6.16 Field Blank—consists of a sample cartridge containing PUF and filter that is spiked with the field fortification solution, shipped to the field, installed on the sampler, and passively exposed at the sampling area (the sampler is not operated). It is then sealed and returned to the laboratory for extraction, cleanup, and HRGC-HRMS analysis. It is treated in exactly the same manner as a test sample. A field blank is processed with each sampling episode. The field blank represents the background contributions from passive exposure to ambient air, PUF, quartz fiber filter, glassware, and solvents.

6.17 Laboratory Method Blank—represents the background contributions from glassware, extraction and cleanup solvents. A Soxhlet extractor is spiked with a solution of $^{13}\text{C}_{12}$ -labeled internal standards, extracted, cleaned up, and analyzed by HRGC-HRMS in exactly the same manner as the test samples.

6.18 Solvent Blank—an aliquot of solvent (the amount used in the method) that is spiked with the $^{13}\text{C}_{12}$ -labeled internal standards and concentrated to 60 μL for HRGC-HRMS analysis. The analysis provides the background contributions from the specific solvent.

6.19 GC Column Performance Evaluation Solution (see Table 9)—a solution containing a mixture of selected PCDD/PCDF isomers, including the first and last chromatographic eluters for each isomeric group. Used to demonstrate continued acceptable performance of the capillary column and to define the PCDD/PCDF retention time windows. Also includes a mixture of tetradoxin isomers that elute closest to 2,3,7,8-TCDD.

6.20 QA/QC Audit Samples—samples of PUF that contain known amounts of unlabeled PCDDs and PCDFs. These samples are submitted as "blind" test samples to the analytical laboratory. The analytical results can then be used to determine and validate the laboratory's accuracy, precision and overall analytical capabilities for determination of PCDDs/PCDFs.

6.21 Relative Response Factor—response of the mass spectrometer to a known amount of an analyte relative to a known amount of a labeled internal standard.

6.22 Method Blank Contamination—the method blank should be free of interferences that affect the identification and quantification of PHDDs and PHDFs. A valid method blank is an analysis in which all internal standard signals are characterized by S/N ratio greater than 10:1 and the MDLs are adequate for the study. The set of samples must be extracted and analyzed again if a valid method blank cannot be achieved.

6.23 Sample Rerun—additional cleanup of the extract and reanalysis of the extract.

6.24 Extract Reanalysis—analysis by HRGC-HRMS of another aliquot of the final extract.

6.25 Mass Resolution Check—a standard method used to demonstrate a static HRMS resolving power of 10,000 or greater (10 percent valley definition).

6.26 Method Calibration Limits (MCLs)—for a given sample size, a final extract volume, and the lowest and highest calibration solutions, the lower and upper MCLs delineate the region of quantitation for which the HRGC-HRMS system was calibrated with standard solutions.

6.27 HRGC-HRMS Solvent Blank—a 1 or 2 μL aliquot of solvent that is analyzed for tetra- through octa-PCDDs and PCDFs following the analysis of a sample that contains high concentrations of these compounds.

An acceptable solvent blank analysis (free of PHDDs/PHDFs) should be achieved before continuing with analysis of the test samples.

6.28 Sampler Spike (SS)—a sampler that is spiked with known amounts of the air sampler field fortification solution (see Table 6) and the matrix spike solutions (see Table 8) prior to operating the sampler for 24 hours to sample 325-400 std m³ ambient air. The results achieved for this sample can be used to determine the efficiency, accuracy and overall capabilities of the sampling device and analytical method.

6.29 Collocated Samplers (CS)—two samplers installed close together at the same site that can be spiked with known amounts of the air sampler field fortification solution (see Table 6) prior to operating the samplers for 24 hours to sample 325-400 std m³ ambient air. The analytical results for these two samples can be used to determine and evaluate efficiency, accuracy, precision, and overall capabilities of the sampling device and analytical method.

6.30 Congener—a term which refers to any one particular member of the same chemical family. As an example, there are 75 congeners of chlorinated dibenzo-p-dioxins. A specific congener is denoted by unique chemical notations. For example, 2,4,8,9-tetrachlorodibenzofuran is referred to as 2,4,8,9-TCDF.

6.31 Homologue—a term which refers to a group of structurally related chemicals that have the same degree of chlorination. For example, there are eight homologues of CDDs, monochlorinated through octochlorinated. Notation for homologous classes is as follows:

Class	Acronym	
Dibenzo-p-dioxin	D	
Dibenzofuran	F	
No. of halogens	Acronym	Example
1	M	
2	D	2,4-DCDD
3	Tr	
4	T	1,4,7,8-TCDD
5	Pe	
6	Hx	
7	Hp	
8	O	
1 through 8	CDDs and CDFs	

7. Interferences And Contamination

7.1 Any compound having a similar mass and mass/charge (m/z) ratio eluting from the HRGC column within ± 2 seconds of the PHDD/PHDF of interest is a potential interference. Also, any compound eluting from the HRGC column in a very high concentration will decrease sensitivity in the retention time frame. Some commonly encountered interferences are compounds that are extracted along with the PCDDs and PCDFs or other PHDDs/PHDFs, e.g., polychlorinated biphenyls (PCBs), methoxybiphenyls, polychlorinated diphenylethers, polychlorinated naphthalenes, DDE, DDT, etc. The cleanup procedures are designed to eliminate the majority of these substances. The capillary column resolution and mass spectrometer resolving power are extremely helpful in segregating any remaining interferences from PCDDs and PCDFs. The severity of an interference

problem is usually dependent on the concentrations and the mass spectrometer and chromatographic resolutions. However, polychlorinated diphenylethers are extremely difficult to resolve from PCDFs because they elute in retention time windows of PCDFs, and their fragment ion resulting from the loss of 2 chlorine atoms is identical to that of the respective PCDF. For example, the molecular ions of hexachlorodiphenylethers must be monitored to confirm their presence or absence in the analysis for TCDFs. This requirement also applies to the other PCDFs and PBDFs.

7.2 Since very low levels of PCDDs and PCDFs must be determined, the elimination of interferences is essential. High purity reagents and solvents must be used, and all equipment must be scrupulously cleaned. All materials, such as PUF, filter solvents, etc., used in the procedures are monitored and analyzed frequently to ensure the absence of contamination. Cleanup procedures must be optimized and performed carefully to minimize the loss of analyte compounds during attempts to increase their concentrations relative to other sample components. The analytical results achieved for the field blank, method blank, and method spike in a "set" of samples is extremely important in evaluating and validating the analytical data achieved for the test samples.

8. Apparatus

[Note: This method was developed using the PS-1 semi-volatile sampler provided by General Metal Works, Village of Cleves, OH as a guideline. EPA has experience in use of this equipment during various field monitoring programs over the last several years. Other manufacturers' equipment should work as well. However, modifications to these procedures may be necessary if another commercially available sampler is selected.]

8.1 High-Volume Sampler (see Figure 2). Capable of pulling ambient air through the filter/adsorbent cartridge at a flow rate of approximately 8 standard cubic feet per minute (scfm) ($0.225 \text{ std m}^3/\text{min}$) to obtain a total sample volume of greater than 325 scm over a 24-hour period. Major manufacturers are:

- Tisch Environmental, Village of Cleves, OH
- Andersen Instruments Inc., 500 Technology Ct., Smyrna, GA
- Thermo Environmental Instruments, Inc., 8 West Forge Parkway, Franklin, MA

8.2 High-Volume Sampler Calibrator. Capable of providing multipoint resistance for the high-volume sampler. Major manufacturers are:

- Tisch Environmental, Village of Cleves, OH
- Andersen Instruments Inc., 500 Technology Ct., Smyrna, GA
- Thermo Environmental Instruments, Inc., 8 West Forge Parkway, Franklin, MA

8.3 High Resolution Gas Chromatograph-High Resolution Mass Spectrometer-Data System (HRGC-HRMS-DS)

8.3.1 The GC should be equipped for temperature programming and all of the required accessories, such as gases and syringes, should be available. The GC injection port should be designed for capillary columns. Splitless injection technique, on-column injections, or moving needle injectors may be used. It is important to use the same technique and injection volume at all times.

8.3.2 The HRGC-HRMS interface, if used, should be constructed of fused silica tubing or all glass or glass lined stainless steel and should be able to withstand temperatures up to 340°C. The interface should not degrade the separation of PHDD/PHDF isomers achieved by the capillary column. Active sites or cold spots in the interface can cause peak broadening and peak tailing. The capillary column should be fitted directly into the HRMS ion source to avoid these types of problems. Graphite ferrules can adsorb PHDDs/PHDFs and cause problems. Therefore, Vespel® or equivalent ferrules are recommended.

8.3.3 The HRMS system should be operated in the electron impact ionization mode. The static resolving power of the instrument should be maintained at 10,000 or greater (10% valley definition). The HRMS should be operated in the selected ion monitoring (SIM) mode with a total cycle time of one second or less. At a minimum, the ions listed in Tables 10, 11, and 12 for each of the select ion monitoring (SIM) descriptors should be monitored. It is important to use the same set of ions for both calibration and sample analysis.

8.3.4 The data system should provide for control of mass spectrometer, data acquisition, and data processing. The data system should have the capability to control and switch to different sets of ions (descriptors/mass menus shown in Tables 10, 11, and 12) at different times during the HRGC-HRMS SIM analysis. The SIM traces/displays of ion signals being monitored can be displayed on the terminal in real time and sorted for processing. Quantifications are reported based on computer generated peak areas. The data system should be able to provide hard copies of individual ion chromatograms for selected SIM time intervals, and it should have the capability to allow measurement of noise on the baseline. It should also have the capability to acquire mass-spectral peak profiles and provide hard copies of the peak profiles to demonstrate the required mass resolution.

8.3.5 HRGC columns, such as the DB-5 (28) and SP-2331 fused silica capillary columns, and the operating parameters known to produce acceptable results are shown in Tables 13 and 14. Other types of capillary columns may also be used as long as the performance requirements can be successfully demonstrated.

9. Equipment And Materials

9.1 Materials for Sample Collection (see Figure 3a)

9.1.1 Quartz fiber filter. 102 millimeter bindless quartz microfiber filter, Whatman International Ltd, QMA-4.

9.1.2 Polyurethane foam (PUF) plugs. 3-inch thick sheet stock polyurethane type (density 0.022 g/cm³). The PUF should be of the polyether type used for furniture upholstery, pillows, and mattresses. The PUF cylinders (plugs) should be slightly larger in diameter than the internal diameter of the cartridge. Sources of equipment are Tisch Environmental, Village of Cleves, OH; University Research Glassware, 116 S. Merritt Mill Road, Chapel Hill, NC; Thermo Environmental Instruments, Inc., 8 West Forge Parkway, Franklin, MA; Supelco, Supelco Park, Bellefonte, PA; and SKC Inc., 334 Valley View Road, Eighty Four, PA (see Figure 3b).

9.1.3 Teflon® end caps. For sample cartridge. Sources of equipment are Tisch Environmental, Village of Cleves, OH; and University Research Glassware, 116 S. Merritt Mill Road, Chapel Hill, NC (see Figure 3b).

9.1.4 Sample cartridge aluminum shipping containers. For sample cartridge shipping. Sources of equipment are Tisch Environmental, Village of Cleves, OH; and University Research Glassware, 116 S. Merritt Mill Road, Chapel Hill, NC (see Figure 3b).

9.1.5 Glass sample cartridge. For sample collection. Sources of equipment are Tisch Environmental, Village of Cleves, OH; Thermo Environmental Instruments, Inc., 8 West Forge, Parkway, Franklin, MA; and University Research Glassware, 116 S. Merritt Mill Road, Chapel Hill, NC (see Figure 3b).

9.2 Laboratory Equipment

- 9.2.1 **Laboratory hoods.**
- 9.2.2 **Drying oven.**
- 9.2.3 **Rotary evaporator.** With temperature-controlled water bath.
- 9.2.4 **Balances.**
- 9.2.5 **Nitrogen evaporation apparatus.**
- 9.2.6 **Pipettes.** Disposal Pasteur, 150-mm long x 5-mm i.d.
- 9.2.7 **Soxhlet apparatus.** 500-mL.
- 9.2.8 **Glass funnels.**
- 9.2.9 **Desiccator.**
- 9.2.10 **Solvent reservoir.** 125-mL, Kontes, 12.35-cm diameter.
- 9.2.11 **Stainless steel spoons and spatulas.**
- 9.2.12 **Glass wool.** Extracted with methylene chloride, stored in clean jar.
- 9.2.13 **Laboratory refrigerator.**
- 9.2.14 **Chromatographic columns.**
- 9.2.15 **Perfluorokerosenes.**

9.3 Reagents and Other Materials

- 9.3.1 **Sulfuric acid.** Ultrapure, ACS grade, specific gravity 1.84, acid silica.
- 9.3.2 **Sodium hydroxide.** Potassium hydroxide, reagent grade, base silica.
- 9.3.3 **Sodium sulfate.**
- 9.3.4 **Anhydrous, reagent grade.**
- 9.3.5 **Glass wool.** Silanized, extracted with methylene chloride and hexane, and dried.
- 9.3.6 **Diethyl ether.** High purity, glass distilled.
- 9.3.7 **Isooctane.** Burdick and Jackson, glass-distilled.
- 9.3.8 **Hexane.** Burdick and Jackson, glass-distilled.
- 9.3.9 **Toluene.** Burdick and Jackson, glass-distilled, or equivalent.
- 9.3.10 **Methylene chloride.** Burdock and Jackson, chromatographic grade, glass distilled.
- 9.3.11 **Acetone.** Burdick and Jackson, high purity, glass distilled.
- 9.3.12 **Tridecane.** Aldrich, high purity, glass distilled.
- 9.3.13 **Isooctane.** Burdick and Jackson, high purity, glass distilled.
- 9.3.14 **Alumina.** Acid, pre-extracted (16-21 hours) and activated.
- 9.3.15 **Silica gel.** High purity grade, type 60, 70-230 mesh; extracted in a Soxhlet apparatus with methylene chloride (see Section 8.18) for 16-24 hours (minimum of 3 cycles per hour) and activated by heating in a foil-covered glass container for 8 hours at 130°C.
- 9.3.16 **18 percent Carbopack C/Celite 545.**
- 9.3.17 **Methanol.** Burdick and Jackson, high purity, glass distilled.
- 9.3.18 **Nonane.** Aldrich, high purity, glass distilled.
- 9.3.19 **Benzene.** High purity, glass distilled.

9.4 Calibration Solutions and Solutions of Standards Used in the Method

9.4.1 HRGC-HRMS Calibration Solutions (see Table 3). Solutions containing $^{13}\text{C}_{12}$ -labeled and unlabeled PCDDs and PCDFs at known concentrations are used to calibrate the instrument. These standards can be obtained from various commercial sources such as Cambridge Isotope Laboratories, 50 Frontage Road, Andover, MA 01810, 508-749-8000.

9.4.2 Sample Fortification Solutions (see Table 4). An isooctane solution (or nonane solution) containing the $^{13}\text{C}_{12}$ -labeled PCDD/PCDF and PBDD/PBDF internal standards at the listed concentrations. The internal standards are spiked to all samples prior to extraction and are used to measure the concentration of the unlabeled native analytes and to determine MDLs.

9.4.3 Recovery Standard Spiking Solution (see Table 5). An isooctane solution containing $^{13}\text{C}_{12}$ -1,2,3,4-TCDD at a concentration of 10 pg/ μL . Additional recovery standards may be used if desired.

9.4.4 Sampler Field Fortification Solution (see Table 6). An isooctane solution containing 10 pg/ μL $^{37}\text{Cl}_4$ -2,3,7,8-TCDD.

9.4.5 Surrogate Standards Solution (see Table 7). An isooctane solution containing the four $^{13}\text{C}_{12}$ -labeled standards at a concentration of 100 pg/ μL .

9.4.6 Matrix/Method Spike Solution (see Table 8). An isooctane solution containing the unlabeled PCDDs/PCDFs and PBDDs/PBDFs at the concentrations listed.

[Note: All PHDD/PHDF solutions listed above should be stored in a refrigerator at less than or equal to 4°C in the dark. Exposure of the solutions to light should be minimized.]

9.4.7 Column Performance Evaluation Solutions (see Table 9). Isooctane solutions of first and last chromatographic eluting isomers for each isomeric group of tetra- through octa-CDDs/CDFs. Also includes a mixture of tetradoxin isomers that elute closest to 2,3,7,8-TCDD.

10. Preparation Of PUF Sampling Cartridge

10.1 Summary of Method

10.1.1 This part of the procedure discusses pertinent information regarding the preparation and cleaning of the filter, adsorbents, and filter/adsorbent cartridge assembly. The separate batches of filters and adsorbents are extracted with the appropriate solvent.

10.1.2 At least one PUF cartridge assembly and one filter from each batch, or 10 percent of the batch, whichever is greater, should be tested and certified before the batch is considered for field use.

10.1.3 Prior to sampling, the cartridges are spiked with surrogate compounds.

10.2 Preparation of Sampling Cartridge

10.2.1 Bake the quartz filters at 400°C for 5 hours before use.

10.2.2 Set aside the filters in a clean container for shipment to the field or prior to combining with the PUF glass cartridge assembly for certification prior to field deployment.

10.2.3 The PUF plugs are 6.0-cm diameter cylindrical plugs cut from 3-inch sheet stock and should fit, with slight compression, in the glass cartridge, supported by the wire screen (see Figure 2). During cutting, rotate the die at high speed (e.g., in a drill press) and continuously lubricate with deionized or distilled water. Pre-cleaned PUF plugs can be obtained from commercial sources (see Section 9.1.2).

10.2.4 For initial cleanup, place the PUF plugs in a Soxhlet apparatus and extract with acetone for 16 hours at approximately 4 cycles per hour. When cartridges are reused, use diethyl ether/hexane (5 to 10 percent volume/volume [v/v]) as the cleanup solvent.

[Note: A modified PUF cleanup procedure can be used to remove unknown interference components of the PUF blank. This method consists of rinsing 50 times with toluene, acetone, and diethyl ether/hexane (5 to 10 percent v/v), followed by Soxhlet extraction. The extracted PUF is placed in a vacuum oven connected to a water aspirator and dried at room temperature for approximately 2 to 4 hours (until no solvent odor is detected). The extract from the Soxhlet extraction procedure from each batch may be analyzed to determine initial cleanliness prior to certification.]

10.2.5 Fit a nickel or stainless steel screen (mesh size 200/200) to the bottom of a hexane-rinsed glass sampling cartridge to retain the PUF adsorbents, as illustrated in Figure 2. Place the Soxhlet-extracted, vacuum-dried PUF (2.5-cm thick by 6.5-cm diameter) on top of the screen in the glass sampling cartridge using polyester gloves.

10.2.6 Wrap the sampling cartridge with hexane-rinsed aluminum foil, cap with the Teflon® end caps, place in a cleaned labeled aluminum shipping container, and seal with Teflon® tape. Analyze at least 1 PUF plug from each batch of PUF plugs using the procedures described in Section 10.3, before the batch is considered acceptable for field use. A level of 2 to 20 pg for tetra-, penta-, and hexa- and 40 to 150 pg for hepta- and octa-CDDs similar to that occasionally detected in the method blank (background contamination) is considered to be acceptable. Background levels can be reduced further, if necessary. Cartridges are considered clean for up to 30 days from date of certification when stored in their sealed containers.

10.3 Procedure for Certification of PUF Cartridge Assembly

10.3.1 Extract 1 filter and PUF adsorbent cartridge by Soxhlet extraction and concentrate using a Kuderna-Danish (K-D) evaporator for each lot of filters and cartridges sent to the field.

10.3.2 Assemble the Soxhlet apparatus. Charge the Soxhlet apparatus with 300 mL of the extraction solvent (10 percent v/v diethyl ether/hexane) and reflux for 2 hours. Let the apparatus cool, disassemble it, and discard the used extraction solvent. Transfer the filter and PUF glass cartridge to the Soxhlet apparatus (the use of an extraction thimble is optional).

[Note: The filter and adsorbent assembly are tested together in order to reach detection limits, to minimize cost and to prevent misinterpretation of the data. Separate analyses of the filter and PUF would not yield useful information about the physical state of most of the PHDDs and PHDFs at the time of sampling due to evaporative losses from the filter during sampling.]

10.3.3 Add 300 mL of diethyl ether/hexane (10 percent v/v) to the Soxhlet apparatus. Reflux the sample for 18 hours at a rate of at least 3 cycles per hour. Allow to cool; then disassemble the apparatus.

10.3.4 Assemble a K-D concentrator by attaching a 10-mL concentrator tube to a 500-mL evaporative flask.

10.3.5 Transfer the extract by pouring it through a drying column containing about 10 cm of anhydrous granular sodium sulfate and collect the extract in the K-D concentrator. Rinse the Erlenmeyer flask and column with 20 to 30 mL of 10 percent diethylether/hexane to complete the quantitative transfer.

10.3.6 Add 1 or 2 clean boiling chips and attach a 3-ball Snyder column to the evaporative flask. Pre-wet the Snyder column by adding about 1 mL of the extraction solvent to the top of the column. Place the K-D apparatus on a hot water bath (50°C) so that the concentrator tube is partially immersed in the hot water, and the entire lower rounded surface of the flask is bathed with hot vapor. Adjust the vertical position of the apparatus

and the water temperature as required to complete the concentration in one hour. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches approximately 5 mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 5 minutes. Remove the Snyder column and rinse the flask and its lower joint into the concentrator tube with 5 mL of hexane. A 5-mL syringe is recommended for this operation.

10.3.7 Concentrate the extract to 1 mL, cleanup the extract (see Section 12.2.2), and analyze the final extract using HRGC-HRMS.

10.3.8 The level of target compounds must be less than or equal to 2 to 20 pg for tetra-, penta-, and hexa- and 40 to 150 pg for hepta- and octa-CDDs for each pair of filter and adsorbent assembly analyzed is considered to be acceptable.

10.4 Deployment of Cartridges for Field Sampling

10.4.1 Prior to field deployment, add surrogate compounds (i.e., chemically inert compounds not expected to occur in an environmental sample) to the center bed of the PUF cartridge, using a microsyringe. The surrogate compounds (see Table 3) must be added to each cartridge assembly.

10.4.2 Use the recoveries of the surrogate compounds to monitor for unusual matrix effects and gross sampling processing errors. Evaluate surrogate recovery for acceptance by determining whether the measured concentration falls within the acceptance limits.

11. Assembly, Calibration And Collection Using Sampling System

[Note: This method was developed using the PS-1 semi-volatile sampler provided by General Metal Works, Village of Cleves, OH as a guideline. EPA has experience in use of this equipment during various field monitoring programs over the last several years. Other manufacturers' equipment should work as well. However, modifications to these procedures may be necessary if another commercially available sampler is selected.]

11.1 Description of Sampling Apparatus

The entire sampling system is diagrammed in Figure 1. This apparatus was developed to operate at a rate of 4 to 10 scfm (0.114 to 0.285 std m³/min) and is used by EPA for high-volume sampling of ambient air. The method write-up presents the use of this device.

The sampling module (see Figure 2) consists of a filter and a glass sampling cartridge containing the PUF utilized to concentrate dioxins/furans from the air. A field portable unit has been developed by EPA (see Figure 4).

11.2 Calibration of Sampling System

Each sampler should be calibrated (1) when new, (2) after major repairs or maintenance, (3) whenever any audit point deviates from the calibration curve by more than 7 percent, (4) before/after each sampling event, and (5) when a different sample collection media, other than that which the sampler was originally calibrated to, will be used for sampling.

11.2.1 Calibration of Orifice Transfer Standard. Calibrate the modified high volume air sampler in the field using a calibrated orifice flow rate transfer standard. Certify the orifice transfer standard in the laboratory against a positive displacement rootsmeter (see Figure 5). Once certified, the recertification is performed rather

infrequently if the orifice is protected from damage. Recertify the orifice transfer standard performed once per year utilizing a set of five multiple resistance plates.

[Note: The set of five multihole resistance plates are used to change the flow through the orifice so that several points can be obtained for the orifice calibration curve. The following procedure outlines the steps to calibrate the orifice transfer standard in the laboratory.]

11.2.1.1 Record the room temperature (T_1 in °C) and barometric pressure (P_b in mm Hg) on the Orifice Calibration Data Sheet (see Figure 6). Calculate the room temperature in K (absolute temperature) and record on Orifice Calibration Data Sheet.

$$T_1 \text{ in K} = 273^\circ + T_1 \text{ in } ^\circ\text{C}$$

11.2.1.2 Set up laboratory orifice calibration equipment as illustrated in Figure 5. Check the oil level of the rootsmeter prior to starting. There are 3 oil level indicators, 1 at the clear plastic end and 2 site glasses, 1 at each end of the measuring chamber.

11.2.1.3 Check for leaks by clamping both manometer lines, blocking the orifice with cellophane tape, turning on the high volume motor, and noting any change in the rootsmeter's reading. If the rootsmeter's reading changes, there is a leak in the system. Eliminate the leak before proceeding. If the rootsmeter's reading remains constant, turn off the hi-vol motor, remove the cellophane tape, and unclamp both manometer lines.

11.2.1.4 Install the 5-hole resistance plate between the orifice and the filter adapter.

11.2.1.5 Turn manometer tubing connectors 1 turn counter-clockwise. Make sure all connectors are open.

11.2.1.6 Adjust both manometer midpoints by sliding their movable scales until the zero point corresponds with the meniscus. Gently shake or tap to remove any air bubbles and/or liquid remaining on tubing connectors. (If additional liquid is required for the water manometer, remove tubing connector and add clean water.)

11.2.1.7 Turn on the high volume motor and let it run for 5 minutes to set the motor brushes. Turn the motor off. Insure manometers are set to zero. Turn the high volume motor on.

11.2.1.8 Record the time, in minutes, required to pass a known volume of air (approximately 200 to 300 ft³ of air for each resistance plate) through the rootsmeter by using the rootsmeter's digital volume dial and a stopwatch.

11.2.1.9 Record both manometer readings-orifice water manometer (ΔH) and rootsmeter mercury manometer (ΔP) on Orifice Calibration Data Sheet (see Figure 6).

[Note: ΔH is the sum of the difference from zero (0) of the two column heights.]

11.2.1.10 Turn off the high volume motor.

11.2.1.11 Replace the 5-hole resistance plate with the 7-hole resistance plate.

11.2.1.12 Repeat Sections 11.2.1.3 through 11.2.1.11.

11.2.1.13 Repeat for each resistance plate. Note results on Orifice Calibration Data Sheet (see Figure 6). Only a minute is needed for warm-up of the motor. Be sure to tighten the orifice enough to eliminate any leaks. Also check the gaskets for cracks.

[Note: The placement of the orifice prior to the rootsmeter causes the pressure at the inlet of the rootsmeter to be reduced below atmospheric conditions, thus causing the measured volume to be incorrect. The volume measured by the rootsmeter must be corrected.]

11.2.1.14 Correct the measured volumes on the Orifice Calibration Data Sheet:

$$V_{\text{std}} = V_{\text{m}} \left(\frac{P_{\text{a}} - \Delta P}{P_{\text{std}}} \right) \left(\frac{T_{\text{std}}}{T_{\text{a}}} \right)$$

where:

- V_{std} = standard volume, std m³
- V_{m} = actual volume measured by the rootsmeter, m³
- P_{a} = barometric pressure during calibration, mm Hg
- ΔP = differential pressure at inlet to volume meter, mm Hg
- P_{std} = 760 mm Hg
- T_{a} = ambient temperature during calibration, K.

11.2.1.15 Record standard volume on Orifice Calibration Data Sheet.

11.2.1.16 The standard flow rate as measured by the rootsmeter can now be calculated using the following formula:

$$Q_{\text{std}} = \frac{V_{\text{std}}}{\theta}$$

where:

- Q_{std} = standard volumetric flow rate, std m³/min
- θ = elapsed time, min

11.2.1.17 Record the standard flow rates to the nearest 0.01 std m³/min.

11.2.1.18 Calculate and record $\sqrt{\Delta H (P_1/P_{\text{std}})(298/T_1)}$ value for each standard flow rate.

11.2.1.19 Plot each $\sqrt{\Delta H (P_1/P_{\text{std}})(298/T_1)}$ value (y-axis) versus its associated standard flow rate (x-axis) on arithmetic graph paper and draw a line of best fit between the individual plotted points.

[Note: This graph will be used in the field to determine standard flow rate.]

11.2.2 Calibration of the High Volume Sampling System Utilizing Calibrated Orifice Transfer Standard

For this calibration procedure, the following conditions are assumed in the field:

- The sampler is equipped with an valve to control sample flow rate.
- The sample flow rate is determined by measuring the orifice pressure differential, using a magnehelic gauge.
- The sampler is designed to operate at a standardized volumetric flow rate of 8 ft³/min (0.225 m³/min), with an acceptable flow rate range within 10 percent of this value.
- The transfer standard for the flow rate calibration is an orifice device. The flow rate through the orifice is determined by the pressure drop caused by the orifice and is measured using a "U" tube water manometer or equivalent.
- The sampler and the orifice transfer standard are calibrated to standard volumetric flow rate units (scfm or scmm).

- An orifice transfer standard with calibration traceable to NIST is used.
- A "U" tube water manometer or equivalent, with a 0- to 16-inch range and a maximum scale division of 0.1 inch, will be used to measure the pressure in the orifice transfer standard.
- A magnehelic gauge or equivalent, with a 9- to 100-inch range and a minimum scale division of 2 inches for measurements of the differential pressure across the sampler's orifice is used.
- A thermometer capable of measuring temperature over the range of 32° to 122°F (0° to 50°C) to $\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$) and referenced annually to a calibrated mercury thermometer is used.
- A portable aneroid barometer (or equivalent) capable of measuring ambient barometric pressure between 500 and 800 mm Hg (19.5 and 31.5 in. Hg) to the nearest mm Hg and referenced annually to a barometer of known accuracy is used.
- Miscellaneous handtools, calibration data sheets or station log book, and wide duct tape are available.

11.2.2.1 Monitor the airflow through the sampling system with a venturi/Magnehelic assembly, as illustrated in Figure 7. Set up the calibration system as illustrated in Figure 7. Audit the field sampling system once per quarter using a flow rate transfer standard, as described in the EPA *High Volume-Sampling Method, 40 CFR 50, Appendix B*. Perform a single-point calibration before and after each sample collection, using the procedures described in Section 11.2.3.

11.2.2.2 Prior to initial multi-point calibration, place an empty glass cartridge in the sampling head and activate the sampling motor. Fully open the flow control valve and adjust the voltage variator so that a sample flow rate corresponding to 110 percent of the desired flow rate (typically 0.20 to 0.28 m³/min) is indicated on the Magnehelic gauge (based on the previously obtained multipoint calibration curve). Allow the motor to warm up for 10 minutes and then adjust the flow control valve to achieve the desired flow rate. Turn off the sampler. Record the ambient temperature and barometric pressure on the Field Calibration Data Sheet (see Figure 8).

11.2.2.3 Place the orifice transfer standard on the sampling head and attach a manometer to the tap on the transfer standard, as illustrated in Figure 7. Properly align the retaining rings with the filter holder and secure by tightening the three screw clamps. Connect the orifice transfer standard by way of the pressure tap to a manometer using a length of tubing. Set the zero level of the manometer or magnehelic. Attach the magnehelic gauge to the sampler venturi quick release connections. Adjust the zero (if needed) using the zero adjust screw on face of the gauge.

11.2.2.4 To leak test, block the orifice with a rubber stopper, wide duct tape, or other suitable means. Seal the pressure port with a rubber cap or similar device. Turn on the sampler.

Caution: Avoid running the sampler from too long a time with the orifice blocked. This precaution will reduce the chance that the motor will be overheated due to the lack of cooling air. Such overheating can shorten the life of the motor.

11.2.2.5 Gently rock the orifice transfer standard and listen for a whistling sound that would indicate a leak in the system. A leak-free system will not produce an upscale response on the sampler's magnehelic. Leaks are usually caused either by damaged or missing gaskets by cross-threading and/or not screwing sample cartridge together tightly. All leaks must be eliminated before proceeding with the calibration. When the sample is determined to be leak-free, turn off the sampler and unblock the orifice. Now remove the rubber stopper or plug from the calibrator orifice.

11.2.2.6 Turn the flow control valve to the fully open position and turn the sampler on. Adjust the flow control valve until a Magnehelic reading of approximately 70 in. is obtained. Allow the Magnehelic and manometer readings to stabilize and record these values on the Field Calibration Data Sheet (see Figure 8).

11.2.2.7 Record the manometer reading under Y1 and the Magnehelic reading under Y2 on the Field Calibration Data Sheet. For the first reading, the Magnehelic should still be at 70 inches as set above.

11.2.2.8 Set the magnehelic to 60 inches by using the sampler's flow control valve. Record the manometer (Y1) and Magnehelic (Y2) readings on the Field Calibration Data Sheet.

11.2.2.9 Repeat the above steps using Magnehelic settings of 50, 40, 30, 20, and 10 inches.

11.2.2.10 Turn the voltage variator to maximum power, open the flow control valve, and confirm that the Magnehelic reads at least 100 inches. Turn off the sampler and confirm that the magnehelic reads zero.

11.2.2.11 Read and record the following parameters on the Field Calibration Data Sheet. Record the following on the calibration data sheet:

Data, job number, and operator's signature;

- Sampler serial number;
- Ambient barometric pressure; and
- Ambient temperature.

11.2.2.12 Remove the "dummy" cartridge and replace with a sample cartridge.

11.2.2.13 Obtain the Manufacturer High Volume Orifice Calibration Certificate.

11.2.2.14 If not performed by the manufacturer, calculate values for each calibrator orifice static pressure (Column 6, inches of water) on the manufacturer's calibration certificate using the following equation:

$$\sqrt{\Delta H(P_a/760)(298/[T_a + 273])}$$

where:

P_a = the barometric pressure (mm Hg) at time of manufacturer calibration, mm Hg

T_a = temperature at time of calibration, °C

11.2.2.15 Perform a linear regression analysis using the values in Column 7 of the manufacturer High Volume Orifice Calibration Certificate for flow rate (Q_{STD}) as the "X" values and the calculated values as the Y values. From this relationship, determine the correlation (CC1), intercept (B1), and slope (M1) for the Orifice Transfer Standard.

11.2.2.16 Record these values on the Field Calibration Data Sheet (see Figure 8).

11.2.2.17 Using the Field Calibration Data Sheet values (see Figure 8), calculate the Orifice Manometer Calculated Values (Y3) for each orifice manometer reading using the following equation:

Y3 Calculation

$$Y3 = [Y1(P_a/760)(298/[T_a + 273])]^{1/2}$$

11.2.2.18 Record the values obtained in Column Y3 on the Field Calibration Data Sheet (see Figure 8).

11.2.2.19 Calculate the Sampler Magnehelic Calculate Values (Y4) using the following equation:

Y4 Calculation

$$Y4 = [Y2(P_a/760)(298/[T_a + 273])]^{1/2}$$

11.2.2.20 Record the value obtained in Column Y4 on the Field Calibration Data Sheet (see Figure 8).

11.2.2.21 Calculate the Orifice Flow Rate (X1) in scm, using the following equation:

X1 Calculation

$$X1 = \frac{Y3 - B1}{M1}$$

11.2.2.22 Record the values obtained in Column X1, on the Field Calibration Data Sheet (see Figure 8).

11.2.2.23 Perform a linear regression of the values in Column X1 (as X) and the values in Column Y4 (as Y). Record the relationship for correlation (CC2), intercept (B2), and slope (M2) on the Field Calibration Data Sheet.

11.2.2.24 Using the following equation, calculate a set point (SP) for the manometer to represent a desired flow rate:

$$\text{Set point (SP)} = [(\text{Expected } P_a) / (\text{Expected } T_a) (T_{\text{std}} / P_{\text{std}})] [M2 (\text{Desired flow rate}) + B2]^2$$

where:

P_a = Expected atmospheric pressure (P_a), mm Hg
 T_a = Expected atmospheric temperature (T_a), °C
 M2 = Slope of developed relationship
 B2 = Intercept of developed relationship
 T_{std} = Temperature standard, 25 °C
 P_{std} = Pressure standard, 760 mm Hg

11.2.2.25 During monitoring, calculate a flow rate from the observed Magnehelic reading using the following equations:

$$Y5 = [\text{Average Magnehelic Reading } (\Delta H) (P_a / T_a) (T_{\text{std}} / P_{\text{std}})]^{1/2}$$

$$X2 = \frac{Y5 - B2}{M2}$$

where:

Y5 = Corrected Magnehelic reading
 X2 = Instant calculated flow rate, scm

11.2.2.26 The relationship in calibration of a sampling system between Orifice Transfer Standard and flow rate through the sampler is illustrated in Figure 9.

11.2.3 Single-Point Audit of the High Volume Sampling System Utilizing Calibrated Orifice Transfer Standard

Single point calibration checks are required as follows:

- Prior to the start of each 24-hour test period.
- After each 24-hour test period. The post-test calibration check may serve as the pre-test calibration check for the next sampling period if the sampler is not moved.
- Prior to sampling after a sample is moved.

For samplers, perform a calibration check for the operational flow rate before each 24-hour sampling event and when required as outlined in the user quality assurance program. The purpose of this check is to track the sampler's calibration stability. Maintain a control chart presenting the percentage difference between a sampler's indicated and measured flow rates. This chart provides a quick reference of sampler flow-rate drift problems and is useful for tracking the performance of the sampler. Either the sampler log book or a data sheet will be used

to document flowcheck information. This information includes, but is not limited to, sampler and orifice transfer standard serial number, ambient temperature, pressure conditions, and collected flow-check data.

In this subsection, the following is assumed:

- The flow rate through a sampler is indicated by the orifice differential pressure;
- Samplers are designed to operate at an actual flow rate of 8 scfm, with a maximum acceptable flow-rate fluctuation range of ± 10 percent of this value;
- The transfer standard will be an orifice device equipped with a pressure tap. The pressure is measured using a manometer; and
- The orifice transfer standard's calibration relationship is in terms of standard volumetric flow rate (Q_{std}).

11.2.3.1 Perform a single point flow audit check before and after each sampling period utilizing the Calibrated Orifice Transfer Standard (see Section 11.2.1).

11.2.3.2 Prior to single point audit, place a "dummy" glass cartridge in the sampling head and activate the sampling motor. Fully open the flow control valve and adjust the voltage variator so that a sample flow rate corresponding to 110 percent of the desired flow rate (typically 0.19 to 0.28 m³/min) is indicated on the Magnehelic gauge (based on the previously obtained multipoint calibration curve). Allow the motor to warm up for 10 minutes and then adjust the flow control valve to achieve the desired flow rate. Turn off the sampler. Record the ambient temperature and barometric pressure on a Field Test Data Sheet (see Figure 10).

11.2.3.3 Place the flow rate transfer standard on the sampling head.

11.2.3.4 Properly align the retaining rings with the filter holder and secure by tightening the 3 screw clamps. Connect the flow rate transfer standard to the manometer using a length of tubing.

11.2.3.5 Using tubing, attach 1 manometer connector to the pressure tap of the transfer standard. Leave the other connector open to the atmosphere.

11.2.3.6 Adjust the manometer midpoint by sliding the movable scale until the zero point corresponds with the water meniscus. Gently shake or tap to remove any air bubbles and/or liquid remaining on tubing connectors. (If additional liquid is required, remove tubing connector and add clean water.)

11.2.3.7 Turn on high-volume motor and let run for 5 minutes.

11.2.3.8 Record the pressure differential indicated, ΔH , in inches of water, on the Field Test Data Sheet. Be sure stable ΔH has been established.

11.2.3.9 Record the observed Magnehelic gauge reading, in inches of water, on the Field Test Data Sheet. Be sure stable ΔM has been established.

11.2.3.10 Using previous established Orifice Transfer Standard curve, calculate Q_{xs} (see Section 11.2.2.23).

11.2.3.11 This flow should be within ± 10 percent of the sampler set point, normally, 8 ft³. If not, perform a new multipoint calibration of the sampler.

11.2.3.12 Remove Flow Rate Transfer Standard and dummy adsorbent cartridge.

11.3 Sample Collection

11.3.1 General Requirements

11.3.1.1 The sampler should be located in an unobstructed area, at least 2 meters from any obstacle to air flow. The exhaust hose should be stretched out in the downwind direction to prevent recycling of air into the sample head.

11.3.1.2 All cleaning and sample module loading and unloading should be conducted in a controlled environment, to minimize any chance of potential contamination.

11.3.1.3 When new or when using the sampler at a different location, all sample contact areas need to be cleared. Use triple rinses of reagent grade hexane or methylene chloride contained in Teflon® rinse bottles. Allow the solvents to evaporate before loading the PUF modules.

11.3.2 Preparing Cartridge for Sampling

11.3.2.1 Detach the lower chamber of the cleaned sample head. While wearing disposable, clean, lint-free nylon, or powder-free surgical gloves, remove a clean glass adsorbent module from its shipping container. Remove the Teflon® end caps. Replace the end caps in the sample container to be reused after the sample has been collected.

11.3.2.2 Insert the glass module into the lower chamber and tightly reattach the lower chambers to the module.

11.3.2.3 Using clean rinsed (with hexane) Teflon-tipped forceps, carefully place a clean conditioned fiber filter atop the filter holder and secure in place by clamping the filter holder ring over the filter. Place the aluminum protective cover on top of the cartridge head. Tighten the 3 screw clamps. Ensure that all module connections are tightly assembled. Place a small piece of aluminum foil on the ball-joint of the sample cartridge to protect from back-diffusion of semi-volatile into the cartridge during transporting to the site.

[Note: Failure to do so could result in air flow leaks at poorly sealed locations which could affect sample representativeness.]

11.3.2.4 Place in a carrying bag to take to the sampler.

11.3.3 Collection

11.3.3.1 After the sampling system has been assembled, perform a single point flow check as described in Sections 11.2.3.

11.3.3.2 With the empty sample module removed from the sampler, rinse all sample contact areas using reagent grade hexane in a Teflon® squeeze bottle. Allow the hexane to evaporate from the module before loading the samples.

11.3.3.3 With the sample cartridge removed from the sampler and the flow control valve fully open, turn the pump on and allow it to warm-up for approximately 5 minutes.

11.3.3.4 Attach a "dummy" sampling cartridge loaded with the exact same type of filter and PUF media to be used for sample collection.

11.3.3.5 Turn the sampler on and adjust the flow control valve to the desired flow as indicated by the Magnehelic gauge reading determined in Section 11.2.2.4. Once the flow is properly adjusted, take extreme care not to inadvertently alter its setting.

11.3.3.6 Turn the sampler off and remove both the "dummy" module. The sampler is now ready for field use.

11.3.3.7 Check the zero reading of the sampler Magnehelic. Record the ambient temperature, barometric pressure, elapsed time meter setting, sampler serial number, filter number, and PUF cartridge number on the Field Test Data Sheet (see Figure 10). Attach the loaded sampler cartridge to the sampler.

11.3.3.8 Place the voltage variator and flow control valve at the settings used in Section 11.3.2, and the power switch. Activate the elapsed time meter and record the start time. Adjust the flow (Magnehelic setting), if necessary, using the flow control valve.

11.3.3.9 Record the Magnehelic reading every 6 hours during the sampling period. Use the calibration factors (see Section 11.2.2.3) to calculate the desired flow rate. Record the ambient temperature, barometric pressure, and Magnehelic reading at the beginning and during sampling period.

11.3.4 Sample Recovery

11.3.4.1 At the end of the desired sampling period, turn the power off. Carefully remove the sampling head containing the filter and adsorbent cartridge to a clean area.

11.3.4.2 While wearing disposable lint free nylon or surgical gloves, remove the PUF cartridge from the lower module chamber and lay it on the retained aluminum foil in which the sample was originally wrapped.

11.3.4.3 Carefully remove the glass fiber filter from the upper chamber using clean Teflon®-tipped forceps.

11.3.4.4 Fold the filter in half twice (sample side inward) and place it in the glass cartridge atop the PUF.

11.3.4.5 Wrap the combined samples in the original hexane rinsed aluminum foil, attached Teflon® end caps and place them in their original aluminum sample container. Complete a sample label and affix it to the aluminum shipping container.

11.3.4.6 Chain-of-custody should be maintained for all samples. Store the containers at <4°C and protect from light to prevent possibly photo-decomposition of collected analytes. If the time span between sample collection and laboratory analysis is to exceed 24 hours, refrigerate sample.

11.3.4.7 Perform a final calculated sample flow check using the calibration orifice, as described in Section 11.3.2. If calibration deviates by more than 10 percent from the initial reading, mark the flow data for that sample as suspect and inspect and/or remove from service.

11.3.4.8 Return at least 1 field filter/PUF blank to the laboratory with each group of samples. Treat a field blank exactly as the sample except that no air is drawn through the filter/adsorbent cartridge assembly.

11.3.4.9 Ship and store samples under ice (<4°C) until receipt at the analytical laboratory, after which it should be refrigerated at less than or equal to 4°C. Extraction must be performed within seven days of sampling and analysis within 40 days after extraction.

12. Sample Preparation

12.1 Extraction Procedure for Quartz Fiber Filters and PUF Plugs

12.1.1 Take the glass sample cartridge containing the PUF plug and quartz fiber filter out of the shipping container and place it in a 43-mm x 123-mm Soxhlet extractor. Add 10 µL of ¹³C₁₂-labeled sample fortification solution (see Table 4) to the sample. Put the thimble into a 50 mm Soxhlet extractor fitted with a 500 mL boiling flask containing 275 mL of benzene.

[Note: While the procedure specifies benzene as the extraction solution, many laboratories have substituted toluene for benzene because of the carcinogenic nature of benzene (28). The EPA is presently studying the replacement of benzene with toluene.]

12.1.2 Place a small funnel in the top of the Soxhlet extractor, making sure that the top of the funnel is inside the thimble. Rinse the inside of the corresponding glass cylinder into the thimble using approximately 25 mL of benzene. Place the extractor on a heating mantel. Adjust the heat until the benzene drips at a rate of 2 drops per second and allow to flow for 16 hours. Allow the apparatus to cool.

12.1.3 Remove the extractor and place a 3-bulb Snyder column onto the flask containing the benzene extract. Place on a heating mantel and concentrate the benzene to 25 mL (do not let go to dryness). Add 100 mL of hexane and again concentrate to 25 mL. Add a second 100 mL portion of hexane and again concentrate to 25 mL.

12.1.4 Let cool and add 25 mL hexane. The extract is ready for acid/base cleanup at this point.

12.2 Cleanup Procedures

12.2.1 Acid/Base Cleanup. Transfer the hexane extract to a 250 mL separatory funnel with two 25-mL portions of hexane. Wash the combined hexane with 30 mL of 2 N potassium hydroxide. Allow layers to separate and discard the aqueous layer. Repeat until no color is visible in the aqueous layer, up to a maximum of 4 washes. Partition the extract against 50 mL of 5% sodium chloride solution. Discard the aqueous layer. Carefully add 50 mL of concentrated sulfuric acid. Shake vigorously for 1 minute, allow layers to separate, and discard the acid layer. Repeat the acid wash until no color is visible in the aqueous layer, up to a maximum of 4 washes. Partition the extract against 50 mL of 5% sodium chloride solution. Discard the aqueous layer. Transfer the hexane through a 42-mm x 160-mm filter funnel containing a plug of glass wool and 3-cm of sodium sulfate into a 250-mL Kuderna-Danish (KD) concentrator fitted with a 15-mL catch tube. Rinse the filter funnel with two 25 mL portions of hexane. Place a 3-bulb Snyder column on the KD concentrator and concentrate on a steam bath to 1-2 mL. The extract is ready for the alumina column cleanup at this point, but it can be sealed and stored in the dark, if necessary. An extract that contains obvious contamination, such as yellow or brown color, is subjected to the silica column cleanup prior to the alumina cleanup.

12.2.2 Silica Column Preparation. Gently tamp a plug of glass wool into the bottom of a 5.75-inch (14.6 cm) disposable Pasteur pipette. Pour prewashed 100-200 mesh Bio-Sil®A (silica gel) into the pipette until a height of 3.0 cm of silica gel is packed into the column. Top the silica gel with 0.5 cm of anhydrous granular sodium sulfate. Place columns in an oven set at 220°C. Store columns in the oven until ready for use, at least overnight. Remove only the columns needed and place them in a desiccator until they have equilibrated to room temperature. Use immediately.

12.2.3 Silica Column Cleanup. Position the silica column over the alumina column so the eluent will drip onto the alumina column. Transfer the 2 mL hexane extract from the Acid/Base Cleanup onto the silica column with two separate 0.5-mL portions of hexane. Elute the silica column with an additional 4.0 mL of hexane. Discard the silica column and proceed with the alumina column cleanup at the point where the column is washed with 6.0 mL of carbon tetrachloride.

12.2.4 Alumina Column Preparation. Gently tamp a plug of glass wool into the bottom of a 5.75-inch (14.6 cm) disposable Pasteur pipette. Pour WOELM neutral alumina into the pipette while tapping the column with a pencil or wooden dowel until a height of 4.5 cm of alumina is packed into the column. Top the alumina with a 0.5 cm of anhydrous granular sodium sulfate. Prewash the column with 3 mL dichloromethane. Allow the dichloromethane to drain from the column; then force the remaining dichloromethane from the column with a stream of dry nitrogen. Place prepared columns in an oven set at 225°C. Store columns in the oven until ready for use, at least overnight. Remove only columns needed and place them in a desiccator over anhydrous calcium sulfate until they have equilibrated to room temperature. Use immediately.

12.2.5 Alumina Column Cleanup. Prewet the alumina column with 1 mL of hexane. Transfer the 2 mL hexane extract from acid/base cleanup into the column. Elute the column with 6.0 mL of carbon tetrachloride and archive. Elute the column with 4.0 mL of dichloromethane and catch the eluate in a 12-mL distillation receiver. Add 3 µL tetradecane, place a micro-Snyder column on the receiver and evaporate the dichloromethane just to dryness by means of a hot water bath. Add 2 mL of hexane to the receiver and evaporate just to dryness. Add another 2-mL portion of hexane and evaporate to 0.5 mL. The extract is ready for the carbon column cleanup at this point.

12.2.6 Carbon Column Preparation. Weigh 9.5 g of Bio-Sil®A (100-200 mesh) silica gel, which has been previously heated to 225°C for 24 hours, into a 50-mL screw cap container. Weigh 0.50 g of Amoco PX-21 carbon onto the silica gel cap and shake vigorously for 1 hour. Just before use, rotate the container by hand for at least 1 minute. Break a glass graduated 2.0-mL disposal pipette at the 1.8 mL mark and fire polish the end. Place a small plug of glass wool in the pipette and pack it at the 0.0 mL mark using two small solid glass rods. Add 0.1 mL of Bio-Sil®A 100-200 mesh silica gel. If more than 1 column is to be made at a time, it is best to

add the silica gel to all the columns and then add the carbon-silica gel mixture to all columns. Add 0.40 mL of the carbon silica gel mixture to the column; the top of the mixture will be at the 0.55-mL mark on the pipette. Top the column with a small plug of glass wool.

12.2.7 Carbon Column Cleanup. Place the column in a suitable clamp with the silica gel plug up. Add approximately 0.5 mL of 50 percent benzene-methylene chloride (v/v) to the top of the column. Fit a 10 mL disposable pipette on the top of the carbon column with a short piece of extruded teflon tubing. Add an additional 9.5 mL of the 50 percent benzene-methylene chloride. When approximately 0.5 mL of this solvent remains, add 10 mL of toluene. After all the toluene has gone into the column, remove the 10-mL reservoir and add at least 2.0 mL of hexane to the column. When approximately 0.1 mL of the hexane is left on the top of the column, transfer the sample extract onto the column with a Pasteur pipette. Rinse the distillation receiver column that contained the extract with two separate 0.2 mL portions of hexane and transfer each rinse onto the column. Allow the top of each transfer layer to enter the glass wool before adding the next one. When the last of the transfer solvent enters the glass wool, add 0.5 mL of methylene chloride, replace the 10-mL reservoir, and add 4.5 mL of methylene chloride to it. When approximately 0.5 mL of this solvent remains, add 10 mL of 50 percent benzene-methylene chloride. When all this solvent has gone onto the column, remove the reservoir, take the column out of the holder and rinse each end with toluene, turn the column over, and put it back in the holder. All previous elution solvents are archived. Place a suitable receiver tube under the column and add 0.5 mL of toluene to the top of the column. Fit the 10 mL reservoir on the column and add 9.5 mL of toluene to it. When all toluene has eluted through the column and has been collected in the receiving tube, add 5 mL of tetradecane and concentrate to 0.5 mL using a stream of nitrogen and water bath maintained at 60°C. Transfer the toluene extract to a 2.0 mL graduated Chromoflex® tube with two 0.5-mL portions of benzene. Add 0.5 ng of ¹³C₁₂-1,2,3,4-TCDD and store the extracts in the dark at room temperature. Concentrate the extract to 30 µL using a stream of nitrogen at room temperature just prior to analysis or shipping. Transfer the extracts that are to be shipped to a 2 mm i.d. x 75 mm glass tube that has been fire sealed on one end with enough benzene to bring the total volume of the extract to 100 µL. Then fire seal other end of the tube.

12.3 Glassware Cleanup Procedures

In this procedure, take each piece of glassware through the cleaning separately except in the oven baking process. Wash the 100-mL round bottom flasks, the 250 mL separatory funnels, the KD concentrators, etc., that were used in the extraction procedures three times with hot tap water, two times with acetone and two times with hexane. Then bake this glassware in a forced air oven that is vented to the outside for 16 hours at 450°C. Clean the PFTE stopcocks as above except for the oven baking step. Rinse all glassware with acetone and hexane immediately before use.

13. HRGC-HRMS System Performance

13.1 Operation of HRGC-HRMS

Operate the HRMS in the electron impact (EI) ionization mode using the selected ion monitoring (SIM) detection technique. Achieve a static mass resolution of 10,000 (10% valley) before analysis of a set of samples is begun. Check the mass resolution at the beginning and at the end of each day. (Corrective actions should be implemented whenever the resolving power does not meet the requirement.) Chromatography time required for PCDDs and PCDFs may exceed the long-term stability of the mass spectrometer because the instrument is operated in the high-resolution mode and the mass drifts of a few ppm (e.g., 5 ppm in mass) can have adverse effects on the analytical results. Therefore, a mass-drift correction may be required. Use a lock-mass ion for the reference

compound perfluorokerosene (PFK) to tune the mass spectrometer. The selection of the SIM lock-mass ions of PFK shown in the descriptors (see Tables 10, 11 and 12) is dependent on the masses of the ions monitored within each descriptor. An acceptable lock-mass ion at any mass between the lightest and heaviest ion in each descriptor can be used to monitor and correct mass drifts. Adjust the level of the reference compound (PFK) metered inside the ion chamber during HRGC-HRMS analyses so that the amplitude of the most intense selected lock-mass ion signal is kept to a minimum. Under those conditions, sensitivity changes can be more effectively monitored. Excessive use of PFK or any reference substance will cause high background signals and contamination of the ion source, which will result in an increase in "downtime" required for instrument maintenance.

Tune the instrument to a mass resolution of 10,000 (10% valley) at m/z 292.9825 (PFK). By using the peak matching unit (manual or computer simulated) and the PFK reference peak, verify that the exact m/z 392.9761 (PFK) is within 3 parts per million (ppm) of the required value.

Document the instrument resolving power by recording the peak profile of the high mass reference signal (m/z 392.9761) obtained during the above peak matching calibration experiment by using the low mass PFK ion at m/z 292.9825 as a reference. The minimum resolving power of 10,000 should be demonstrated on the high mass ion while it is transmitted at a lower accelerating voltage than the low mass reference ion, which is transmitted at full voltage and full sensitivity. There will be little, if any, loss in sensitivity on the high mass ion if the source parameters are properly tuned and optimized. The format of the peak profile representation should allow for computer calculated and manual determination of the resolution, i.e., the horizontal axis should be a calibrated mass scale (amu or ppm per division). Detailed descriptions for mass resolution adjustments are usually found in the instrument operators manual or instructions.

13.2 Column Performance

After the HRMS parameters are optimized, analyze an aliquot of a column performance solution containing the first and last eluting compounds (see Table 9), or a solution containing all congeners, to determine and confirm SIM parameters, retention time windows, and HRGC resolution of the compounds. Adjustments can be made at this point, if necessary. Some PeCDFs elute in the TCDD retention time window when using the 60 m DB-5 column. The PeCDF masses can be included with the TCDD/TCDF masses in Descriptor 1. Include the PeCDD/PeCDF masses with the TCDD/TCDF masses when using the 60 m SP-2331 polar column. The HRGC-HRMS SIM parameters and retention time windows can be rapidly and efficiently determined and optimized by analysis of a window defining solution of PCDDs/PCDFs using one mass for each isomer for the complete analysis of tetra- through octa- compounds, as illustrated in Figure 11.

13.3 SIM Cycle Time

The total time for each SIM cycle should be 1 second or less for data acquisition, which includes the sum of the mass ion dwell times and ESA voltage reset times.

13.4 Peak Separation

Chromatographic peak separation between 2,3,7,8-TCDD and the co-eluting isomers should be resolved with a valley of 25% or more (see Figure 12).

13.5 Initial Calibration

After the HRGC-HRMS SIM operating conditions are optimized, perform an initial calibration using the 5 calibration solutions shown in Table 3. The quantification relationships of labeled and unlabeled standards are illustrated in Tables 15, 16, 17, and 18. Figures 13 through 22 represent the extracted ion current profiles (EICP) for specific masses for 2,3,7,8-TCDF, 2,3,7,8-TCDD and other 2,3,7,8-substituted PCDF/PCDD (along with their labeled standards) through OCDF and OCDD respectively.

[Note: Other solutions containing fewer or different congeners and at different concentrations may also be used for calibration purposes.]

Referring to Tables 10, 11, or 12, calculate (1) the relative response factors (RRFs) for each unlabeled PCDD/PCDF and PBDD/PBDF [RRF (I)] relative to their corresponding $^{13}\text{C}_{12}$ -labeled internal standard and (2) the RRFs for the $^{13}\text{C}_{12}$ -labeled PCDD/PCDF and PBDD/PBDF internal standards [RRF (II)] relative to $^{37}\text{Cl}_4$ -2,3,7,8-TCDD recovery standard using the following formulae:

$$\text{RRF(I)} = \frac{(A_x \times Q_{is})}{(Q_x \times A_{is})}$$

$$\text{RRF(II)} = \frac{(A_{is} \times Q_{rs})}{(Q_{is} \times A_{rs})}$$

where:

A_x = the sum of the integrated ion abundances of the quantitation ions (see Tables 10, 11 or 12) for unlabeled PCDDs/PCDFs, and PBDDs/PBDFs and BCDDs/BCDFs.

A_{is} = the sum of the integrated ion abundances of the quantitation ions for the $^{13}\text{C}_{12}$ -labeled internal standards (see Table 10, 11 or 12).

[Note: Other $^{13}\text{C}_{12}$ -labeled analytes may also be used as the recovery standard(s)]

A_{rs} = the integrated ion abundance for the quantitation ion of the $^{37}\text{Cl}_4$ -2,3,7,8-TCDD recovery standard.

Q_{is} = the quantity of the $^{13}\text{C}_{12}$ -labeled internal standard injected, pg.

Q_x = the quantity of the unlabeled PCDD/PCDF analyte injected, pg.

Q_{rs} = the quantity of the $^{37}\text{Cl}_4$ -2,3,7,8-TCDD injected, pg.

RRF(I) and RRF(II) = dimensionless quantities. The units used to express Q_{is} and Q_x must be the same.

[Note: $^{13}\text{C}_{12}$ -1,2,3,7,8-PeBDF is used to determine the response factor for the unlabeled 2,3,7,8-substituted, PeBDD, HxBDF and HxBDD.]

Calculate the average RRFs for the 5 concentration levels of unlabeled and $^{13}\text{C}_{12}$ -labeled PCDDs/PCDFs and PBDDs/PBDFs for the initial calibration using the following equation:

$$\overline{\text{RRF}} = \frac{\text{RRF1} + \text{RRF2} + \text{RRF3} + \text{RRF4} + \text{RRF5}}{5}$$

13.6 Criteria Required for Initial Calibration

The analytical data must satisfy certain criteria for acceptable calibration. The isotopic ratios must be within the acceptable range (see Tables 19 and 20). The percent relative standard deviation for the response factors should be less than the values presented in Table 21. The signal-to-noise ratio for the $^{13}\text{C}_{12}$ -labeled standards must be 10:1 or more and 5:1 or more for the unlabeled standards.

13.7 Continuing Calibration

Conduct an analysis at the beginning of each day to check and confirm the calibration using an aliquot of the calibration solution. This analysis should meet the isotopic ratios and signal to noise ratios of the criteria stated in Section 13.6 (see Table 21 for daily calibration percent difference criteria). It is good practice to confirm the calibration at the end of the day also. Calculate the daily calibration percent difference using the following equation.

$$\% \text{RRF} = \frac{\text{RRF}_{\text{cc}} - \overline{\text{RRF}}}{\overline{\text{RRF}}} \times 100$$

RRF_{cc} = the relative response factor for a specific analyte in the continuing calibration standard.

14. HRGC-HRMS Analysis And Operating Parameters

14.1 Sample Analysis

Sample Analysis. An aliquot of the sample extract is analyzed with the HRGC-HRMS system using the instrument parameters illustrated in Tables 13 and 14 and the SIM descriptors and masses shown in Tables 10, 11, and 12. A 30-m SE-54 fused silica capillary column is used to determine the concentrations of total tetra-, penta-, hexa-, hepta- and octa-CDDs/CDFs and/or to determine the minimum limits of detections (MLDs) for the compounds. If the tetra-, penta-, and hexa-CDDs/CDFs were detected in a sample and isomer specific analyses are required, then an aliquot of the sample extract is analyzed using the 60 m SP-2331 fused silica capillary column to provide a concentration for each 2,3,7,8-substituted PCDD/PCDF and concentrations for total PCDDs and PCDFs also.

[Note: Other capillary columns such as the DB-5, SE-30, and DB-225 may be used if the performance satisfies the specifications for resolution of PCDDs/PCDFs. The SE-54 column resolves the four HpCDF isomers, two HpCDD isomers, OCDF and OCDD for isomer specific analysis. It does not resolve the tetra-, penta-, and hexa-2,3,7,8-substituted isomers. The SE-54 column is used for the analysis of PBDDs and PBDFs.]

Isomer specificity for all 2,3,7,8-substituted PCDDs/PCDFs cannot be achieved on a single HRGC capillary column at this time. However, many types of HRGC capillary columns are available and can be used for these analyses after their resolution capabilities are confirmed to be adequate using appropriate standards.

Two HRGC columns shown in Table 13 have been used successfully since 1984 (27, 28). The 60-m DB-5 provides an efficient analysis for total concentrations of PCDDs/PCDFs, specific isomers (total tetra-, penta-, hexa-CDDs/CDFs, four HpCDF isomers, two HpCDD isomers, OCDD and OCDF), PBDDs/PBDFs, and/or determination of MDLs. The 60 m SP-2331 column provides demonstrated and confirmed resolution of 2,3,7,8-substituted tetra-, penta-, and hexa-PCDDs/PCDFs (14). The descriptors and masses shown in Tables 10, 11 and 12 must be modified to take into account the elution of some of the PeCDDs and PeCDFs in the tetra retention time window using the SP-2331 column.

14.2 Identification Criteria

Criteria used for identification of PCDDs and PCDFs in samples are as follows:

- The integrated ion abundance ratio $M/(M+2)$ or $(M+2)/(M+4)$ shall be within 15 percent of the theoretical value. The acceptable ion abundance ranges are shown in Tables 19 and 20.
- The ions monitored for a given analyte, shown in Tables 10, 11, and 12, shall reach their maximum within 2 seconds of each other.
- The retention time for the 2,3,7,8-substituted analytes must be within 3 seconds of the corresponding $^{13}\text{C}_{12}$ -labeled internal standard, surrogate, or alternate standard.
- The identification of 2,3,7,8-substituted isomers that do not have corresponding $^{13}\text{C}_{12}$ -labeled standards is done by comparison to the analysis of a standard that contains the specific congeners. Comparison of the relative retention time (RRT) of the analyte to the nearest internal standard with reference (i.e., within 0.005 RRT time units to the comparable RRTs found in the continuing calibration or literature).
- The signal-to-noise ratio for the monitored ions must be greater than 2.5.
- The analysis shall show the absence of polychlorinated diphenyl-ethers (PCDPEs). Any PCDPEs that co-elute (± 2 seconds) with peaks in the PCDF channels indicates a positive interference, especially if the intensity of the PCDPE peak is 10 percent or more of the PCDF.

Use the identification criteria in Section 14.2 to identify and quantify the PCDDs and PCDFs in the sample. Figure 23 illustrates a reconstructed EICP for an environmental sample, identifying the presence of 2,3,7,8-TCDF as referenced to the labeled standard.

14.3 Quantification

The peak areas of ions monitored for $^{13}\text{C}_{12}$ -labeled PCDDs/PCDFs and ^{37}Cl -2,3,7,8-TCDD, unlabeled PCDDs/PCDFs, and respective relative response factors are used for quantification. The $^{37}\text{Cl}_4$ -2,3,7,8-TCDD, spiked to extract prior to final concentration, and respective response factors are used to determine the sample extraction efficiencies achieved for the nine $^{13}\text{C}_{12}$ -labeled internal standards, which are spiked to the sample prior to extraction (% recovery). The $^{13}\text{C}_{12}$ -labeled PCDD/PCDF internal standards and response factors are used for quantification of unlabeled PCDDs/PCDFs and for determination of the minimum limits of detection with but one exception: $^{13}\text{C}_{12}$ -OCDD is used for OCDF. Each $^{13}\text{C}_{12}$ -labeled internal standard is used to quantify all of the PCDDs/PCDFs in its isomeric group. For example, $^{13}\text{C}_{12}$ -2,3,7,8-TCDD and the 2,3,7,8-TCDD response factor are used to quantify all of the 22 tetra-chlorinated isomers. The quantification relationships of these standards are shown in Tables 15, 16, 17, and 18. The $^{37}\text{Cl}_4$ -2,3,7,8-TCDD spiked to the filter of the sampler

prior to sample collection is used to determine the sampler retention efficiency, which also indicates the collection efficiency for the sampling period.

14.4 Calculations

14.4.1 Extraction Efficiency. Calculate the extraction efficiencies (percent recovery) of the 9 $^{13}\text{C}_{12}$ -labeled PCDD/PCDF or the 3 $^{13}\text{C}_{12}$ -labeled PBDD/PBDF internal standards measured in the extract using the formula:

$$\%R_{\text{is}} = \frac{[A_{\text{is}} \times Q_{\text{rs}} \times 100]}{[Q_{\text{is}} \times A_{\text{rs}} \times \text{RRF(II)}]}$$

where:

$\%R_{\text{is}}$ = percent recovery (extraction efficiency).

A_{is} = the sum of the integrated ion abundances of the quantitation ions (see Tables 10, 11 or 12) for the $^{13}\text{C}_{12}$ -labeled internal standard.

A_{rs} = the sum of the integrated ion abundances of the quantitation ions (see Table 10, 11 or 12) for the $^{37}\text{Cl}_4$ - or $^{13}\text{C}_{12}$ -labeled recovery standard; the selection of the recovery standard(s) depends on the type of homologues.

Q_{is} = quantity of the $^{13}\text{C}_{12}$ -labeled internal standard added to the sample before extraction, pg.

Q_{rs} = quantity of the $^{37}\text{Cl}_4$ - or $^{13}\text{C}_{12}$ -labeled recovery standard added to the sample extract before HRGC-HRMS analysis, pg.

RRF(II) = calculated mean relative response factor for the labeled internal standard relative to the appropriate labeled recovery standard.

14.4.2 Calculation of Concentration. Calculate the concentration of each 2,3,7,8-substituted PCDD/PCDF, other isomers or PBDD/PBDF that have met the criteria described in Sections 14.2 using the following formula:

$$C_{\text{x}} = \frac{[A_{\text{x}} \times Q_{\text{is}}]}{[A_{\text{is}} \times V_{\text{std}} \times \text{RRF(I)}]}$$

where:

C_{x} = concentration of unlabeled PCDD/PCDF, PBDD/PBDF or BCDD/BCDF congener(s), pg/m³.

A_{x} = the sum of the integrated ion abundances of the quantitation ions (see Table 11, 12 or 13) for the unlabeled PCDDs/PCDFs, or PBDDs/PBDFs or BCDFs.

A_{is} = the sum of the integrated ion abundances of the quantitation ions (see Table 11, 12 or 13) for the respective $^{13}\text{C}_{12}$ -labeled internal standard.

Q_{is} = quantity of the $^{13}\text{C}_{12}$ -labeled internal standard added to the sample before extraction, pg.

V_{std} = standard volume of air, std m³.

RRF(I) = calculated mean relative response factor for an unlabeled 2,3,7,8-substituted PCDD/PCDF obtained in Section 13.4.

14.5 Method Detection Limits (MDLs)

The ambient background levels of total PCDDs/PCDFs are usually found in the range of 0.3 to 2.9 pg/m³. Therefore, the MDLs required to generate meaningful data for ambient air should be in the range of 0.02 to 0.15 pg/m³ for tetra-, penta-, and hexa-CDDs/CDFs. Trace levels, 0.05 to 0.25 pg/m³, of HpCDDs and OCDD are usually detected in the method blank (background contamination).

An MDL is defined as the amount of an analyte required to produce a signal with a peak area at least 2.5 x the area of the background signal level measured at the retention time of interest. MDLs are calculated for total PHDDs/PHDFs and for each 2,3,7,8-substituted congener. The calculation method used is dependent upon the type of signal responses present in the analysis. For example:

- Absence of response signals of one or both quantitation ion signals at the retention time of the 2,3,7,8-substituted isomer or at the retention time of non 2,3,7,8-substituted isomers. The instrument noise level is measured at the analyte's expected retention time and multiplied by 2.5, inserted into the formula below and calculated and reported as not detected (ND) at the specific MDL.
- Response signals at the same retention time as the 2,3,7,8-substituted isomers or the other isomers that have a S/N ratio in excess of 2.5:1 but that do not satisfy the identification criteria described in 14.2 are calculated and reported as ND at the elevated MDL and discussed in the narrative that accompanies the analytical results. Calculate the MDLs using the following formula:

$$\text{MDL} = \frac{[2.5 \times A_x \times Q_{is}]}{[A_{is} \times V_{std} \times \overline{\text{RRF}}]}$$

where:

MDL = concentration of unlabeled PHDD/PHDF, pg/m³.

A_x = sum of integrated ion abundances of the quantitation ions (see Table 10, 11 or 12) for the unlabeled PHDDs/PHDFs which do not meet the identification criteria or 2.5 x area of noise level at the analyte's retention time.

A_{is} = sum of the integrated ion abundances of the quantitation ions (see Table 10, 11, or 12) for the ¹³C₁₂-labeled internal standards.

Q_{is} = quantity of the ¹³C₁₂-labeled internal standard spiked to the sample prior to extraction, pg.

V_{std} = standard volume of ambient air sampled, std m³.

$\overline{\text{RRF}}$ = mean relative response factor for the unlabeled PHDD/PHDF.

14.6 2,3,7,8-TCDD Toxic Equivalents

Calculate the 2,3,7,8-TCDD toxic equivalents of PCDDs and PCDFs present in a sample according to the method recommended by EPA and the Center for Disease Control (18). This method assigns a 2,3,7,8-TCDD toxicity equivalency factor (TEF) for each of the seventeen 2,3,7,8-substituted PCDDs/PCDFs (see Table 22). The 2,3,7,8-TCDD equivalent of the PCDDs and PCDFs present in the sample is calculated by the respective TEF factors times their concentration for each of the compounds listed in Table 22. The exclusion of the other isomeric groupings (mono-, di-, and tri-chlorinated dibenzodioxins and dibenzofurans) does not mean that they are non-toxic. Their toxicity, as known at this time, is much less than the toxicity of the compounds listed in Table 22. The above procedure for calculating the 2,3,7,8-TCDD toxic equivalents is not claimed to be based on a

thoroughly established scientific foundation. The procedure, rather, represents a "consensus recommendation on science policy." Similar methods are used throughout the world.

15. Quality Assurance/Quality Control (QA/QC)

15.1 Certified analytical standards were obtained from Cambridge Isotope Laboratories, 50 Frontage Road, Andover, MA 01810, 508-749-8000.

15.2 Criteria used for HRGC-HRMS initial and continuing calibration are defined in Sections 13.5 and 13.6.

15.3 Analytical criteria used for identification purposes are defined in Section 14.2.

15.4 All test samples, method blanks, field blanks, and laboratory control samples are spiked with $^{13}\text{C}_{12}$ -labeled internal standards prior to extraction.

15.5 Sample preparation and analysis and evaluation of data are performed on a set of 12 samples, which may consist of 9 test samples, field blank, method blank, fortified method blank, or a laboratory control sample.

15.6 Method evaluation studies were performed to determine and evaluate the overall method capabilities (1, 2).

15.7 The $^{13}\text{C}_{12}$ -1,2,3,4-TCDD solution is spiked to filters of all samplers, including field blanks, immediately prior to operation or is spiked to all PUF plugs prior to shipping them to the field for sampling to determine and document the sampling efficiency.

15.8 Minimum equipment calibration and accuracy requirements achieved are illustrated in Table 23.

15.9 QA/QC requirements for data:

<u>Criteria</u>	<u>Requirements</u>
The data shall satisfy all indicated identification criteria	Discussed in Section 14.2
Method efficiency achieved for $^{13}\text{C}_{12}$ -labeled tetra-, penta-, hexa-CDDs/CDFs and PBDDs/PBDFs	50 to 120%
Method efficiency achieved for $^{13}\text{C}_{12}$ -labeled HpCDD and OCDD	40 to 120%
Accuracy achieved for PHDDs and PHDFs in method spike at 0.25 to 2.0 pg/m^3 concentration range	70 to 130%
Precision achieved for duplicate method spikes or QA samples	$\pm 30\%$
Sampler efficiency achieved for $^{13}\text{C}_{12}$ -1,2,3,4-TCDD	50 to 120%
Method blank contamination	Free of contamination that would interfere with test sample results.
Method detection limit range for method blank and field blank (individual isomers)	0.02 to 0.25 pg/m^3

16. Report Format

The analytical results achieved for a set of 12 samples should be presented in a table such as the one shown in Table 24. The analytical results, analysis, QA/QC criteria, and requirements used to evaluate data are discussed in an accompanying analytical report. The validity of the data in regard to the data quality requirements and any qualification that may apply is explained in a clear and concise manner for the user's information.

17. References

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TABLE 1. NUMBER OF POLYCHLORINATED DIBENZO-P-DIOXIN AND DIBENZOFURAN (PCDD/PCDF) CONGENERS

No. of Chlorine Atoms	No. of PCDD Isomers	No. of PCDF Isomers
1	2	4
2	10	16
3	14	28
4	22	38
5	14	28
6	10	16
7	2	4
8	1	1
Total	75	135

[*Note:* This also applies for the polybrominated dibenzo-p-dioxins and dibenzofurans (PBDDs/PBDFs).]

TABLE 2. LIST OF 2,3,7,8-CHLORINE SUBSTITUTED PCDD/PCDF CONGENERS

PCDDs	PCDFs
2,3,7,8-TCDD	2,3,7,8-TCDF
1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDF
	2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-HxCDF
	2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDF
	1,2,3,4,7,8,9-HpCDF
1,2,3,4,6,7,8,9-OCDD	1,2,3,4,6,7,8,9-OCDF

TABLE 3. COMPOSITIONS OF THE INITIAL CALIBRATION SOLUTIONS OF
LABELED AND UNLABELED PCDDS AND PCDFS

Compound Solution No.	Concentrations (pg/ μ L)				
	1	2	3	4	5
Unlabeled Analytes					
2,3,7,8-TCDD	0.5	1	5	50	100
2,3,7,8-TCDF	0.5	1	5	50	100
1,2,3,7,8-PeCDD	2.5	5	25	250	500
1,2,3,7,8-PeCDF	2.5	5	25	250	500
2,3,4,7,8-PeCDF	2.5	5	25	250	500
1,2,3,4,7,8-HxCDD	2.5	5	25	250	500
1,2,3,6,7,8-HxCDD	2.5	5	25	250	500
1,2,3,7,8,9-HxCDD	2.5	5	25	250	500
1,2,3,4,7,8-HxCDF	2.5	5	25	250	500
1,2,3,6,7,8-HxCDF	2.5	5	25	250	500
1,2,3,7,8,9-HxCDF	2.5	5	25	250	500
2,3,4,6,7,8-HxCDD	2.5	5	25	250	500
1,2,3,4,6,7,8-HpCDD	2.5	5	25	250	500
1,2,3,4,6,7,8-HpCDF	2.5	5	25	250	500
1,2,3,4,7,8,9-HpCDF	2.5	5	25	250	500
OCDD	5.0	10	50	500	1000
OCDF	5.0	10	50	500	1000
Internal Standards					
$^{13}\text{C}_{12}$ -2,3,7,8-TCDD	100	100	100	100	100
$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDD	100	100	100	100	100
$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD	100	100	100	100	100
$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDD	100	100	100	100	100
$^{13}\text{C}_{12}$ -OCDD	200	200	200	200	200
$^{13}\text{C}_{12}$ -2,3,7,8-TCDF	100	100	100	100	100

TABLE 3. (continued)

Compound Solution No.	Concentrations (pg/ μ L)				
	1	2	3	4	5
¹³ C ₁₂ -1,2,3,7,8-PeCDF	100	100	100	100	100
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	100	100	100	100	100
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	100	100	100	100	100
Surrogate Standards					
¹³ C ₁₂ -2,3,4,7,8-PeCDF	60	80	100	120	140
¹³ C ₁₂ -1,2,3,4,7,8-HxCd	60	80	100	120	140
¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	60	80	100	120	140
¹³ C ₁₂ -1,2,3,6,7,8,9-HpCD	60	80	100	120	140
Field Standards					
³⁷ Cl ₄ -2,3,7,8-TCDD	100	100	100	100	100
¹³ C ₁₂ -1,2,3,7,8,9-HxCDD	100	100	100	100	100
Recovery Standard					
¹³ C ₁₂ -1,2,3,4-TCDD	50	50	50	50	50

[Note: Standards specified in EPA Method 1613 can also be used in this method.]

TABLE 4. COMPOSITION OF THE SAMPLE
FORTIFICATION SOLUTIONS

Analyte	Concentration (pg/ μ L)
Chlorinated Internal Standards	
$^{13}\text{C}_{12}$ -2,3,7,8-TCDD	100
$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDD	100
$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD	100
$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDD	100
$^{13}\text{C}_{12}$ -OCDD	100
$^{13}\text{C}_{12}$ -2,3,7,8-TCDF	100
$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDF	100
$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF	100
$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDF	100
Brominated Internal Standards	
$^{13}\text{Cl}_{12}$ -2,3,7,8-TBDD	0.86
$^{13}\text{C}_{12}$ -2,3,7,8-TBDF	0.86
$^{13}\text{C}_{12}$ -1,2,3,7,8-PeBDF	0.86

TABLE 5. COMPOSITION OF RECOVERY STANDARD SOLUTION

Analyte	Concentration (pg/ μ L)
Recovery Standard	
$^{13}\text{C}_{12}$ -1,2,3,4-TCDD	10

TABLE 6. COMPOSITION OF AIR SAMPLER FIELD FORTIFICATION STANDARD SOLUTION

Analyte	Concentration (pg/ μ L)
Field Fortification Standard	
$^{37}\text{Cl}_4$ -2,3,7,8-TCDD	10

TABLE 7. COMPOSITION OF SURROGATE STANDARD SOLUTION

Analyte	Concentration (pg/ μ L)
Surrogate Standards	
$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDD	100
$^{13}\text{C}_{12}$ -2,3,4,7,8-PeCDF	100
$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDF	100
$^{13}\text{C}_{12}$ -1,2,3,4,7,8,9-HpCDF	100

TABLE 8. COMPOSITION OF MATRIX AND METHOD SPIKE AND METHOD SPIKE SOLUTIONS OF PCDDS/PCDFS AND PBDDS/PBDFS^a

Analyte	Concentration (pg/ μ L)	Analyte	Concentration (pg/ μ L)
Native PCDDs and PCDFs		Native PBDDs and PBDFs	
2,3,7,8-TCDD	1	2,3,7,8-TBDD	1
2,3,7,8-TCDF	1	2,3,7,8-TBDF	1
1,2,3,7,8-PeCDD	5	1,2,3,7,8-PeBDD	5
1,2,3,7,8-PeCDF	5	1,2,3,7,8-PeBDF	5
2,3,4,7,8-PeCDF	5	1,2,3,4,7,8-HxBDD	5
1,2,3,4,7,8-HxCDD	5	1,2,3,4,7,8-HxBDF	5
1,2,3,6,7,8-HxCDD	5		
1,2,3,7,8,9-HxCDD	5		
1,2,3,4,7,8-HxCDF	5		
1,2,3,6,7,8-HxCDF	5		
1,2,3,7,8,9-HxCDF	5		
2,3,4,6,7,8-HxCDF	5		
1,2,3,4,6,7,8-HpCDD	5		
1,2,3,4,6,7,8-HpCDF	5		
1,2,3,4,7,8,9-HpCDF	5		
OCDD	10		
OCDF	10		

^aSolutions at different concentrations and those containing different congeners may also be used.

TABLE 9. HRGC-HRMS COLUMN PERFORMANCE EVALUATION SOLUTIONS

Congener	First Eluted	Last Eluted
SE-54 Column GC Retention Time Window Defining Standard ^a		
TCDF	1,3,6,8-	1,2,8,9-
TCDD	1,3,6,8-	1,2,8,9-
PeCDF	1,3,4,6,8-	1,2,3,8,9-
PeCDD	1,2,4,7,9-	1,2,3,8,9-
HxCDF	1,2,3,4,6,8-	1,2,3,4,8,9-
HxCDD	1,2,4,6,7,9-	1,2,3,4,6,7-
HpCDF	1,2,3,4,6,7,8-	1,2,3,4,7,8,9-
HpCDD	1,2,3,4,6,7,9-	1,2,3,4,6,7,8-
OCDF	OCDF	
OCDD	OCDD	
SE-54 TCDD Isomer Specificity Test Standard ^b		
	1,2,3,4-TCDD	
	1,4,7,8-TCDD	2,3,7,8-TCDD
SP-2331 Column TCDF Isomer Specificity Test Standard ^c		
	2,3,4,7-TCDF	
	2,3,7,8-TCDF	
	1,2,3,9-TCDF	

^aA solution containing these congeners and the seventeen 2,3,7,8-substituted congeners may also be used for these purposes.

^bA solution containing the 1,2,3,4,-TCDD and 2,3,7,8-TCDD may also be used for this purpose.

^cSolution containing all tetra- through octa-congeners may also be used for these purposes.

TABLE 10. DESCRIPTORS, MASSES, M/Z TYPES, AND ELEMENTAL COMPOSITIONS OF THE PCDDS AND PCDFS

Descriptor Number	Accurate Mass	m/z Type	Elemental Composition	Compound ²	Primary m/z
1	292.9825	Lock	C ₇ F ₁₁	PFK	
	303.9016	M	C ₁₂ H ₄ ³⁵ Cl ₄ O	TCDF	Yes
	305.8987	M+2	C ₁₂ H ₄ ³⁵ Cl ₃ ³⁷ Cl O	TCDF	
	315.9419	M	¹³ C ₁₂ H ₄ ³⁵ Cl ₄ O	TCDF ³	Yes
	317.9389	M+2	¹³ C ₁₂ H ₄ ³⁵ Cl ₃ ³⁷ Cl O	TCDF ³	
	319.8965	M	C ₁₂ H ₄ ³⁵ Cl ₄ O ₂	TCDD	Yes
	321.8936	M+2	C ₁₂ H ₄ ³⁵ Cl ₃ ³⁷ Cl O ₂	TCDD	
	327.8847	M	C ₁₂ H ₄ ³⁷ Cl ₄ O ₂	TCDD ⁴	
	330.9792	QC	C ₇ F ₁₃	PFK	
	331.9368	M	¹³ C ₁₂ H ₄ ³⁵ Cl ₄ O ₂	TCDD ³	Yes
	333.9339	M+2	¹³ C ₁₂ H ₄ ³⁵ Cl ₃ ³⁷ Cl O ₂	TCDD ³	
	375.8364	M+2	C ₁₂ H ₄ ³⁵ Cl ₅ ³⁷ Cl O	HxCDFE	
2	339.8597	M+2	C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O	PeCDF	Yes
	341.8567	M+4	C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ₂ O	PeCDF	
	351.9000	M+2	¹³ C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O	PeCDF ³	Yes
	353.8970	M+4	¹³ C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ₂ O	PeCDF ³	
	354.9792	Lock	C ₉ F ₁₃	PFK	
	355.8546	M+2	C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O ₂	PeCDD	Yes
	357.8516	M+4	C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ₂ O ₂	PeCDD	
	367.8949	M+2	¹³ C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O ₂	PeCDD ⁴	Yes
	369.8919	M+4	¹³ C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ₂ O ₂	PeCDD ⁴	
	409.7974	M+2	C ₁₂ H ₃ ³⁵ Cl ₆ ³⁷ Cl O	HpCDFE	

TABLE 10. (continued)

Descriptor Number	Accurate Mass	m/z Type	Elemental Composition	Compound ²	Primary m/z
3	373.8208	M+2	C ₁₂ H ₂ ³⁵ Cl ₅ ³⁷ Cl O	HxCDF	Yes
	375.8178	M+4	C ₁₂ H ₂ ³⁵ Cl ₄ ³⁷ Cl ₂ O	HxCDF	
	383.8639	M	¹³ C ₁₂ H ₂ ³⁵ Cl ₆ O	HxCDF ³	Yes
	385.8610	M+2	¹³ C ₁₂ H ₂ ³⁵ Cl ₅ ³⁷ Cl O	HxCDF ³	
	389.8157	M+2	C ₁₂ H ₂ ³⁵ Cl ₅ ³⁷ Cl O ₂	HxCDD	Yes
	391.8127	M+4	C ₁₂ H ₂ ³⁵ Cl ₄ ³⁷ Cl ₂ O ₂	HxCDD	
	392.9760	Lock	C ₉ F ₁₅	PFK	
	401.8559	M+2	¹³ C ₁₂ H ₂ ³⁵ Cl ₅ ³⁷ Cl O ₂	HxCDD ³	Yes
	403.8529	M+4	¹³ C ₁₂ H ₂ ³⁵ Cl ₄ ³⁷ Cl ₂ O ₂	HxCDD ³	
	430.9729	QC	C ₉ F ₁₃	PFK	
	445.7555	M+4	C ₁₂ H ₂ ³⁵ Cl ₆ ³⁷ Cl ₂ O	OCDPE	
4	407.7818	M+2	C ₁₂ H ³⁵ Cl ₆ ³⁷ Cl O	H _p CDF	Yes
	409.7789	M+4	C ₁₂ H ³⁵ Cl ₅ ³⁷ Cl ₂ O	HpCDF	
	417.8253	M	¹³ C ₁₂ H ³⁵ Cl ₇ O	HpCDF ³	Yes
	419.8220	M+2	¹³ C ₁₂ H ³⁵ Cl ₆ ³⁷ Cl O	HpCDF ³	
	423.7766	M+2	C ₁₂ H ³⁵ Cl ₆ ³⁷ Cl O ₂	HpCDD	Yes
	425.7737	M+4	C ₁₂ H ³⁵ Cl ₅ ³⁷ Cl ₂ O ₂	HpCDD	
	430.9729	Lock	C ₉ F ₁₇	PFK	
	435.8169	M+2	¹³ C ₁₂ H ³⁵ Cl ₆ ³⁷ Cl O ₂	HpCDD ³	Yes
	437.8140	M+4	¹³ C ₁₂ H ³⁵ Cl ₅ ³⁷ Cl ₂ O ₂	HpCDD ³	
	479.7165	M+4	C ₁₂ H ³⁵ Cl ₇ ³⁷ Cl ₂ O	NCDPE	

TABLE 10. (continued)

Descriptor Number	Accurate Mass	m/z Type	Elemental Composition	Compound ²	Primary m/z
5	441.7428	M+2	C ₁₂ ³⁵ Cl ₇ ³⁷ Cl O	OCDF	Yes
	442.9728	Lock	C ₁₀ F ₁₇	PFK	
	443.7399	M+4	C ₁₂ ³⁵ Cl ₆ ³⁷ Cl ₂ O	OCDF	
	457.7377	M+2	C ₁₂ ³⁵ Cl ₇ ³⁷ Cl O ₂	OCDD	Yes
	459.7348	M+4	C ₁₂ ³⁵ Cl ₆ ³⁷ Cl ₂ O ₂	OCDD	
	469.7779	M+2	¹³ C ₁₂ ³⁵ Cl ₇ ³⁷ Cl O ₂	OCDD ³	Yes
	471.7750	M+4	¹³ C ₁₂ ³⁵ Cl ₆ ³⁷ Cl ₂ O ₂	OCDD ³	
	513.6775	M+4	C ₁₂ ³⁵ Cl ₈ ³⁷ Cl ₂ O	DCDPE	

¹Nuclidic masses used:

H = 1.007825 C = 12.00000 ¹³C = 13.003355 F = 18.9984
 O = 15.994915 ³⁵Cl = 34.968853 ³⁷Cl = 36.965903

²Compound abbreviations:

Polychlorinated dibenzo-p-dioxins

TCDD = Tetrachlorodibenzo-p-dioxin
 PeCDD = Pentachlorodibenzo-p-dioxin
 HxCDD = Hexachlorodibenzo-p-dioxin
 HpCDD = Heptachlorodibenzo-p-dioxin
 OCDD = Octachlorodibenzo-p-dioxin

Polychlorinated dibenzofurans

TCDF = Tetrachlorodibenzofuran
 PeCDF = Pentachlorodibenzofuran
 HxCDF = Hexachlorodibenzofuran
 HpCDF = Heptachlorodibenzofuran

Polychlorinated diphenyl ethers

HxCDE = Hexachlorodiphenyl ether
 HpCDE = Heptachlorodiphenyl ether
 OCDE = Octachlorodiphenyl ether
 NCDPE = Nonachlorodiphenyl ether
 DCDPE = Decachlorodiphenyl ether

Lock mass and QC compound

PFK = Perfluorokerosene

³Labeled compound

⁴There is only one m/z for ³⁷Cl₄-2,3,7,8-TCDD (recovery standard).

TABLE 11. DESCRIPTORS, M/Z TYPES, EXACT MASSES AND ELEMENTAL COMPOSITIONS OF THE PBDDS AND PBDFS

Descriptor Number	Accurate Mass ¹	Ion Type	Elemental Composition	Compound ²
1	327.8847	M	C ₁₂ H ₄ ³⁷ Cl ₄ O ₂	TCDD ⁴
	330.9792	QC	C ₇ F ₁₃	PFK
	331.9368	M	C ₁₂ H ₄ ³⁵ Cl ₄ O ₂	TCDD ³
	333.9339	M+2	C ₁₂ H ₄ ³⁵ Cl ₃ ³⁷ Cl O ₂	TCDD ³
2	417.825	M	¹³ C ₁₂ H ₄ ³⁵ Cl ₇ O	HpCDF ³
	419.822	M+2	¹³ C ₁₂ H ₄ ³⁵ Cl ₆ ³⁷ Cl O	HpCDF ³
	466.973	QC		PFK
	481.698	M+2	C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br O	TBDF
	483.696	M+4	C ₁₂ H ₄ ⁷⁹ Br ₂ ⁸¹ Br ₂ O	TBDF
	485.694	M+6	C ₁₂ H ₄ ⁷⁹ Br ⁸¹ Br ₃ O	TBDF
	492.970	LOCK MASS		PFK
	493.738	M+2	¹³ C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br O	TBDF ³
	495.736	M+4	¹³ C ₁₂ H ₄ ⁷⁹ Br ₂ ⁸¹ Br ₂ O	TBDD ³
	497.692	M+2	C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br O ₂	TBDD
	499.690	M+4	C ₁₂ H ₄ ⁷⁹ Br ₂ ⁸¹ Br ₂ O ₂	TBDD
	501.689	M+6	C ₁₂ H ₄ ⁷⁹ Br ⁸¹ Br ₃ O	TBDD
	509.733	M+2	¹³ C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br O ₂	TBDD ³
	511.731	M+4	¹³ C ₁₂ H ₄ ⁷⁹ Br ₂ ⁸¹ Br ₂ O ₂	TBDD ³
	565.620	M+6	C ₁₂ H ₅ ⁷⁹ Br ₂ ⁸¹ Br ₃ O	PeBDPO
	643.530	M+6	C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br ₃ O	HxBDPO

TABLE 11. (continued)

Descriptor Number	Accurate Mass ¹	Ion Type	Elemental Composition	Compound ²
3	469.778	M+2	$^{13}\text{C}_{12} \text{ } ^{35}\text{Cl}_7 \text{ } ^{37}\text{Cl} \text{ O}_2$	OCDD ³
	471.775	M+4	$^{13}\text{C}_{12} \text{ } ^{35}\text{Cl}_6 \text{ } ^{37}\text{Cl} \text{ O}_2$	OCDD ³
	559.608	M+2	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_4 \text{ } ^{81}\text{Br} \text{ O}$	PeBDF
	561.606	M+4	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_3 \text{ } ^{81}\text{Br}_2 \text{ O}$	PeBDF
	563.604	M+6	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_2 \text{ } ^{81}\text{Br}_3 \text{ O}$	PeBDF
	566.966	LOCK MASS		PFK
	573.646	M+4	$^{13}\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_3 \text{ } ^{81}\text{Br}_2 \text{ O}$	PeBDF ³
	575.644	M+6	$^{13}\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_2 \text{ } ^{81}\text{Br}_3 \text{ O}$	PeBDF ³
	575.603	M+2	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_4 \text{ } ^{81}\text{Br} \text{ O}_2$	PeBDD
	577.601	M+4	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_3 \text{ } ^{37}\text{Br}_2 \text{ O}_2$	PeBDD
	579.599	M+6	$\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_2 \text{ } ^{81}\text{Br}_3 \text{ O}_2$	PeBDD
	589.641	M+4	$^{13}\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_3 \text{ } ^{37}\text{Br}_2 \text{ O}_2$	PeBDD ³
	591.639	M+6	$^{13}\text{C}_{12} \text{ H}_3 \text{ } ^{79}\text{Br}_3 \text{ } ^{81}\text{Br}_2 \text{ O}_2$	PeBDD ³
	616.963	QC		PFK

TABLE 11. (continued)

Descriptor Number	Accurate Mass ¹	Ion Type	Elemental Composition	Compound ²
4	643.530	M+6	C ₁₂ H ₄ ⁷⁹ Br ₃ ⁸¹ Br ₃ O	HxBDPO
	721.441	M+6	C ₁₂ H ₃ ⁷⁹ Br ₄ ⁸¹ Br ₃ O	HpBDPO
	616.963	QC		PFK
	639.517	M+4	C ₁₂ H ₂ ⁷⁹ Br ₄ ⁸¹ Br ₂ O	HxBDF
	641.514	M+6	C ₁₂ H ₂ ⁷⁹ Br ₃ ⁸¹ Br ₃ O	HxBDF
	643.512	M+8	C ₁₂ H ₂ ⁷⁹ Br ₂ ⁸¹ Br ₄ O	HxBDF
	655.511	M+4	C ₁₂ H ₂ ⁷⁹ Br ₄ ⁸¹ Br ₂ O ₂	HxBDD
	657.509	M+6	C ₁₂ H ₂ ⁷⁹ Br ₃ ⁸¹ Br ₃ O ₂	HxBDD
	659.507	M+8	C ₁₂ H ₂ ⁷⁹ Br ₂ ⁸¹ Br ₄ O ₂	HxBDD
	666.960	LOCK MASS		PFK
	721.441	M+6	C ₁₂ H ₃ ⁷⁹ Br ₄ ⁸¹ Br ₃ O	HpBDPO
	801.349	M+8	C ₁₂ H ₂ ⁷⁹ Br ₄ ⁸¹ Br ₄ O	OBDDPO

TABLE 11. (continued)

Descriptor Number	Accurate Mass ¹	Ion Type	Elemental Composition	Compound ²
5	717.427	M+4	C ₁₂ H ⁷⁹ Br ₅ ⁸¹ Br ₂ O	HpBDF
	719.425	M+6	C ₁₂ H ⁷⁹ Br ₄ ⁸¹ Br ₃ O	HpBDF
	721.423	M+8	C ₁₂ H ⁷⁹ Br ₃ ⁸¹ Br ₄ O	HpBDF
	733.422	M+4	C ₁₂ H ⁷⁹ Br ₅ ⁸¹ Br ₂ O ₂	HpBDD
	735.420	M+6	C ₁₂ H ⁷⁹ Br ₄ ⁸¹ Br ₃ O ₂	HpBDD
	737.418	M+4	C ₁₂ H ⁷⁹ Br ₃ ⁸¹ Br ₄ O ₂	HpBDD
	754.954	QC		PFK
	770.960	LOCK MASS ALTERNATE		HpTriazine
	801.349	M+8	C ₁₂ H ₂ ⁷⁹ Br ₄ ⁸¹ Br ₄ O	OBDPO
	816.951	LOCK MASS		PFK
	879.260	M+8	C ₁₂ H ⁷⁹ Br ₅ ⁸¹ Br ₄ O	NBDPO
	865.958	QC ALTERNATE		HpTriazine

¹Nuclidic masses used: H = 1.007825 C = 12.000000 ¹³C = 13.003355
O = 15.994915 ⁷⁹Br = 78.91834 ⁸¹Br = 80.91629
¹⁹F = 18.9984

²Compound abbreviations:

Polybrominated dibenzo-p-dioxins

TBDD = Tetrabromodibenzo-p-dioxin
PeBDD = Pentabromodibenzo-p-dioxin
HxBDD = Hexabromodibenzo-p-dioxin
HpBDD = Heptabromodibenzo-p-dioxin
OBDD = Octabromodibenzo-p-dioxin

Polybrominated dibenzofurans

TBDF = Tetrabromodibenzofuran
PeBDF = Pentabromodibenzofuran
HxBDF = Hexabromodibenzofuran
HpBDF = Heptabromodibenzofuran
OBDF = Octabromodibenzofuran

³Labeled Compound

⁴There is only one m/z for ³⁷Cl₄-2378-TCDD (recovery standard).

Polybrominated diphenyl ethers

HxBDPE = Hexabromodiphenyl ether
HpBDPE = Heptabromodiphenyl ether
OBDPE = Octabromodiphenyl ether
NBDPE = Nonabromodiphenyl ether
DBDPE = Decabromodiphenyl ether
PFK = Perfluorokerosene
HpTriazine = Tris-(perfluoroheptyl)-s-Triazine

TABLE 12. DESCRIPTORS, MASSES, M/Z TYPES, AND ELEMENTAL COMPOSITIONS OF THE BCDDS AND BCDFS

Descriptor Number	Accurate mass ¹	m/z Type	Elemental Composition	Compound ²	Primary m/z
1	315.942	M	$^{13}\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_4\text{O}$	TCDF ⁴	
	317.939	M+2	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_3\text{ }^{37}\text{Cl}\text{O}$	TCDF ⁴	Yes
	327.885	M	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_4\text{O}_2$	TCDD ³	Yes
	330.979	Lock	C_7F_{13}	PFK	
	331.937	M	$^{13}\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_4\text{O}_2$	TCDD ⁴	
	333.934	M+2	$^{13}\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_3\text{ }^{37}\text{Cl}\text{O}_2$	TCDD ⁴	Yes
	347.851	M	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_3\text{ }^{79}\text{Br}\text{O}$	Br Cl ₃ DF	
	349.849	M+2	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_2\text{ }^{37}\text{Cl}\text{ }^{79}\text{Br}\text{O}$	Br Cl ₃ DF	Yes
	363.846	M	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_3\text{ }^{79}\text{Br}\text{O}_2$	Br Cl ₃ DD	
	365.844	M+2	$\text{C}_{12}\text{H}_4\text{ }^{35}\text{Cl}_2\text{ }^{37}\text{Cl}\text{ }^{79}\text{Br}\text{O}_2$	Br Cl ₃ DD	Yes

TABLE 12. (continued)

Descriptor Number	Accurate mass ¹	m/z Type	Elemental Composition	Compound ²	Primary m/z
2	351.900	M+2	¹³ C ₁₂ H ₃ ³⁵ Cl ₅ O	PeCDF ₄	
	353.897	M+4	¹³ C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O	PeCDF ⁴	
	354.979	Lock	C ₉ F ₃	PFK	
	367.895	M+2	¹³ C ₁₂ H ₃ ³⁵ Cl ₅ O ₂	PeCDD ⁴	Yes
	369.892	M+4	¹³ C ₁₂ H ₃ ³⁵ Cl ₄ ³⁷ Cl O ₂	PeCDD ⁴	
	381.812	M	C ₁₂ H ₃ ³⁵ Cl ₄ ⁷⁹ Br O	Br Cl ₄ DF	
	383.809	M+2	C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ⁷⁹ Br O	Br Cl ₄ DF	Yes
	397.807	M	C ₁₂ H ₃ ³⁵ Cl ₄ ⁷⁹ Br O ₂	Br Cl ₄ DD	
	399.804	M+2	C ₁₂ H ₃ ³⁵ Cl ₃ ³⁷ Cl ⁷⁹ Br O ₂	Br Cl ₄ DD	Yes

¹Nuclidic masses used:

H = 1.007825

C = 12.00000

¹³C = 13.003355

O = 15.994915

³⁵Cl = 34.968853³⁷Cl = 36.965903

F = 18.9984

⁷⁹Br = 78.91834⁸¹Br = 80.91629²Compound abbreviations:Polychlorinated dibenzo-p-dioxins

TCDD = Tetrachlorodibenzo-p-dioxin

PeCDD = Pentachlorodibenzo-p-dioxin

HxCDD = Hexachlorodibenzo-p-dioxin

HpCDD = Heptachlorodibenzo-p-dioxin

OCDD = Octachlorodibenzo-p-dioxin

Polychlorinated dibenzofurans

TCDF = Tetrachlorodibenzofuran

PeCDF = Pentachlorodibenzofuran

HxCDF = Hexachlorodibenzofuran

HpCDF = Heptachlorodibenzofuran

Brominated/Chlorinateddibenzo-p-dioxins and dibenzofuransBrCl₃DD = Bromotrichloro dibenzo-p-dioxinBrCl₄DD = Bromotetrachloro dibenzo-p-dioxinBrCl₃DF = Bromotrichloro dibenzofuranBrCl₄DF = Bromotetrachloro dibenzofuranLock mass and QC compound

PFK = Perfluorokerosene

³There is only one m/z for ³⁷Cl₄-2,3,7,8-TCDD (recovery standard).⁴Labeled compound

TABLE 13. HRGC OPERATING CONDITIONS

Column Type	DB-5	SE-54	SP-2331
Length (m)	60	30	60
i.d. (mm)	0.25	0.25	0.25
Film Thickness (μm)	0.25	0.25	0.20
Carrier Gas	Helium	Helium	Helium
Carrier Gas Flow (mL/min)	1-2	1-2	1-2
Injector temperature ($^{\circ}\text{C}$)	290	308	308
Injection Mode	Splitless	<--- Moving needle --->	
Initial Temperature ($^{\circ}\text{C}$)	200	170.0	150.0
Initial Time (min)	2	7.0	7.0
Rate 1 ($^{\circ}\text{C}/\text{min}$)	5	8.0	10.0
Temperature ($^{\circ}\text{C}$)	220		
Hold Time (min)	16		
Rate 2 (deg. C/min)	5		
Temperature ($^{\circ}\text{C}$)	235		
Hold Time (min)	7		
Rate 2 (deg. C/min)	5		
Final Temperature ($^{\circ}\text{C}$)	330	300.0	250.0
Hold Time (min)	5		

TABLE 14. HRMS OPERATING CONDITIONS

Electron impact ionization	25-70 eV
Mass resolution	>10,000 (10% Valley Definition)
Analysis	Selected ion monitoring (SIM)
Exact masses monitored	Masses shown in Tables 10, 11, 12

TABLE 15. UNLABELED AND LABELED
ANALYTE QUANTIFICATION RELATIONSHIPS

Analyte	Internal Standard Used During Quantification
2,3,7,8-TCDD	$^{13}\text{C}_{12}$ -2,3,7,8-TCDD
Other TCDDs	$^{13}\text{C}_{12}$ -2,3,7,8-TCDD
$^{37}\text{Cl}_4$ -2,3,7,8-TCDD	$^{13}\text{C}_{12}$ -2,3,7,8-TCDD
1,2,3,7,8-PeCDD	$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDD
Other PeCDDs	$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD	$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD
1,2,3,6,7,8-HxCDD	$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD	$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD
Other HxCDDs	$^{13}\text{C}_{12}$ -1,2,3,6,7,8-HxCDD
1,2,3,4,6,7,8-HpCDD	$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDD
Other HpCDDs	$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDD
OCDD	$^{13}\text{C}_{12}$ -OCDD
2,3,7,8-TCDF	$^{13}\text{C}_{12}$ -2,3,7,8-TCDF
Other TCDFs	$^{13}\text{C}_{12}$ -2,3,7,8-TCDF
1,2,3,7,8-PeCDF	$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF	$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDF
Other PeCDFs	$^{13}\text{C}_{12}$ -1,2,3,7,8-PeCDF
1,2,3,4,7,8-HxCDF	$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF	$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF
1,2,3,7,8,9-HxCDF	$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF
2,3,4,6,7,8-HxCDF	$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF
Other HxCDFs	$^{13}\text{C}_{12}$ -1,2,3,4,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF	$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF	$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDF
Other HpCDFs	$^{13}\text{C}_{12}$ -1,2,3,4,6,7,8-HpCDF
OCDF	$^{13}\text{C}_{12}$ -OCDD

TABLE 16. INTERNAL STANDARDS QUANTIFICATION RELATIONSHIPS

Internal Standard	Standard Used During Percent Recovery Determination ^a
¹³ C ₁₂ -2,3,7,8-TCDD	¹³ C ₁₂ -1,2,3,4-TCDD
¹³ C ₁₂ -1,2,3,7,8-PeCDD	¹³ C ₁₂ -1,2,3,4-TCDD
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD	¹³ C ₁₂ -1,2,3,7,8,9-HxCDD
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD	¹³ C ₁₂ -1,2,3,7,8,9-HxCDD
¹³ C ₁₂ -OCDD	¹³ C ₁₂ -1,2,3,7,8,9-HxCDD
¹³ C ₁₂ -2,3,7,8-TCDF	¹³ C ₁₂ -1,2,3,4-TCDD
¹³ C ₁₂ -1,2,3,7,8-PeCDF	¹³ C ₁₂ -1,2,3,4-TCDD
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	¹³ C ₁₂ -1,2,3,7,8,9-HxCDD
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	¹³ C ₁₂ -1,2,3,7,8,9-HxCDD

^aSurrogate standards shown in Table 7 may also be used.

TABLE 17. SURROGATE/ALTERNATE STANDARDS QUANTIFICATION RELATIONSHIPS

Surrogate Standard	Standard Used During Percent Recovery Determination
¹³ C ₁₂ -2,3,4,7,8-PeCDF	¹³ C ₁₂ -1,2,3,7,8-PeCDF
¹³ C ₁₂ -1,2,3,4,7,8-HxCDD	¹³ C ₁₂ -1,2,3,6,7,8-HxCDD
¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	¹³ C ₁₂ -1,2,3,4,7,8-HxCDF
¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF	¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF

[Note: Other surrogate standards may be used instead]

TABLE 18. QUANTIFICATION RELATIONSHIPS OF THE CARBON-LABELED STANDARDS AND THE ANALYTES

Analytes	Quantification Standard
2,3,7,8-TBDD	¹³ C ₁₂ -2,3,7,8-TBDD
2,3,7,8-TBDF	¹³ C ₁₂ -2,3,7,8-TBDF
1,2,3,7,8-PeBDD	¹³ C ₁₂ -1,2,3,7,8-PeBDD
1,2,3,7,8-PeBDF	¹³ C ₁₂ -1,2,3,7,8-PeBDF
2,3,4,7,8-PeBDF	¹³ C ₁₂ -1,2,3,7,8-PeBDF
1,2,3,4,7,8-HxBDD	¹³ C ₁₂ -1,2,3,7,8-PeBDD

[Note: 0.5 ng ³⁷Cl₄-2,3,7,8-TCDD spiked to the extract prior to final concentration to 60 µL was used to determine the method efficiency (% recovery of the ¹³C₁₂-labeled PBDDs/PBDFs).

- Additional 2,3,7,8-substituted PBDDs/PBDFs are now commercially available.
- Retention Index for the PBDDs/PBDFs were published by Sovocool, et al., *Chemosphere* 16, 221-114, 1987; and Donnelly, et al., *Biomedical Environmental Mass Spectrometry*, 14, pp. 465-472, 1987.]

TABLE 19. THEORETICAL ION ABUNDANCE RATIOS AND CONTROL LIMITS FOR PCDDs AND PCDFs

No. of Chlorine Atoms	m/z's Forming Ratio	Theoretical Ratio	Control Limits ¹	
			Lower	Upper
4 ²	M/M+2	0.77	0.65	0.89
5	M+2/M+4	1.55	1.32	1.78
6	M+2/M+4	1.24	1.05	1.43
6 ³	M/M+2	0.51	0.43	0.59
7	M+2/M+4	1.04	0.88	1.20
7 ⁴	M/M+2	0.44	0.37	0.51
8	M+2/M+4	0.89	0.76	1.02

¹Represent ± 15% windows around the theoretical ion abundance ratios.

²Does not apply to ³⁷Cl₄-2,3,7,8-TCDD (cleanup standard).

³Used for ¹³C₁₂-HxCDF only.

⁴Used for ¹³C₁₂-HpCDF only.

TABLE 20. THEORETICAL ION ABUNDANCE RATIOS AND CONTROL LIMITS FOR PBDDS AND PBDFS

Number of Bromine Atoms	Ion Type	Theoretical Ratio	Control Limits	
			Lower	Upper
4	M+2/M+4	0.68	0.54	0.82
4	M+4/M+6	1.52	1.22	1.82
5	M+2/M+4	0.51	0.41	0.61
5	M+4/M+6	1.02	0.82	1.22
6	M+4/M+6	0.77	0.62	0.92
6	M+6/M+8	1.36	1.09	1.63
7	M+4/M+6	0.61	0.49	0.73
7	M+6/M+8	1.02	0.82	1.22

TABLE 21. MINIMUM REQUIREMENTS FOR INITIAL AND DAILY CALIBRATION
RESPONSE FACTORS

Compound	Relative Response Factors	
	Initial Calibration RSD	Daily Calibration % Difference
Unlabeled Analytes		
2,3,7,8-TCDD	25	25
2,3,7,8-TCDF	25	25
1,2,3,7,8-PeCDD	25	25
1,2,3,7,8-PeCDF	25	25
2,3,4,7,8-PeCDF	25	25
1,2,4,5,7,8-HxCDD	25	25
1,2,3,6,7,8-HxCDD	25	25
1,2,3,7,8,9-HxCDD	25	25
1,2,3,4,7,8-HxCDF	25	25
1,2,3,6,7,8-HxCDF	25	25
1,2,3,7,8,9-HxCDF	25	25
2,3,4,6,7,8-HxCDF	25	25
1,2,3,4,6,7,8-HpCDD	25	25
1,2,3,4,6,7,8-HpCDF	25	25
OCDD	25	25
OCDF	30	30
Internal Standards		
¹³ C ₁₂ -2,3,7,8-TCDD	25	25
¹³ C ₁₂ -1,2,3,7,8-PeCDD	30	30
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD	25	25
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD	30	30

TABLE 21. (continued)

Compound	Relative Response Factors	
	Initial Calibration RSD	Daily Calibration % Difference
¹³ C ₁₂ -OCDD	30	30
¹³ C ₁₂ -2,3,7,8-TCDF	30	30
¹³ C ₁₂ -1,2,3,7,8-PeCDF	30	30
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	30	30
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	30	30
Surrogate Standards		
³⁷ Cl ₄ -2,3,7,8-TCDD	25	25
¹³ C ₁₂ -2,3,4,7,8-PeCDF	25	25
¹³ C ₁₂ -1,2,3,4,7,8-HxCDD	25	25
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	25	25
¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF	25	25

TABLE 22. 2,3,7,8-TCDD EQUIVALENT FACTORS (TEFs)¹
FOR THE POLYCHLORINATED DIBENZODIOXINS
AND POLYCHLORINATED DIBENZOFURANS

Number	Compound	TEF
1	2,3,7,8-TCDD	1.00
2	1,2,3,7,8-PeCDD	0.50
3	1,2,3,4,7,8-HxCDD	0.1
4	1,2,3,6,7,8-HxCDD	0.1
5	1,2,3,7,8,9-HxCDD	0.1
6	1,2,3,4,6,7,8-HpCDD	0.01
7	OCDD	0.001
8	2,3,4,7,8-TCDF	0.10
9	1,2,3,7,8-PeCDF	0.05
10	2,3,4,7,8-PeCDF	0.5
11	1,2,3,4,7,8-HxCDF	0.1
12	1,2,3,6,7,8-HxCDF	0.1
13	1,2,3,7,8,9-HxCDF	0.1
14	2,3,4,6,7,8-HxCDF	0.1
15	1,2,3,4,6,7,8-HpCDF	0.01
16	1,2,3,4,7,8,9-HpCDF	0.01
17	OCDF	0.001

¹Interim procedures for Estimating Risks associated with Exposures to mixtures of Chlorinated Dibenzo-p-Dioxins and Dibenzofurans (CDDs/CDFs), WPA-625/3-89-016, March 1989.

[*Note:* The same TEFs are assigned to the PBDDs/PBDFs and BCDDs/BCDFs.]

TABLE 23. MINIMUM SAMPLING EQUIPMENT CALIBRATION AND ACCURACY REQUIREMENTS

Equipment	Acceptance limits	Frequency and method of measurement	Action if requirements are not met
<u>Sampler</u>	Indicated flow rate = true flow rate $\pm 10\%$.	Calibrate with certified transfer standard on receipt, after maintenance on sampler, and any time audits or flow checks deviate more than $\pm 10\%$ from the indicated flow rate or $\pm 10\%$ from the design flow rate.	Recalibrate
<u>Associated equipment</u>			
Sampler on/off timer	± 30 min/24 hour	Check at purchase and routinely on sample-recovery days	Adjust or replace
Elapsed-time meter	± 30 min/24 hour	Compare with a standard time-piece of known accuracy at receipt and at 6-month intervals	Adjust or replace
Flowrate transfer standard (orifice device)	Check at receipt for visual damage	Recalibrate annually against positive displacement standard volume meter	Adopt new calibration curve

TABLE 24. FORMAT FOR TABLE OF ANALYTICAL RESULTS

IDENTIFICATION					
AIR SAMPLER EFFICIENCY (% RECOVERY)					
¹³ C ₁₂ -1,2,3,4,-TCDD					
METHOD EFFICIENCY (% RECOVERY)					
¹³ C ₁₂ -2,3,7,8-TCDF					
¹³ C ₁₂ -2,3,7,8-TCDD					
¹³ C ₁₂ -1,2,3,7,8-PeCDF					
¹³ C ₁₂ -1,2,3,7,8-PeCDD					
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF					
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD					
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD					
¹³ C ₁₂ -OCDD					
CONCENTRATIONS DETECTED or MDL (pg/m ³)					
TCDDs (TOTAL) ¹					
2,3,7,8-TCDD					
PeCDDs (TOTAL)					
1,2,3,7,8-PeCDD					
HxCDDs (TOTAL)					
1,2,3,4,7,8-HxCDD					
1,2,3,6,7,8-HxCDD					
1,2,3,7,8,9-HxCDD					
HpCDDs (TOTAL)					
1,2,3,4,6,7,8-HpCDD					

TABLE 24. (continued)

IDENTIFICATION					
OCDD					
TCDFs (TOTAL)					
2,3,7,8-TCDF					
PeCDFs (TOTAL)					
1,2,3,7,8-PeCDF					
2,3,4,7,8-PeCDF					
HxCDFs (TOTAL)					
1,2,3,4,7,8-HxCDF					
1,2,3,6,7,8-HxCDF					
1,2,3,7,8,9-HxCDF					
2,3,4,6,7,8-HxCDF					
HpCDFs (TOTAL)					
1,2,3,4,6,7,8-HpCDF					
1,2,3,4,7,8,9-HpCDF					
OCDF					

¹(TOTAL) = All congeners, including the 2,3,7,8-substituted congeners.

ND = Not detected at specified minimum detection limit (MDL).

[Note: Please refer to text for discussion and qualification that must accompany the results.]

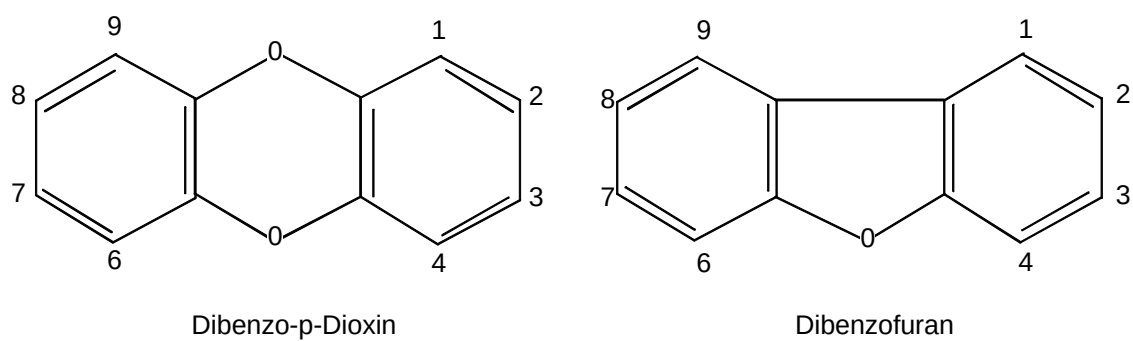


Figure 1. Dibenzo-p-dioxin and dibenzofuran structures.

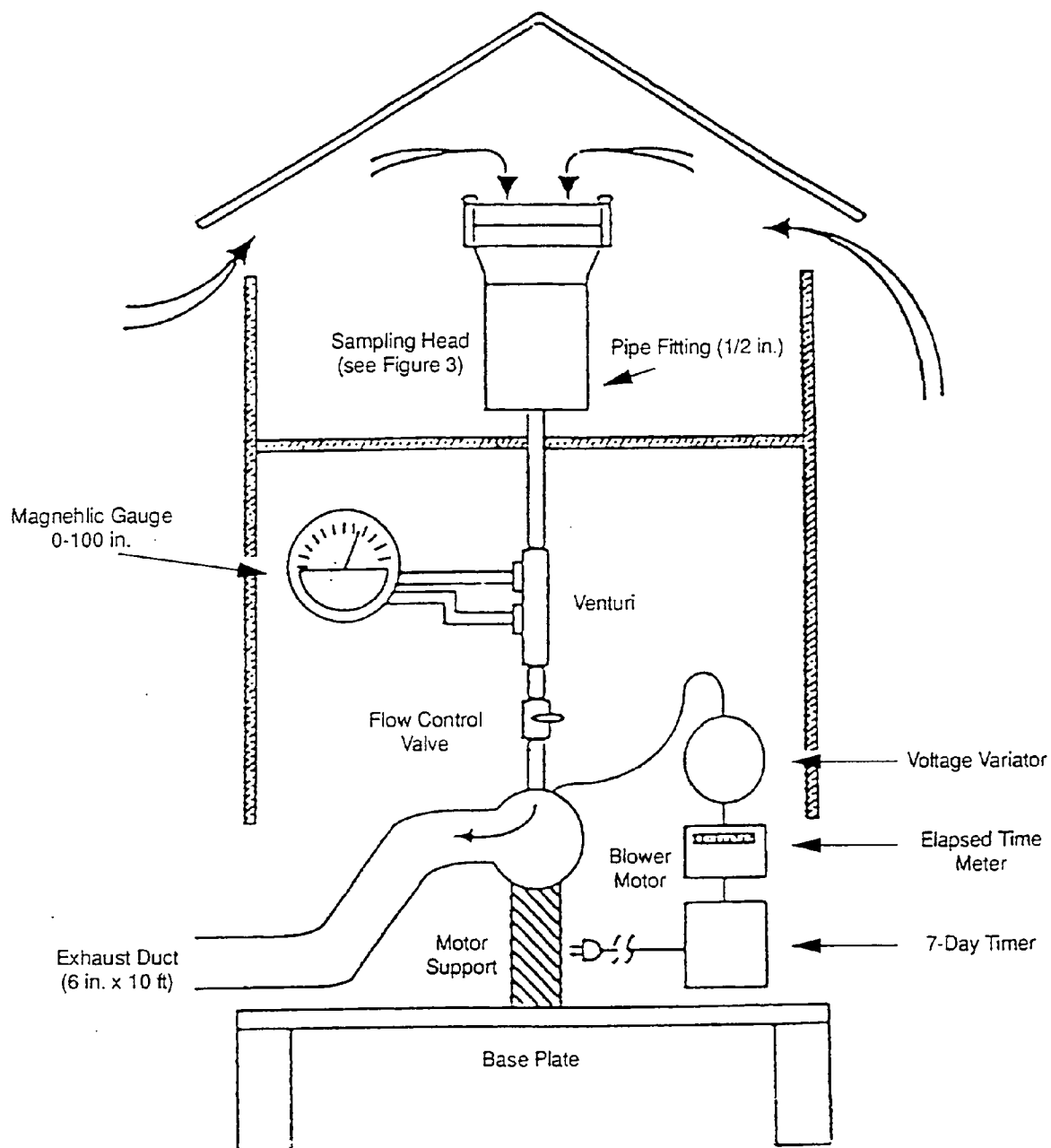


Figure 2. Typical dioxins/furan high volume air sampler.

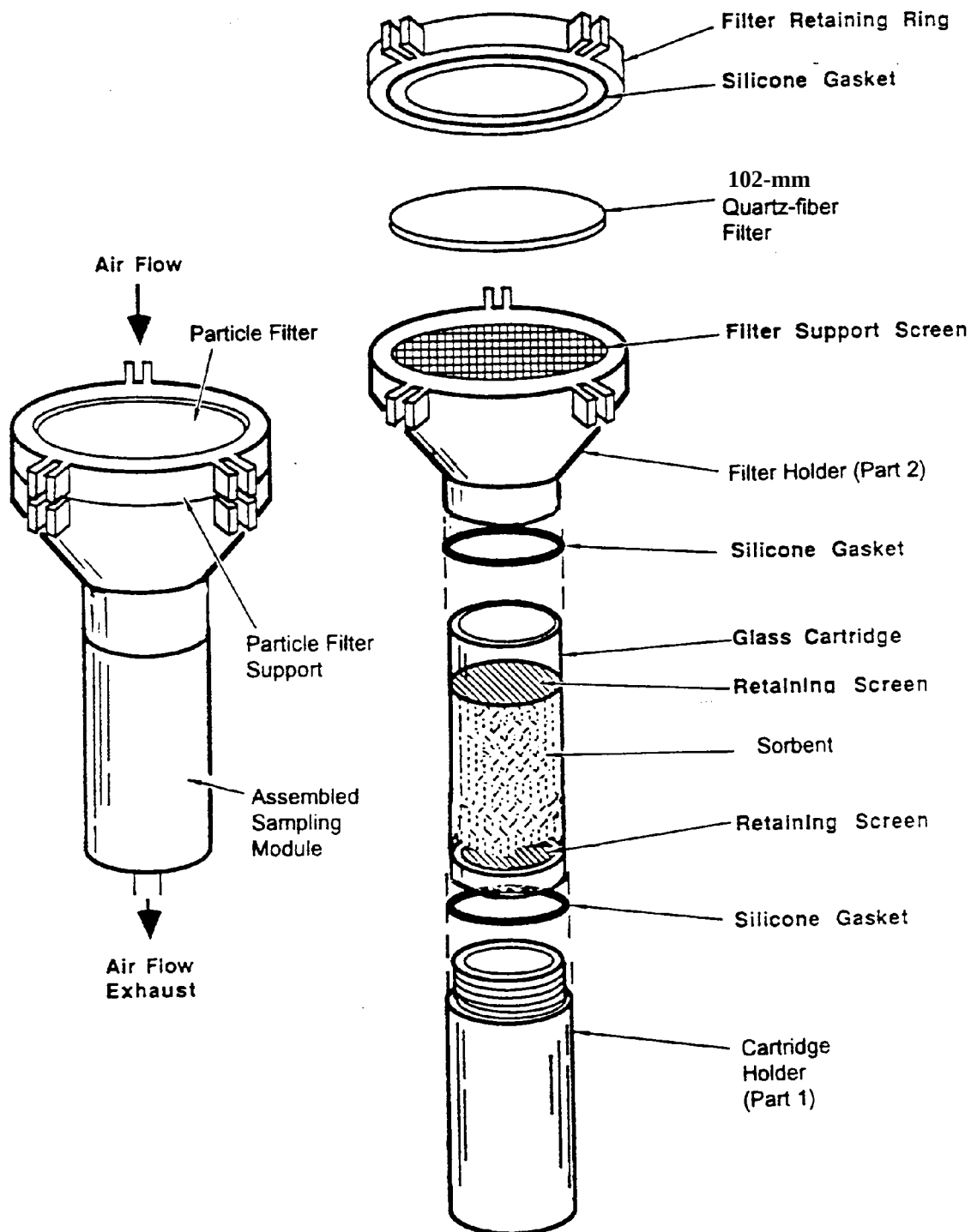
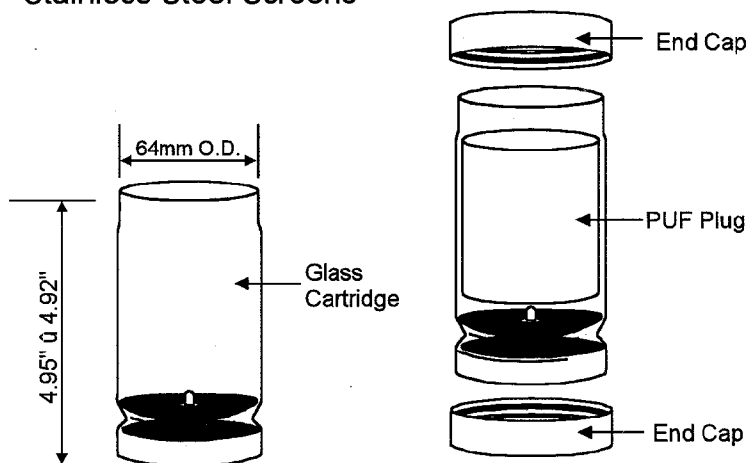
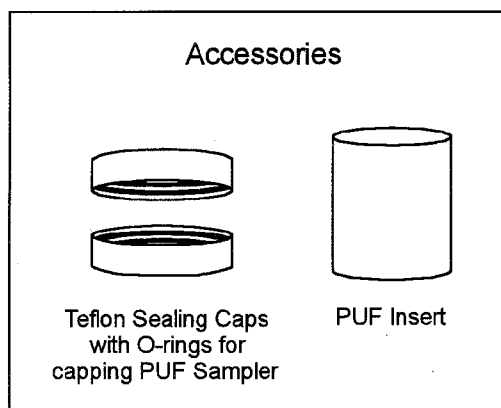


Figure 3a. Typical absorbent cartridge assembly for sampling dioxin/furans.

Glass PUF Sampler with Stainless Steel Screens



(1) Glass PUF cartridge, plug, and end caps.



(2) PUF shipping container.

Figure 3b. Typical glass PUF cartridge (1) and shipping container (2) for use with hi-vol sampling systems.

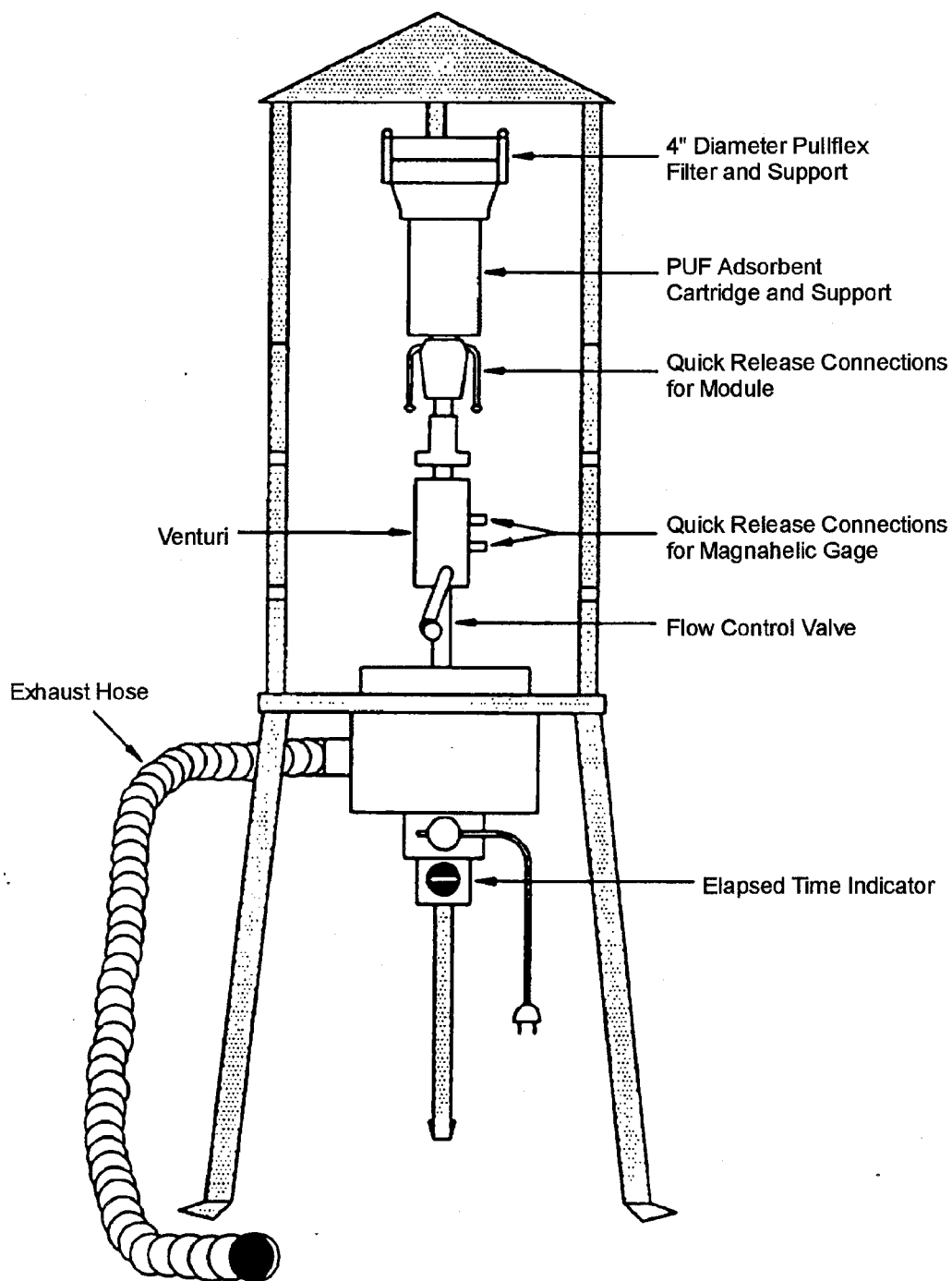


Figure 4. Portable high volume air sampler developed by EPA.

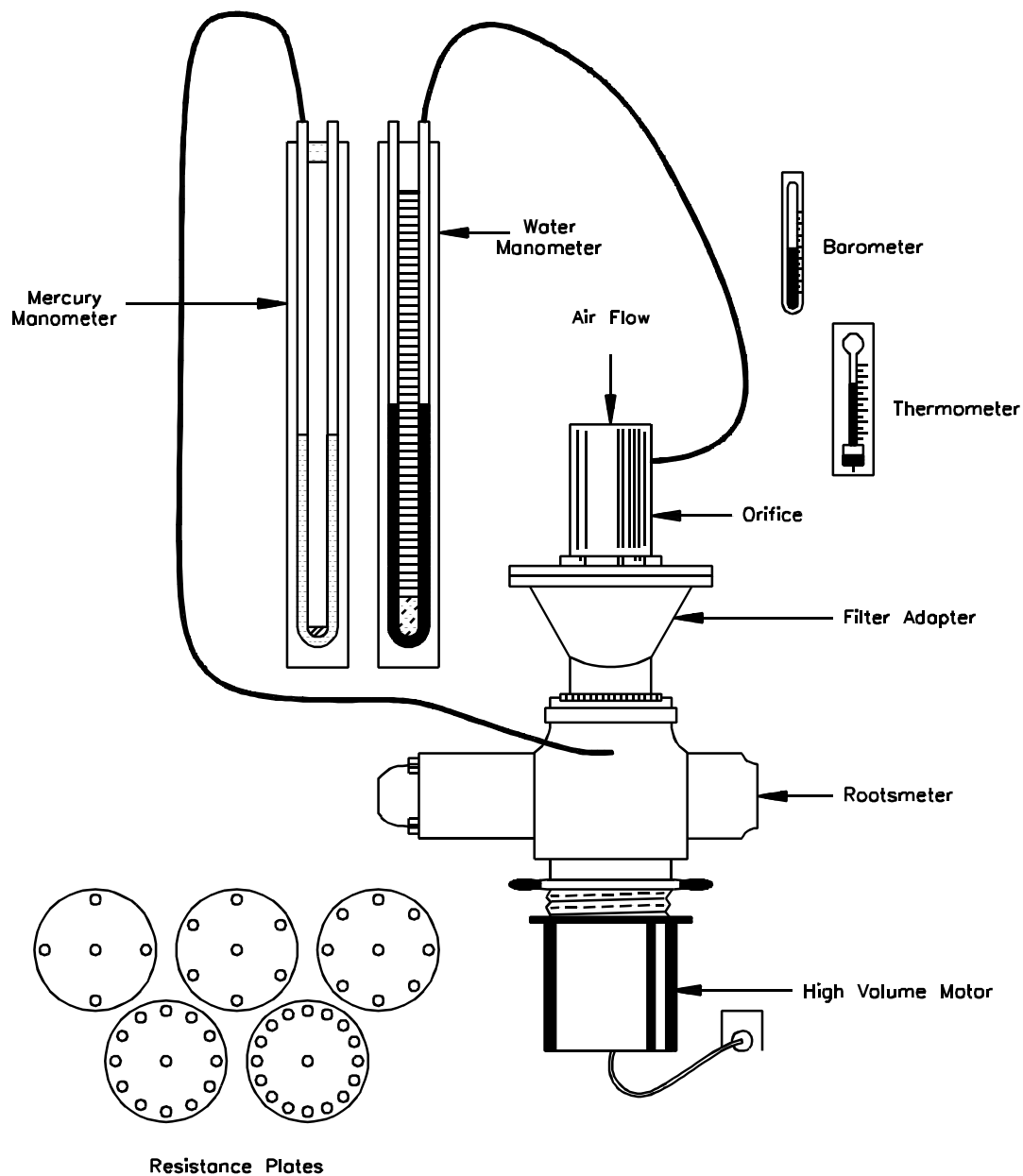


Figure 5. Positive displacement rootsmeter used to calibrate orifice transfer standard.

COMPENDIUM METHOD TO-9A ORIFICE CALIBRATION DATA SHEET

T₁ _____

Name _____

P₁ _____ mmHg

Date _____

Orifice No. _____

Rootmeter No. _____

Resistance Plants (No. of holes)	Air Volume Measured by Rootmeter V _m		Standard Volume, V _{std} , (std m ³)	Time for Air Volume to Pass Through Rootmeter, θ (min)	Rootmeter Pressure Differential, ΔP (mm Hg)	Pressure Drop Across Orifice, ΔH (in. H ₂ O)	x-Axis Standard Flowrate, Q _{std} (std m ³ /min)	Y - axis $\sqrt{\Delta H(P_1/P_{std})(298/T_1)}$ value
	(R ³)	(m ³)						
5	200	5.66						
7	200	5.66						
10	300	8.50						
13	300	8.50						
18	300	8.50						

Factors: (R³)(0.02832 $\frac{m^3}{R^3}$) = m³ and (in. Hg) 25.4 ($\frac{mm\ Hg}{in.\ Hg}$) = mm Hg

Calculation Equations:

$$1. \quad V_{std} = V_m \left(\frac{P_1 - \Delta P}{P_{std}} \right) \left(\frac{T_{std}}{T_1} \right)$$

where:

$$T_{std} = 296^\circ K$$

$$P_{std} = 760.0\ mm\ Hg$$

$$2. \quad Q_{std} = \frac{V_{std}}{\theta}$$

Figure 6. Orifice calibration data sheet.

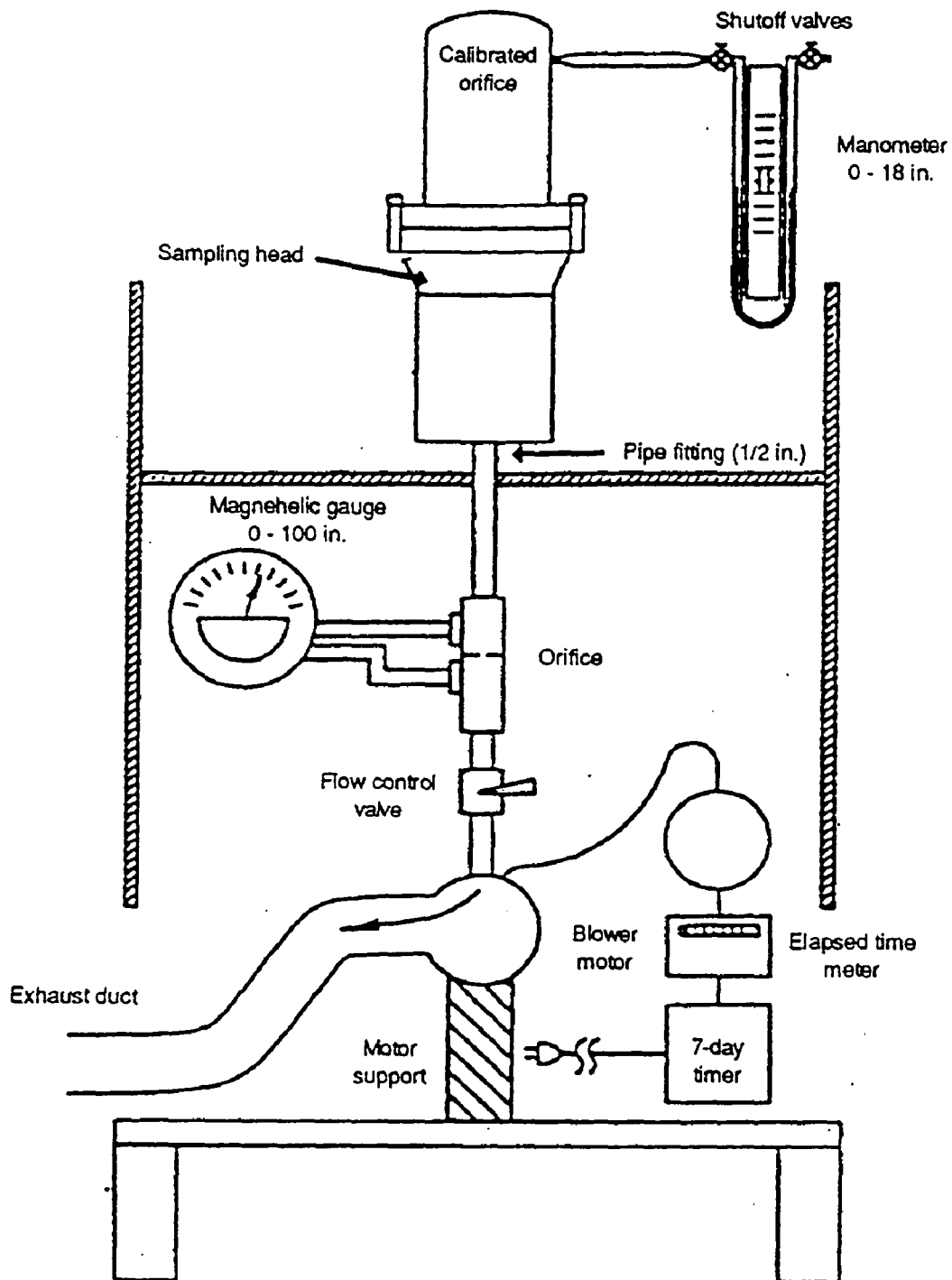


Figure 7. Field calibration configuration of the dioxin/furan sampler.

COMPENDIUM METHOD TO-9A
FIELD CALIBRATION DATA SHEET DIOXIN/FURAN SAMPLER CALIBRATION

Sampler ID: _____ Calibration Orifice ID: _____
 Sampler Location: _____ Job No.: _____
 High Volume Transfer Orifice Data:
 Correlation Coefficient (CC1): _____ Slope (M1): _____
 (CC2): _____ (M2): _____
 Intercept (B1): _____
 (B2): _____

Calibration Date: ____ Time: ____

Calibration Ambient Temperature: ____ °F ____ °C

CALIBRATOR'S SIGNATURE

Calibration Ambient Barometric Pressure: ____ "Hg ____ mm Hg

Calibration set point (SP): _____

SAMPLER CALIBRATION

Actual values from calibration		Calibrated values		
Orifice manometer, inches (Y1)	Monitor magnehelic, inches (Y2)	Orifice manometer (Y3)	Monitor magnehelic (Y4)	Calculated value orifice flow, scm (X1)
	70			
	60			
	50			
	40			
	30			
	20			
	10			

Definitions

Y1 = Calibration orifice reading, in. H₂O

Y2 = Monitor magnehelic reading, in. H₂O

P_a = Barometric pressure actual, mm Hg

B1 = Manufacturer's Calibration orifice Intercept

M1 = Manufacturer's Calibration orifice manometer slope

Y3 = Calculated value for orifice manometer
 $= [Y1(P_a/760)(298/\{T_a + 273\})]^{1/2}$

Y4 = Calculated value for magnehelic

$= [Y2(P_a/760)(298/\{T_a + 273\})]^{1/2}$

X1 = Calculated value orifice flow, scm

$= \frac{Y3 - B1}{M1}$

P_{std} = Barometric pressure standard, 760 mm Hg

T_a = Temperature actual, °C

T_{std} = Temperature standard, 25 °C

Figure 8. Orifice transfer field calibration data sheet.

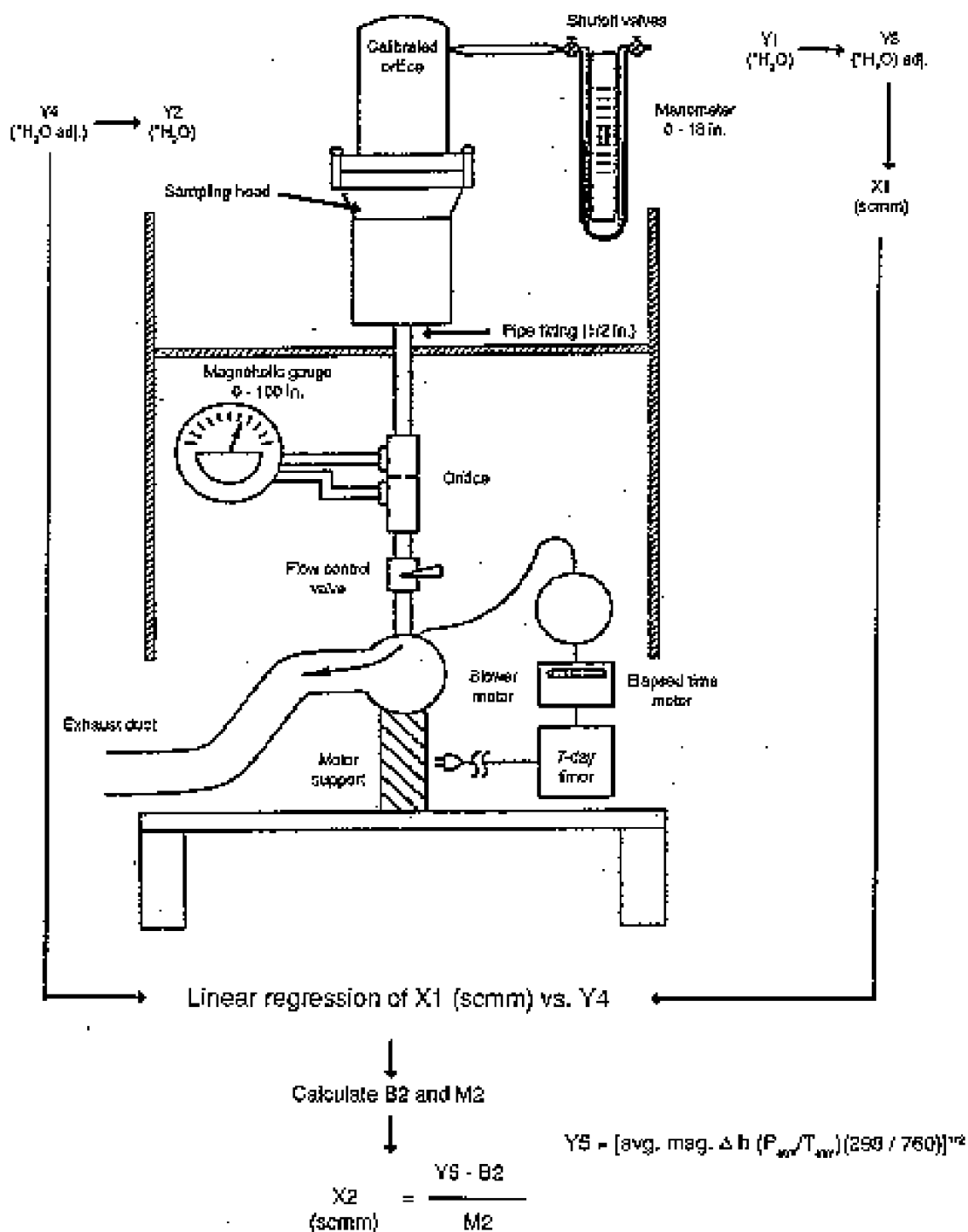


Figure 9. Relationship between orifice transfer standard and flow rate through sampler.

**COMPENDIUM METHOD TO-9A
FIELD TEST DATA SHEET
GENERAL INFORMATION**

Sampler I.D. No.: _____
 Lab PUF Sample No.: _____
 Sample location: _____

Operator: _____
 Other: _____

PUF Cartridge Certification Date: _____
 Date/Time PUF Cartridge Installed: _____
 Elapsed Timer: _____
 Start _____
 Stop _____
 Diff. _____

Sampling

M1 _____ B1 _____
 M2 _____ B2 _____

	Start	Stop
Barometric pressure ("Hg)	_____	_____
Ambient Temperature (°F)	_____	_____
Rain	Yes _____	Yes _____
	No _____	No _____

Sampling time
 Start _____
 Stop _____
 Diff. _____

Audit flow check within ± 10 of set point
 _____ Yes
 _____ No

TIME	TEMP	BAROMETRIC PRESSURE	MAGNEHELIC READING	CALCULATED FLOW RATE (scmm)	READ BY
Avg.					

Comments

Figure 10. Field test data sheet.

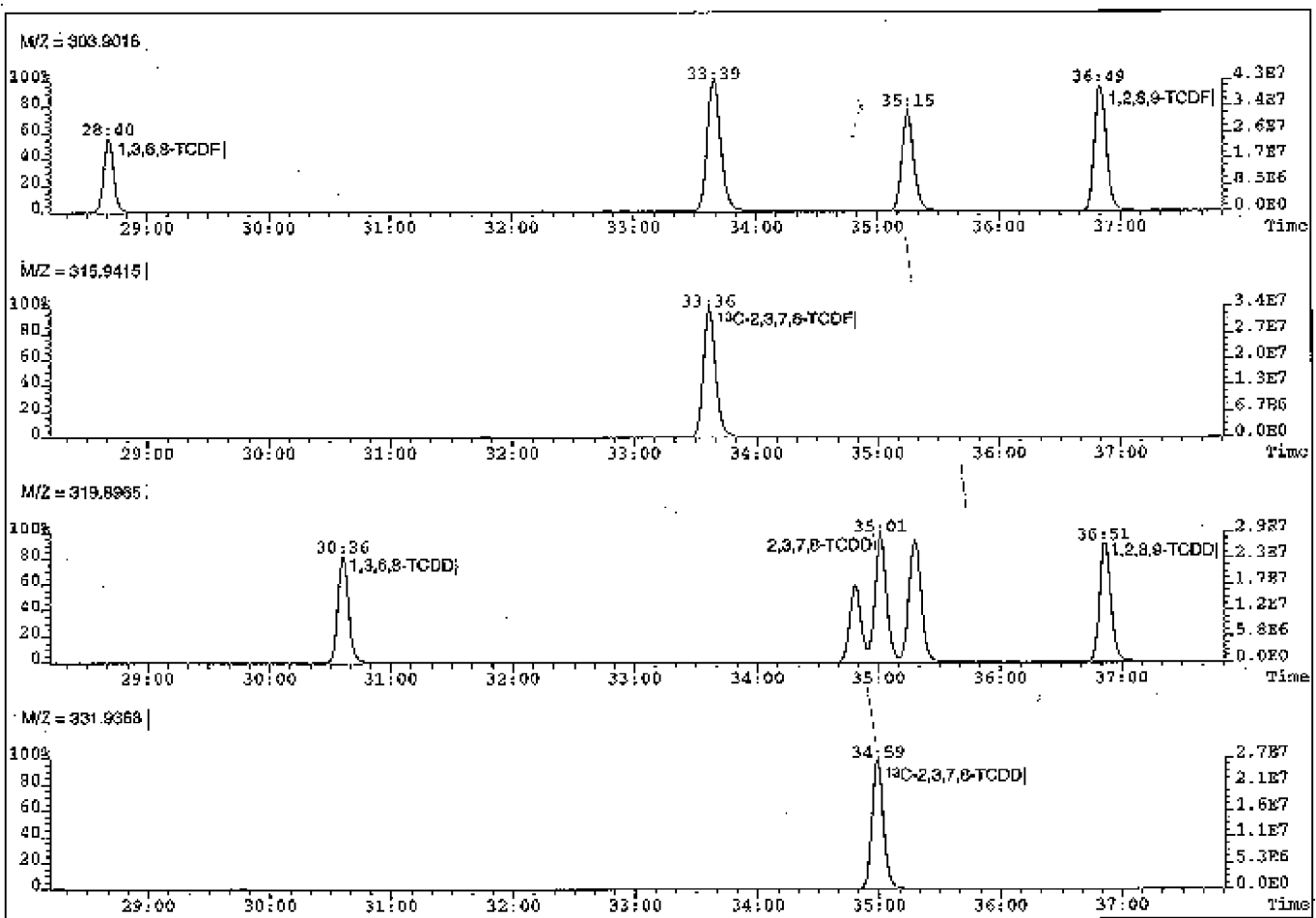


Figure 11. Chromatograms showing the window defining mix. First and last eluting PCDF and PCDD isomer in each group are shown above the respective internal quantification standard (IQS).

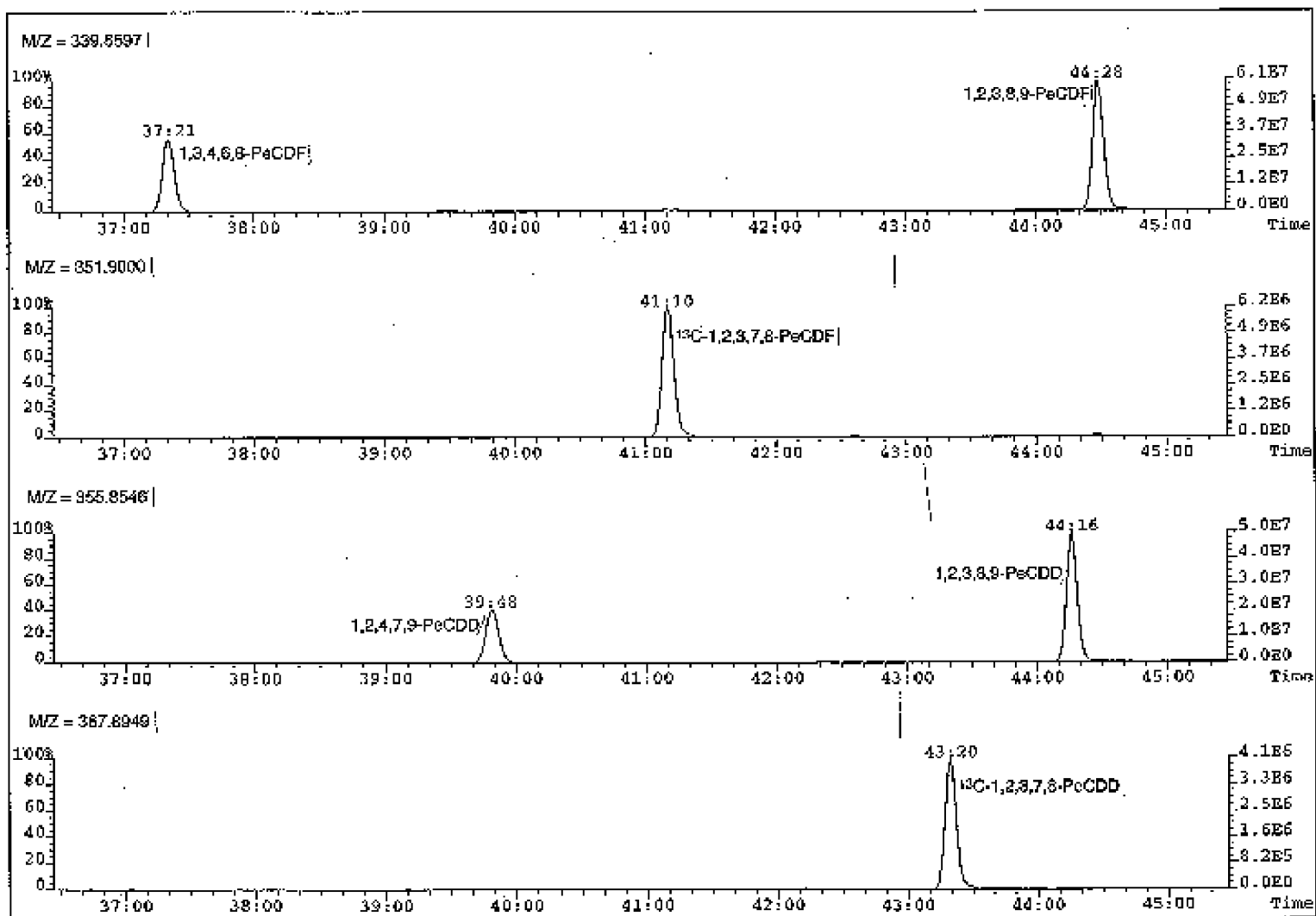


Figure 11. (continued)

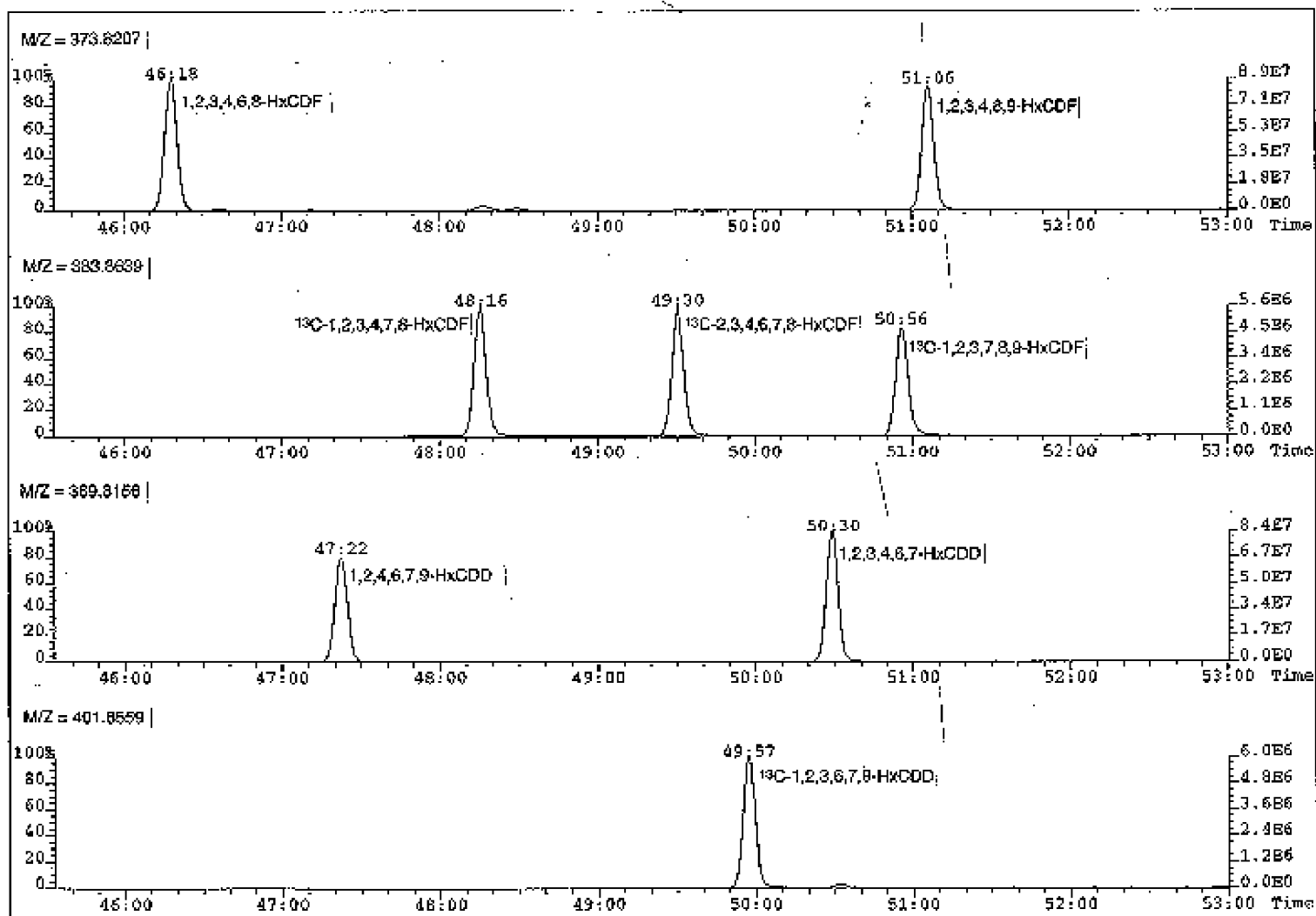


Figure 11. (continued)

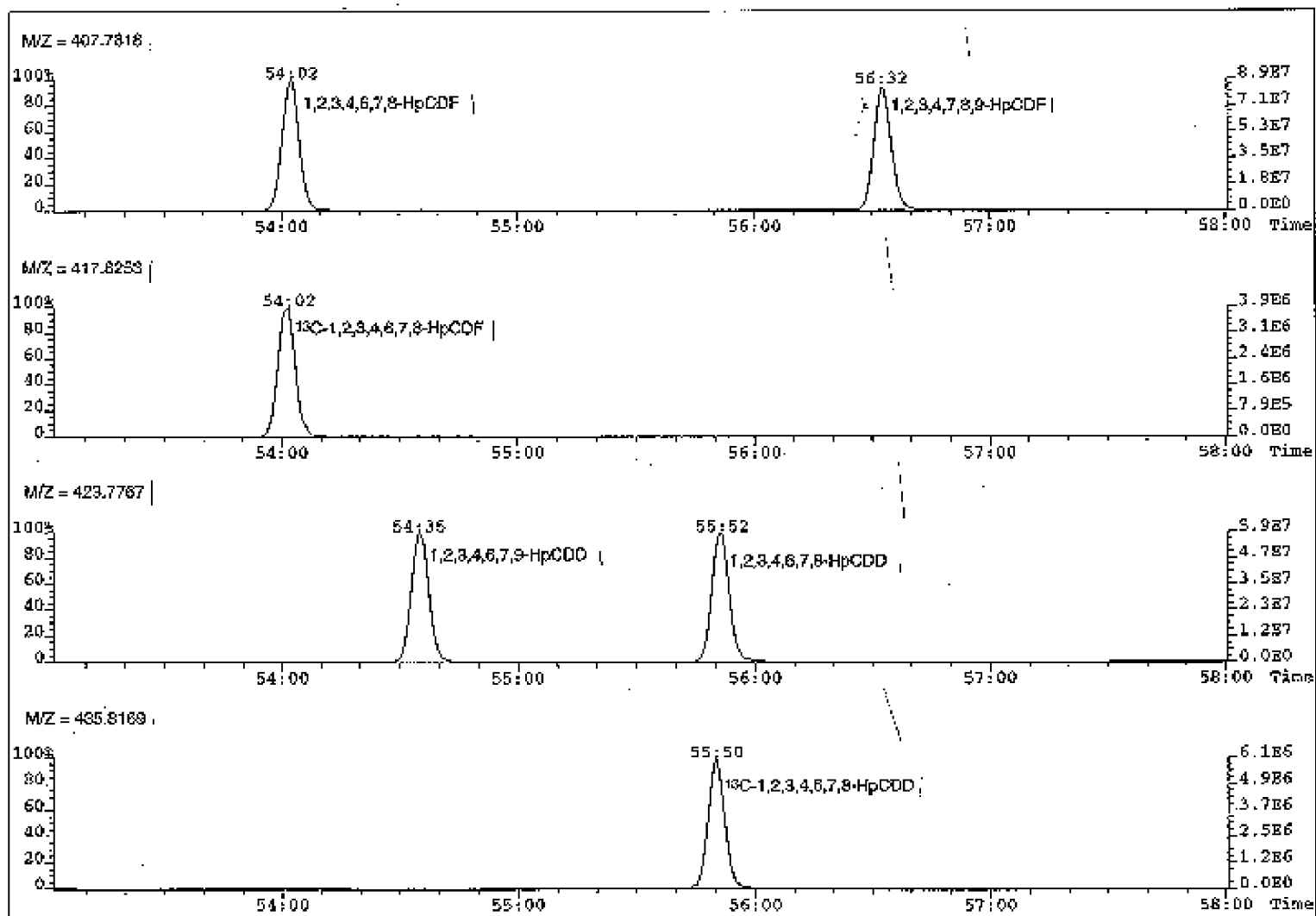


Figure 11. (continued)

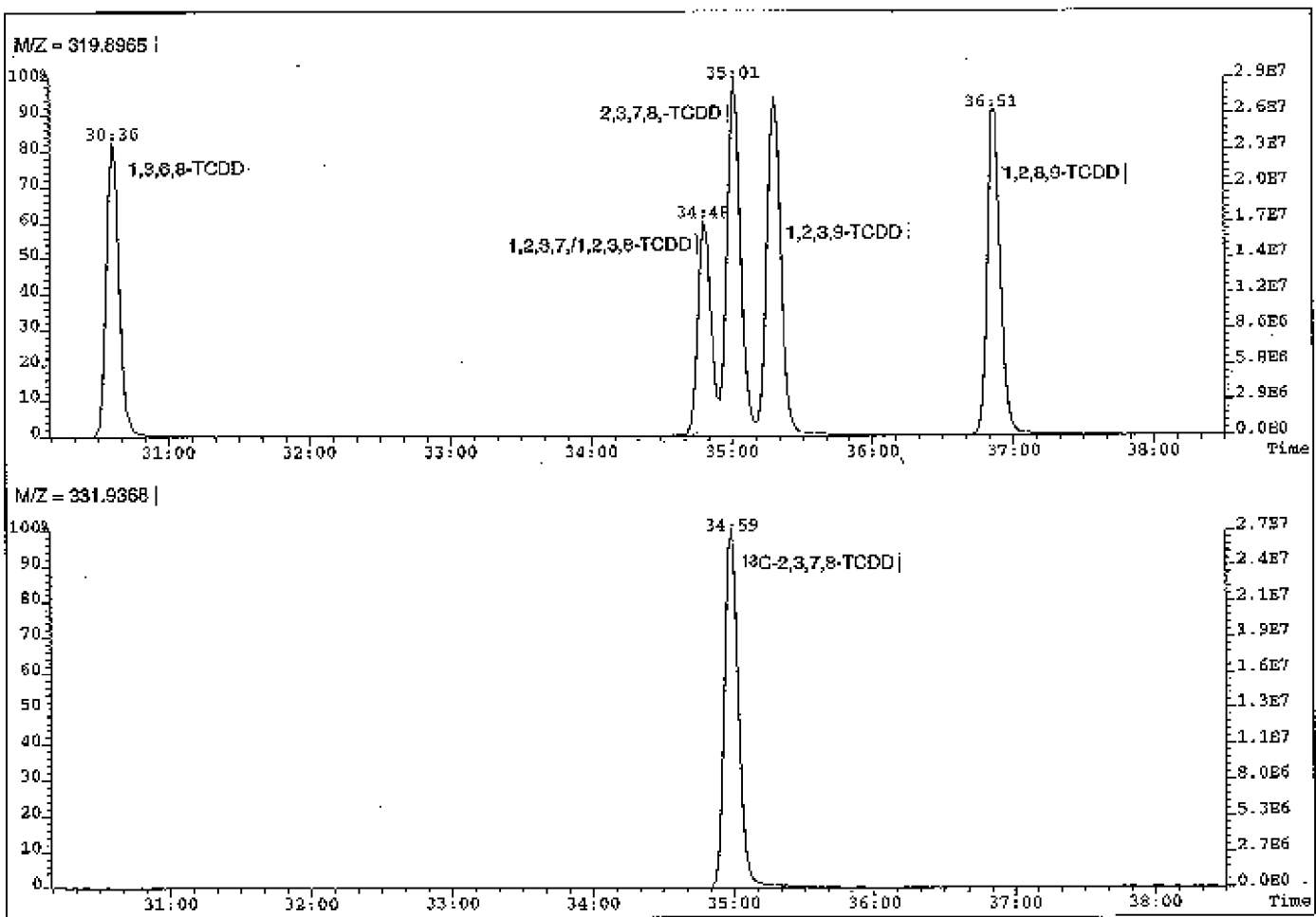


Figure 12. HRGC-HRMS column performance mix showing acceptable separation of 2,3,7,8-TCDD from the adjacent isomers.

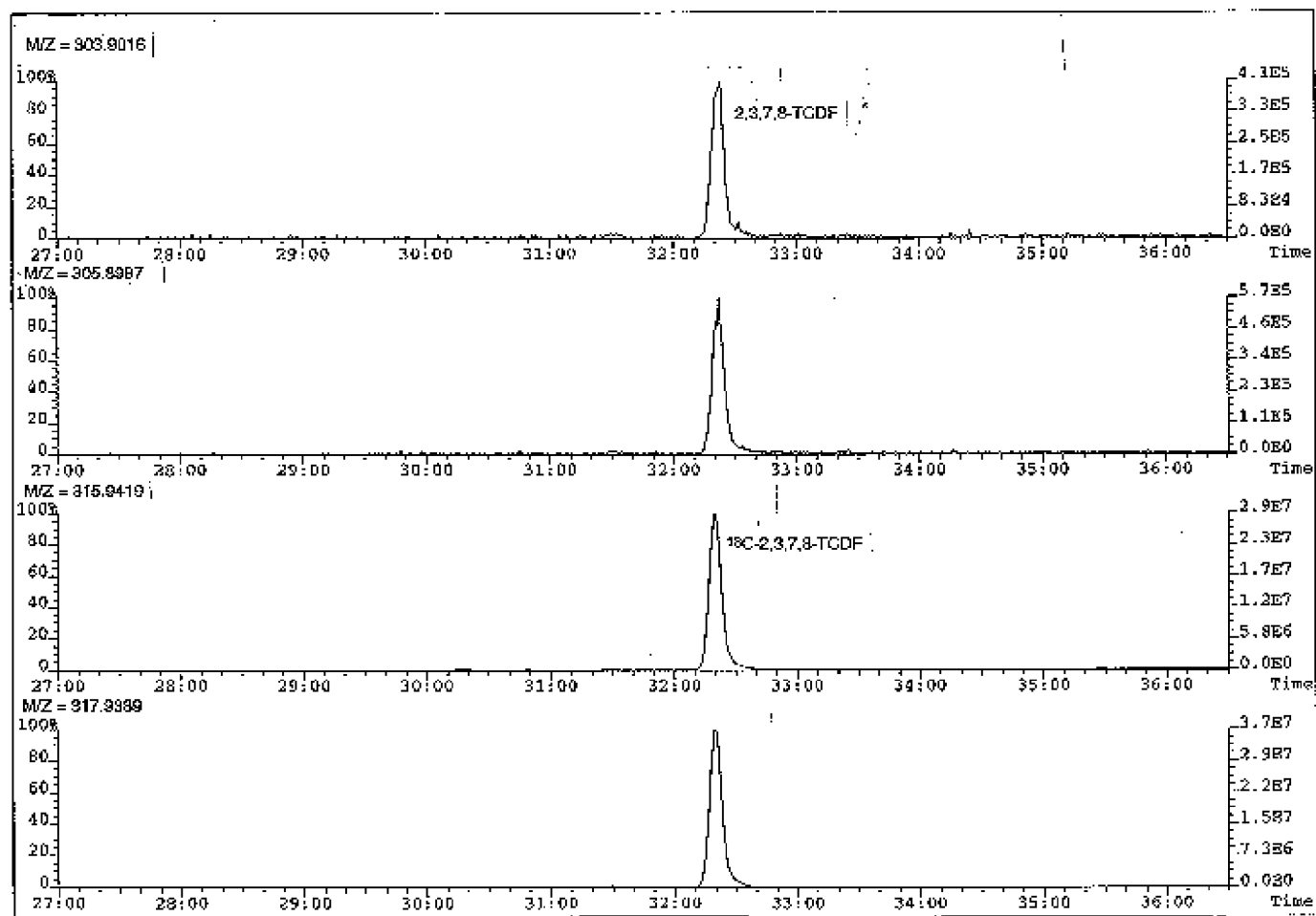


Figure 13. Extracted ion current profiles (EICP) for 2,3,7,8-TCDF and labeled standard.

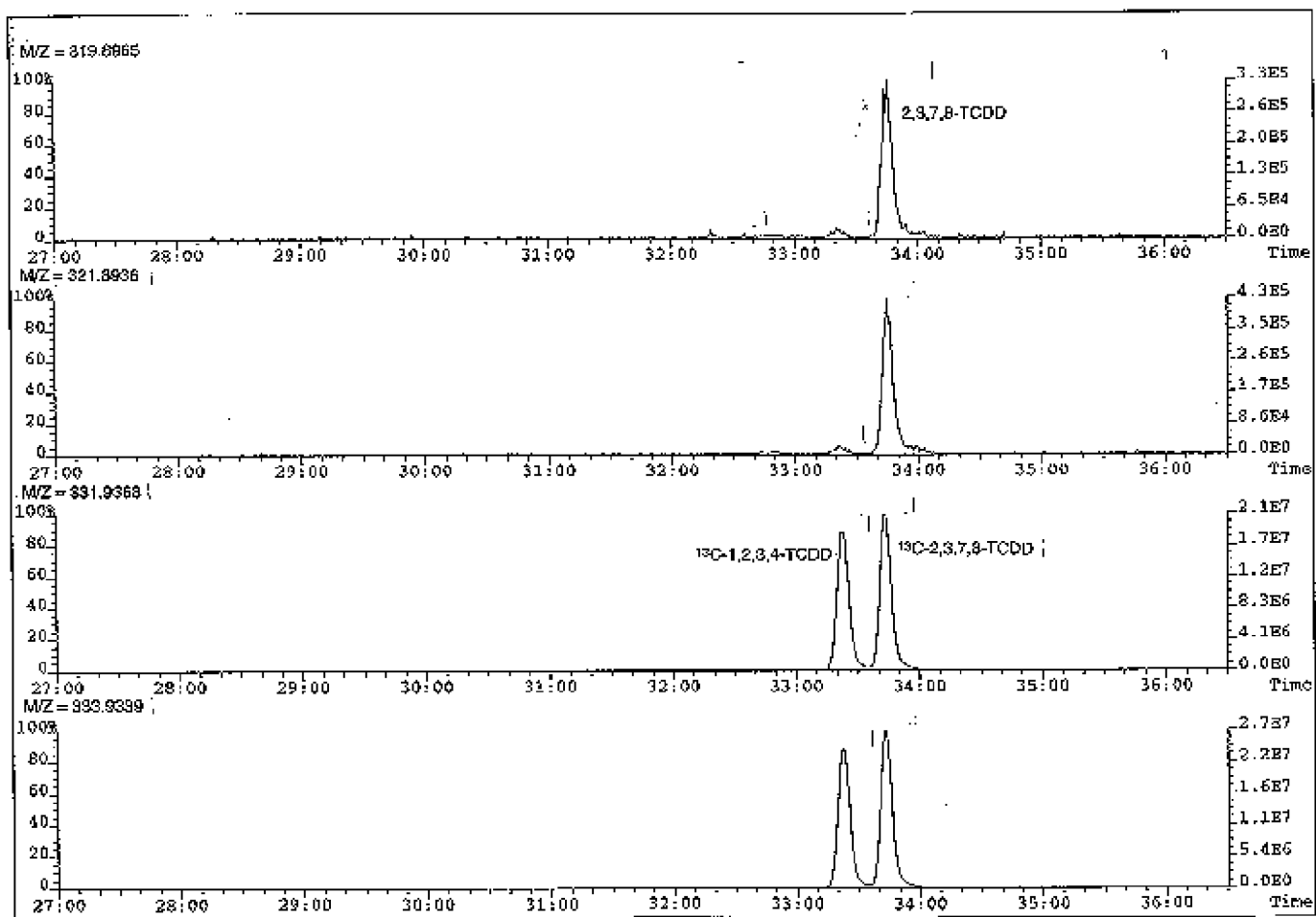


Figure 14. Extracted ion current profiles (HLCP) for 2,3,7,8-TCDD and labeled standard.

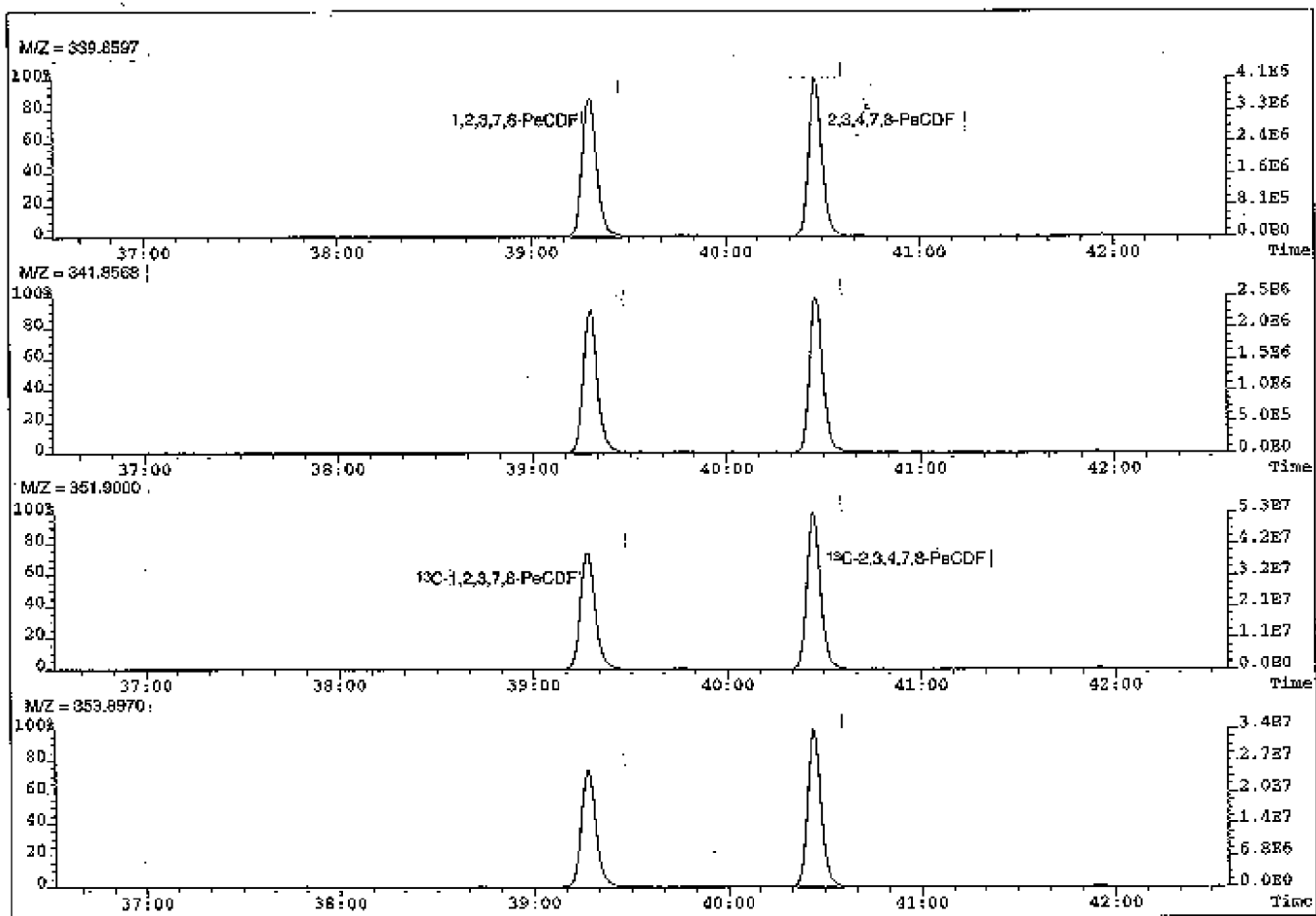


Figure 15. Extracted ion current profiles (ELCP) for 2,3,7,8-substituted PeCDF and labeled standard.

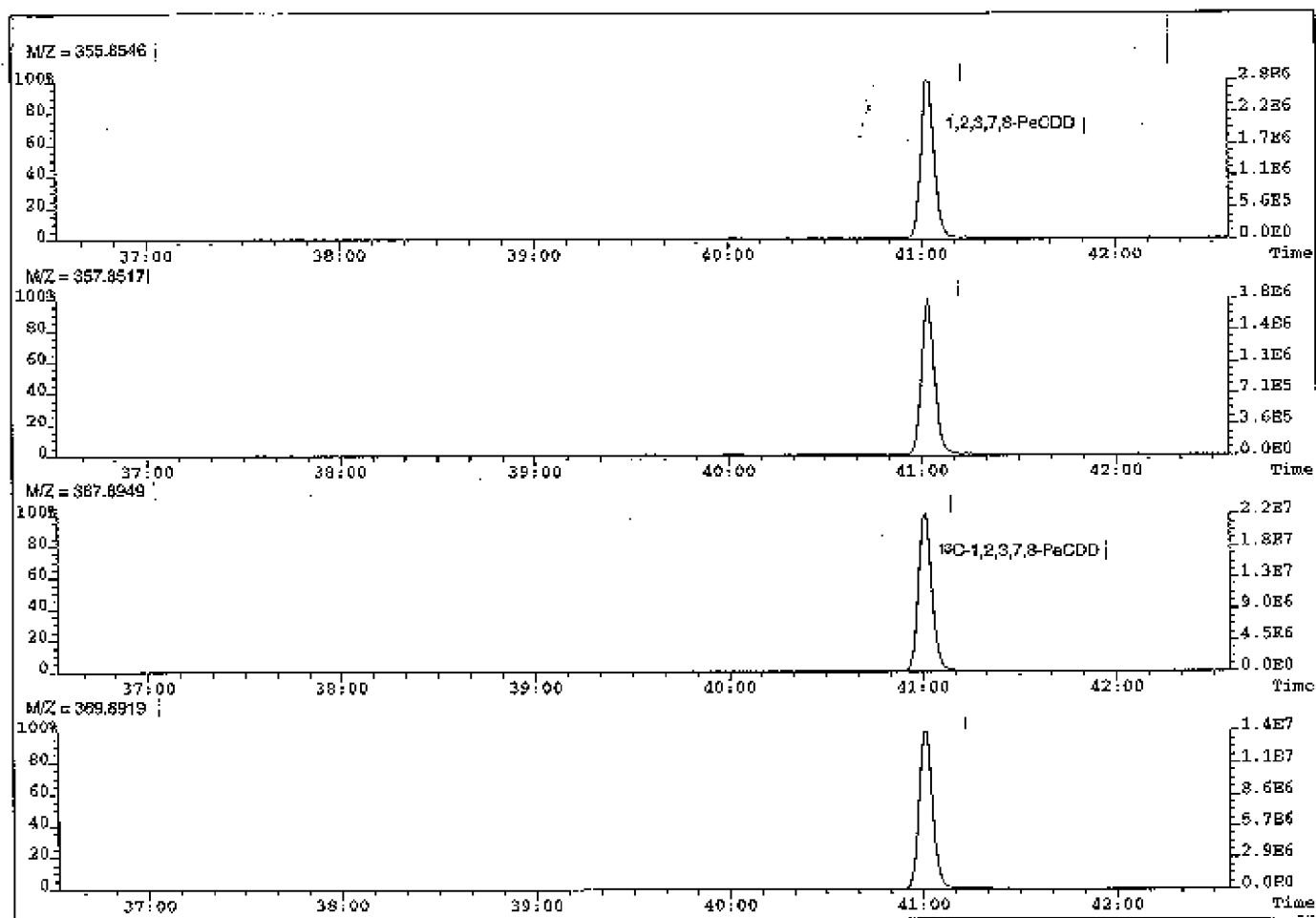


Figure 16. Extracted ion current profiles (EICP) for 2,3,7,8-substituted PeCDD and labeled standard.

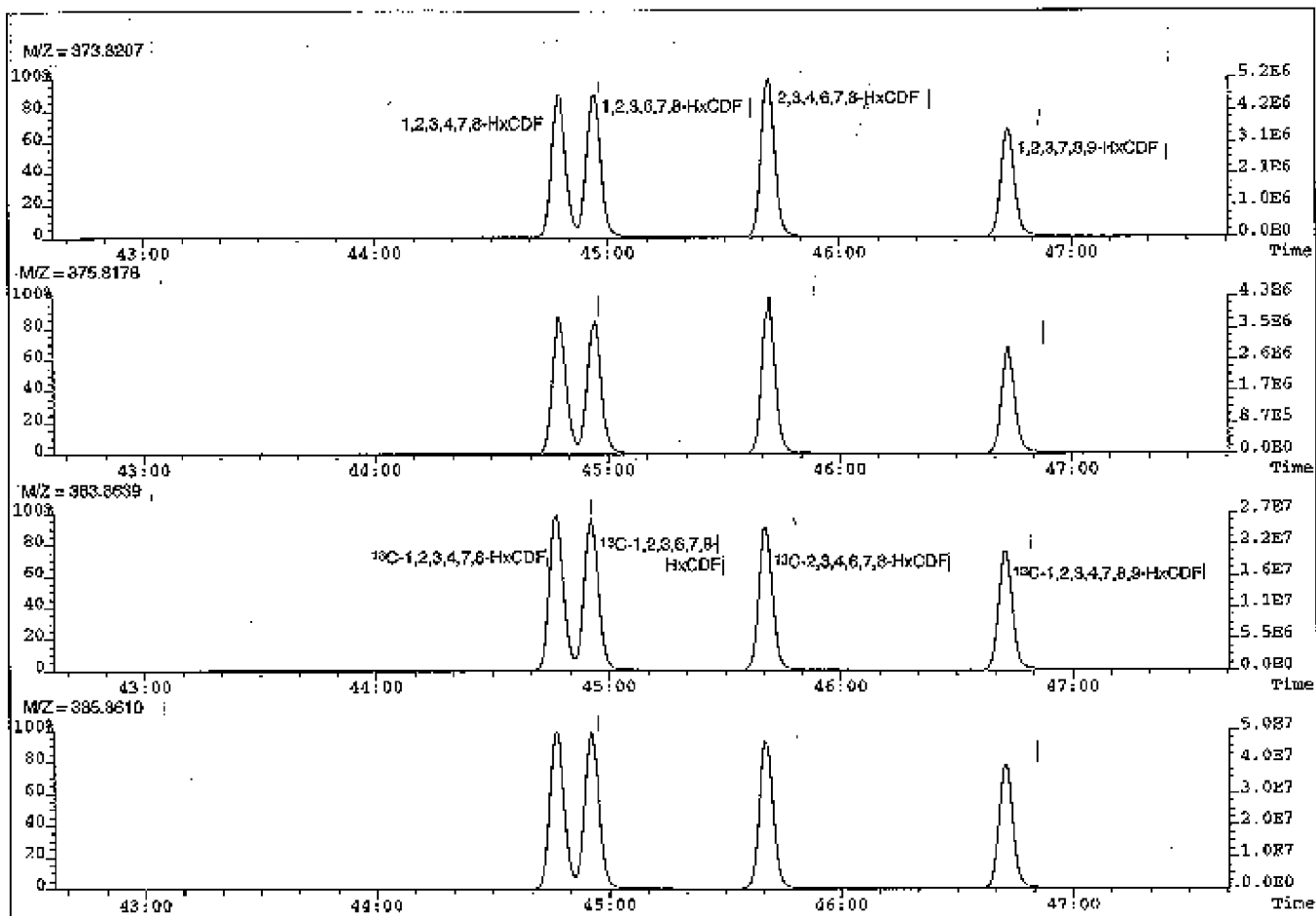


Figure 17. Extracted ion current profiles (EICP) for 2,3,7,8-substituted HxCDF and labeled standard.

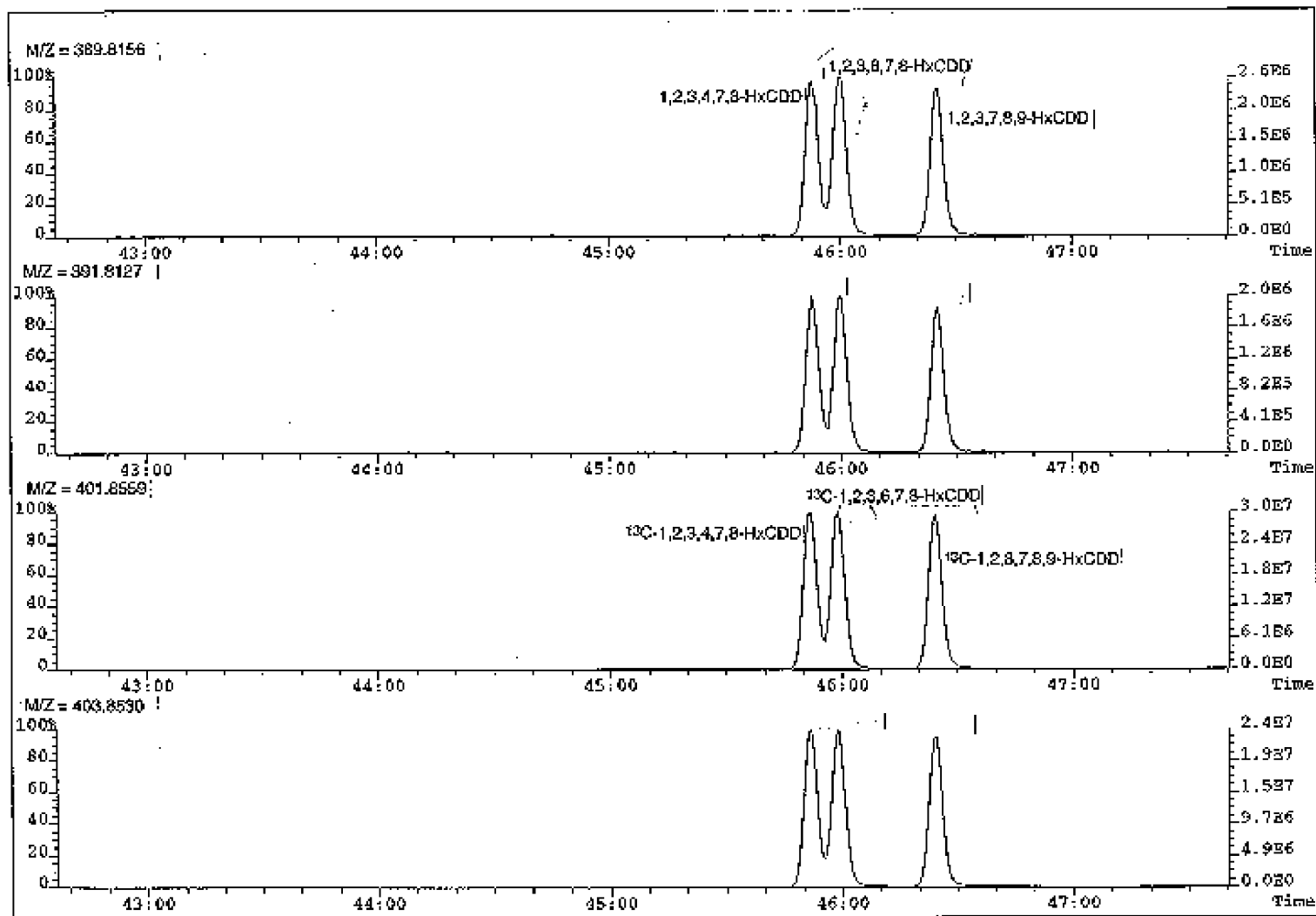


Figure 18. Extracted ion current profiles (EICP) for 2,3,7,8-substituted HxCDD and labeled standard.

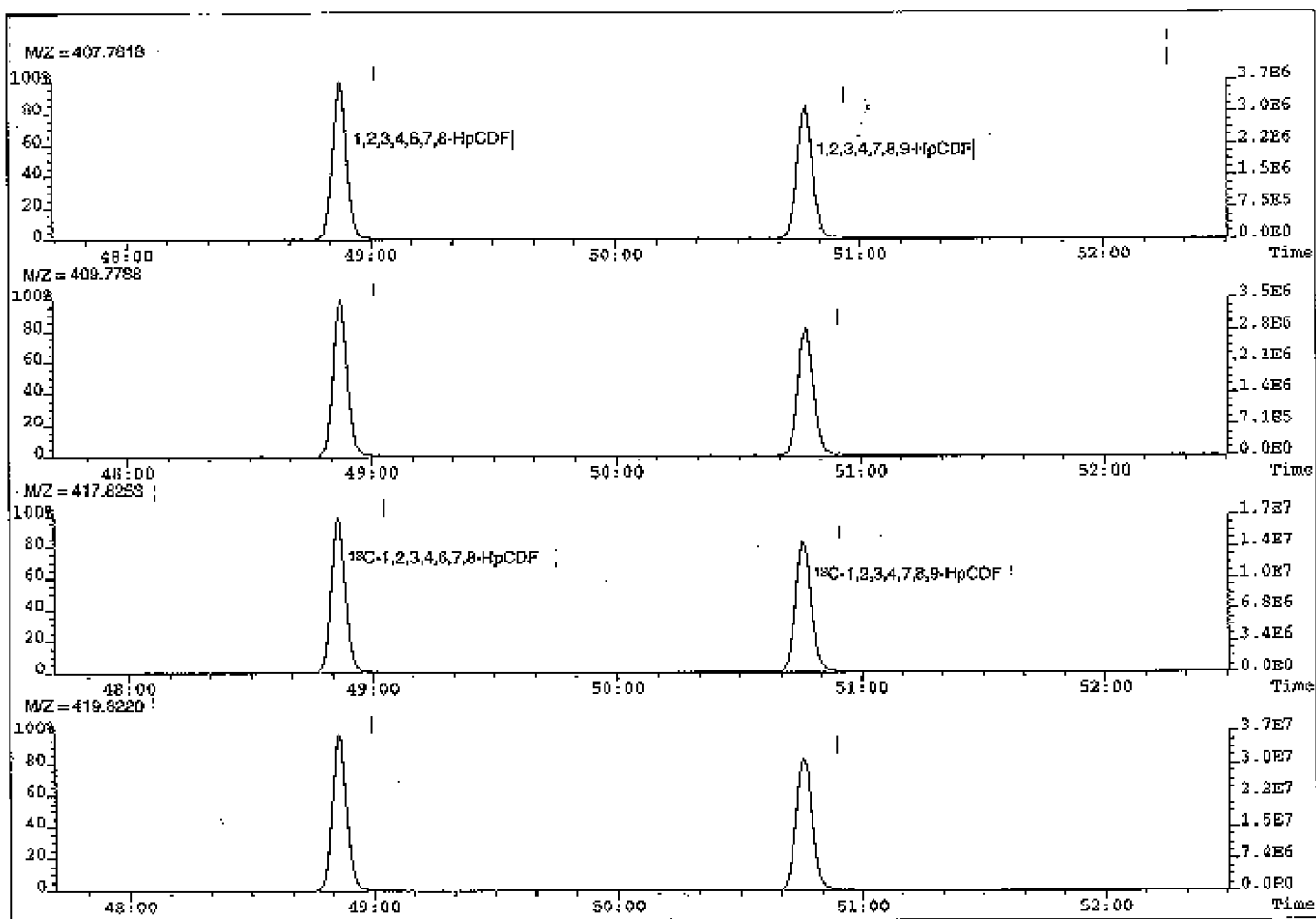


Figure 19. Extracted ion current profiles (EICP) for 2,3,7,8-substituted HpCDF and labeled standard.

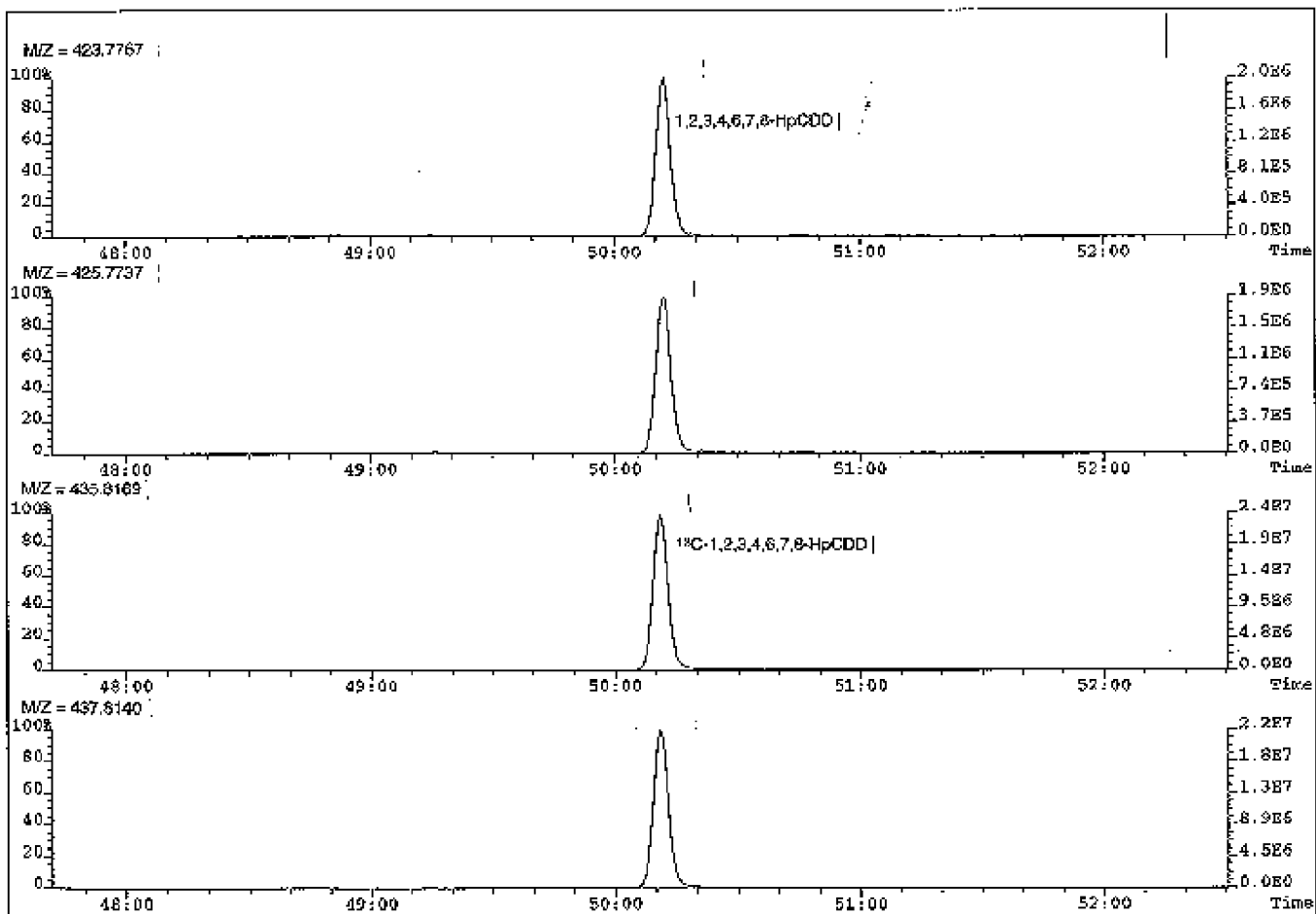


Figure 20. Extracted ion current profiles (EICP) for 2,3,7,8-substituted HpCDD and labeled standard.

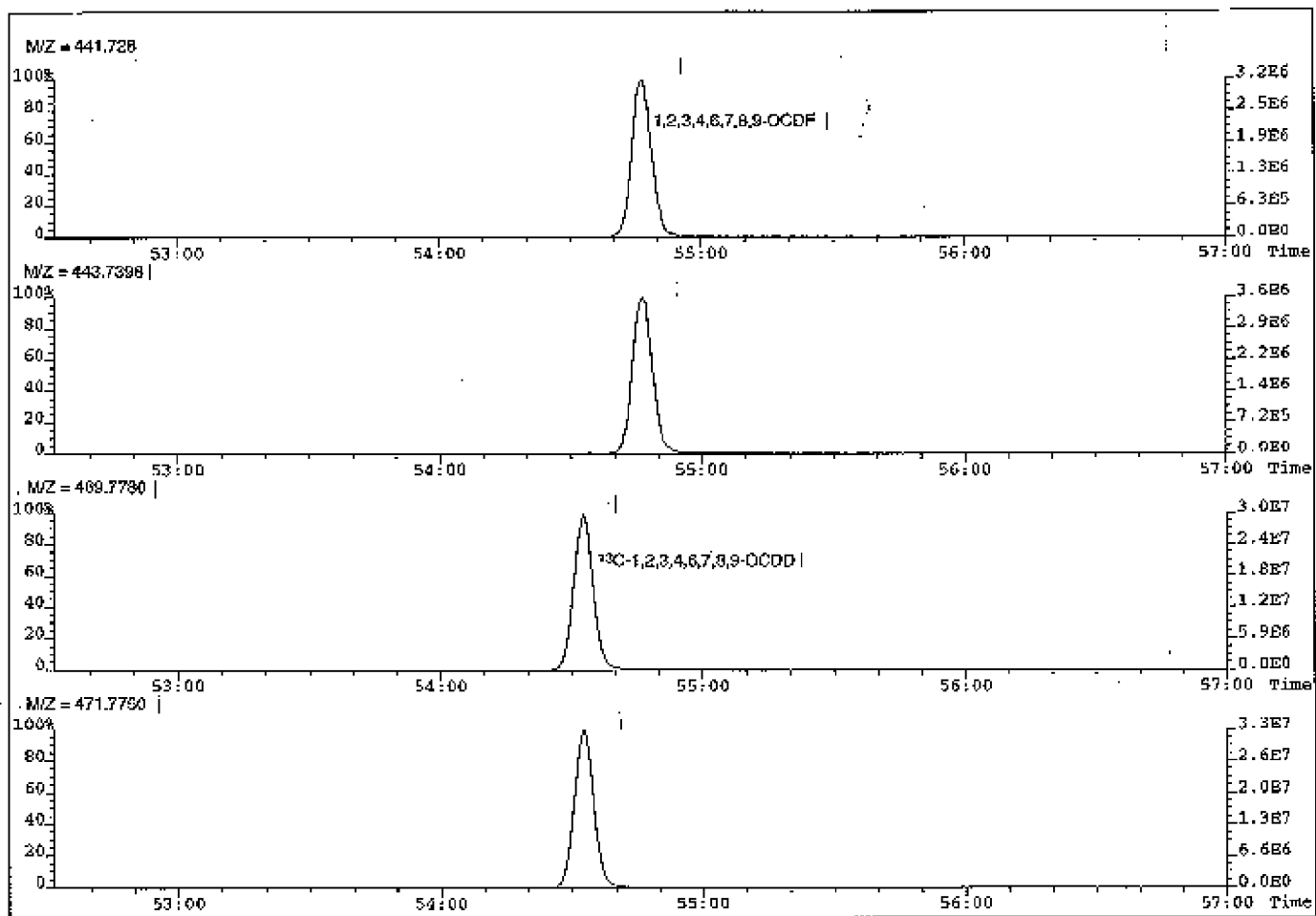


Figure 21. Extracted ion current profiles (EICP) for OCDF and labeled standard.

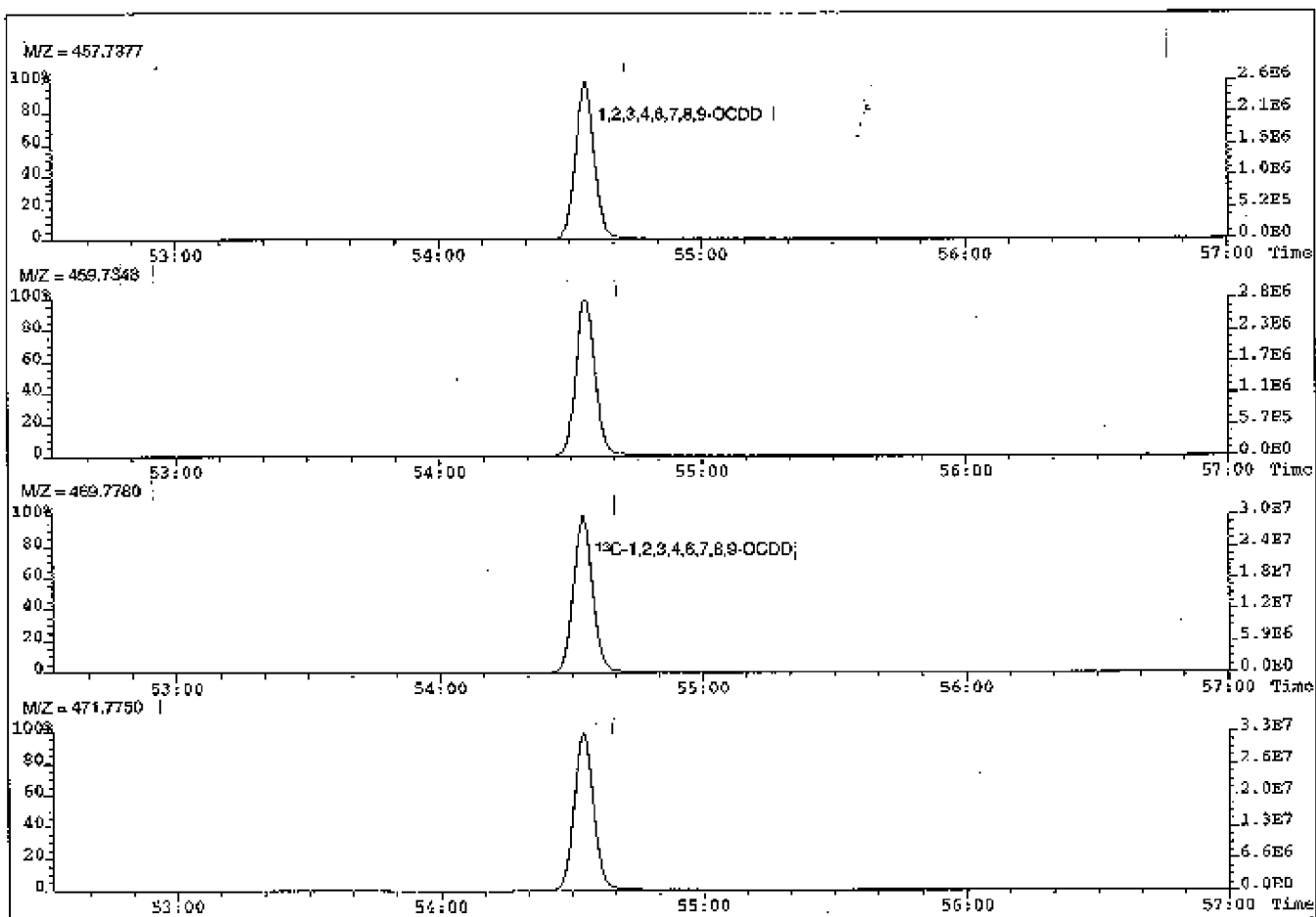


Figure 22. Extracted ion current profiles (EICP) for OCDD and labeled standard.

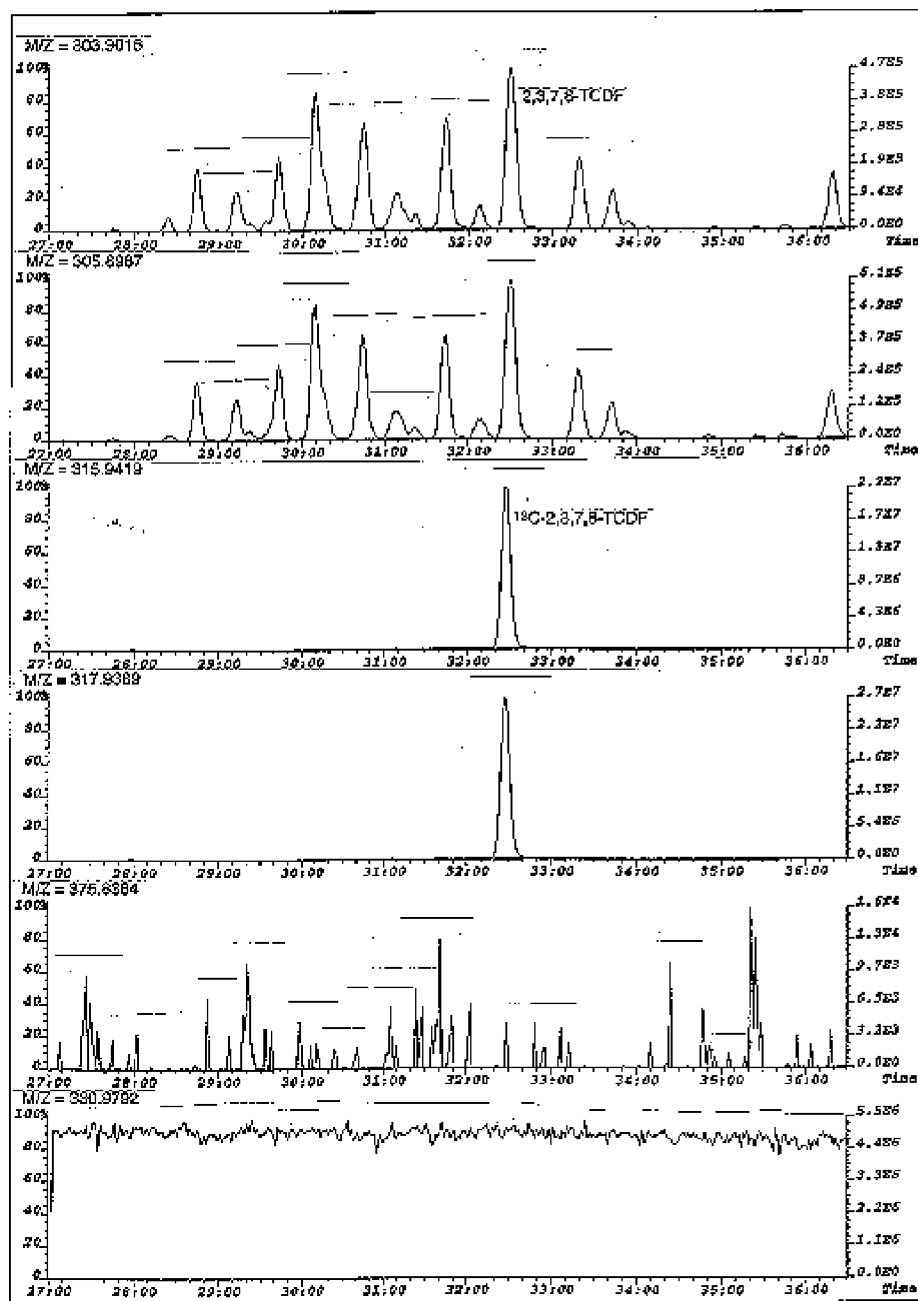


Figure 23. Extracted ion current profiles (EICP) for 2,3,7,8-TCDF and labeled standard in a complex environmental sample showing presence of other TCDF isomers.

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OPERATIONS MANUAL

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Direct: (513) 467-9000

FAX: (513) 467-9009

sales@tisch-env.com

www.Tisch-Env.com

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Introduction

EPA Standards

The following manual will instruct you in the unpacking, assemblage, operation, calibration, and usage of the corresponding Tisch Environmental product. For information on air sampling principles, procedures and requirements and to ensure compliance with government regulations please contact the local Environmental Protection Agency Office serving your area or visit www.epa.gov.

Safety Precautions

Before using Tisch Environmental products, always be sure to review the corresponding operations manuals and take all necessary safety precautions. Tisch Environmental products are to be used only for the purposes specified by operations manuals and by Tisch Environmental personnel. Tisch Environmental cannot guarantee the safe usage of its instruments in procedures that do not adhere to Tisch Environmental guidelines and standards. If you have concerns about the safety of your product or questions about safe practices, contact Tisch Environmental by phone or e-mail to speak with a representative.

Important Safety Instructions

Read and understand all instructions. Do not dispose of these instructions. Failure to follow all instruction listed in this manual may result in electric shock, fire, and/or personal injury. When using an electrical device, basic precautions must always be followed, including the precautions listed in the safety section of this manual. Never operate this unit in the presence of flammable materials or vapors are present as electrical devices may produce arcs or sparks that can cause fire or explosions. Always disconnect power supply before attempting to service or remove any components. Never immerse electrical parts in water or any other liquid. Always avoid body contact with grounded surfaces when plugging or unplugging this device is wet or dangerous conditions.

Electrical Installation

Installation must be carried out by specialized personal only, and must adhere to all local safety rules. This unit can be used for different power supply versions; before connecting this unit to the power line, always check if the voltage shown on the serial number tag corresponds to the one on your power supply. This product does use grounded plugs and wires. Grounding provides the path of least resistance for electrical currents, thereby reducing the risk of electric shock to users. This system is equipped with electrical cords with internal ground wires and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances. Do not modify the plug provided. If plug will not fit outlet, have the proper corresponding outlet installed by a professional, qualified electrician.

Do Not Abuse Cords

In the event that any electrical component of this system needs to be transported, **DO NOT** carry the unit by its power cord or unplug the unit by yanking the cord from the outlet. **Pull the plugs, not the cords**, to reduce risk of damage to unit. Keep all cords away from heat, oil, sharp objects, and moving parts.

Extension Cords

It is always advisable to use the shortest extension cord possible. Grounded units require a three-wire extension cord. As the distance from the supply outlet increases, you must use a heavier gauge extension cord. Using extension cords with inadequately sized wires results in serious changes in voltage, resulting in a loss of power and possible damage to equipment. It is recommended to only use 10-gauge extension cords for this product. Never use cords that exceed one hundred feet. Outdoor extension cords must be marked with the suffix "W-A" (or "W" in Canada) to indicate that it is suitable for outdoor usage. Always ensure that extension cords are properly wired and in good electrical condition. Always replace damaged extension cords immediately, or seek repair from qualified electricians before further use. Remember to protect extension cords from sharp objects, excessive heat, and damp or wet conditions.

Product Description

Introduction

TE-1000-PUF Poly-Urethane Foam sampler is a complete system designed to simultaneously collect suspended airborne particulates as well as trap airborne pesticide vapors at flow rates up to 280 liters per minute. The TE-PUF features the latest in technological advances for accurately measuring airborne particulates and vapors.

A dual chambered aluminum sampling module contains both filtering systems. The upper chamber supports the airborne particulate filter media in a circular filter holder. The lower chamber encapsulates a glass cartridge which contains the PolyUrethane Foam for vapor entrapment.

A wide variety of sorbents can be used in a manner that permits their continual use. Poly urethane foam or wet/dry granular solid media can be used individually or in combination. The dual chambered sampling module is designed for easy access to both upper and lower media. The threaded lower canister is removed with the cartridge intact for immediate exchange. Filter support screens and module components are equipped with gaskets providing a leak proof seal during the sampling process. Air flow rates are infinitely variable up to 280 liters per minute. The voltage variator adjusting screw alters the blower motor speed to achieve the flow rate desired. Air flow rate is measured through the flow venturi utilizing a 0-100" Magnehelic Gage. Periodic calibration is necessary to maintain on-site sampling accuracy. A Seven Day Mechanical Timer (TE-5007) is included as standard equipment and permits weekly scheduling with individual settings for each day and 14 trippers to turn the sampler On and Off as desired. Any day or days may be omitted. Day and night periods are distinctly marked. Other timers and programmers are available optionally to suit any sampling requirement.

Applications

- ❖ Meets US EPA methods TO-4A, TO-9A, and TO-13A.
- ❖ Samples semi-volatile organic compounds.
- ❖ Especially designed for sampling airborne particulates and vapor contamination from pesticide compounds.
- ❖ Successfully demonstrated to efficiently collect a number of organochlorine and organophosphate pesticides.
- ❖ By-pass blower motor design permits continuous sampling for extended periods at rates to 280 liters per minute.
- ❖ Proven sampler components housed in an anodized aluminum shelter for outdoor service.
- ❖ Samples in accordance with U.S. EPA Method TO-4A, "Method for the Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air using high volume polyurethane foam (PUF) sampler."

Calibration Requirements

The TE-1000 PUF Sampler should be calibrated:

- Upon installation
- After motor maintenance
- At least once every three months
- After 360 sampling hours

Parts

1. Shelter Box - 48" x 20" x 20" 74 lbs

PUF Anodized Aluminum Shelter

TE-1000 110volt, 60hz

TE-1000X 220volt, 50hz

TE-1000XZ 220volt, 60hz



7-Day Mechanical Timer

TE-5007 110volt, 60hz

TE-5007X 220volt, 50hz

TE-5007XZ 220volt, 60hz



Flow Venturi & Calibration Valve

TE-1003



Motor Voltage Control

TE-5010 110volt, 60hz

TE-5010X 220volt, 50hz

TE-5010XZ 220volt, 60hz



PUF Blower Motor Assembly

TE-1004 110volt

TE-1004X 220volt



Dual Sampling Module

TE-1002



Exhaust Hose

TE-1023



Magnehelic Gauge

TE-1005



2. Lid Box - 19" x 14" x 14" 9 lbs

TE-5001-10

Gabled Roof



***** Save the shipping containers and packing material for future use.**

Assembly

1. Open shelter box and remove the Anodized Aluminum Shelter.
2. Inside of the shelter is the exhaust hose. Unwrap and insert end with speed clamp on end of blower motor discharge. Tighten with a flat edge screwdriver and put end of hose downwind of sampler.
3. Enclosed in the 13" x 10" x 7" box on the bottom of the shelter is the TE-1002 Dual Sampling Module. Remove it from the box.
4. Take out the rubber plug that is in the quick disconnect on the top pan of the shelter. Insert Dual Sampling Module and lock in place by pushing rings down to seal tightly.
5. Take off the cover that is on top of the 4" filter holder. Turning motor on with cover in place will damage motor.
6. Open lid box and remove 5001-10 roof.

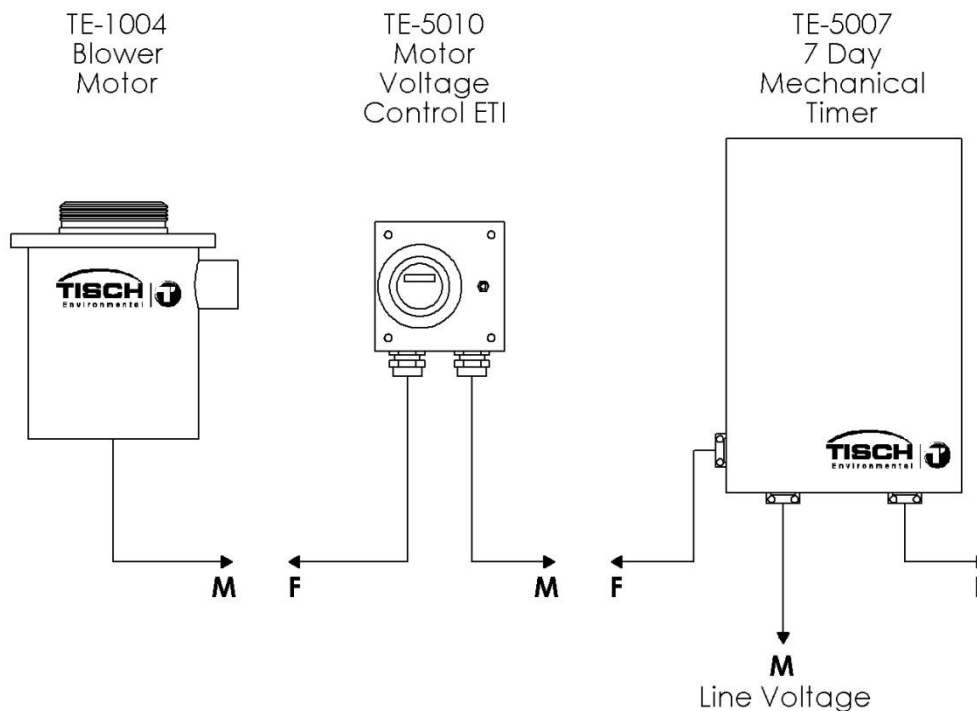
Gabled Roof Assembly

<u>Lid Hardware</u> 5 pcs 10-24 x 1/2 pan head screws 5 pcs 10-24 stop nuts 1 pc 6-32 x 3/8 pan head screw 1 pc 6-32 hex nut 1 pc 20" chain with "S" hook 1 pc TE-5001-10-9 roof back catch 1 pc TE-5001-10-10 front catch 1 pc TE-5001-10-11 rear lid hasp	
<u>Step 1</u> Secure TE-5001-10-10 front catch to the shelter using 2 10-24 pan head screws with stop nuts. <i>*Do not tighten completely, this may need to be adjusted after final assembly*</i>	
<u>Step 2</u> Secure TE-5001-10-9 roof back catch to the back of shelter using #6-32 pan head screw with stop nut.	
<u>Step 3</u> Secure TE-5001-10-11 rear lid hasp inside the lid with the slot angled up using (2) #10-24 pan head screws with stop nuts. <i>*Do not tighten completely, this may need to be adjusted after final assembly*</i>	
<u>Step 4</u> Remove (4) #10-24 x 1/2" pan head screws from the rear of the shelter, attach the lid to the shelter by placing the lid hinge plates on the "OUTSIDE" of the shelter, line the hinges up with the (4) threaded holes in the back of the shelter. Use the (4) #10-24X 1/2" pan head screws that were removed previously to attach the lid hinges to the shelter. <i>*Tighten completely*</i>	

<u>Step 5</u> Adjust the front and rears catch to be sure that the lid slots lowers over it when closing. Tighten the roof back hasp and front catch completely.	
<u>Step 6</u> Attach the chain and “S” hook assembly to the side of the shelter with a #6-32 x 3/8” pan head screw.	
<u>Step 7</u> The Lid can now be secured in an open or closed position with the “S” hook.	

Electrical Set-Up

TE-1000 Electrical Set-Up



1. The TE-1004 PUF Blower Motor male cord set plugs into the TE-5010 Motor Voltage Control Female cord set.
2. The male cord set of the Motor Voltage Control plugs into the TE-5007 7-Day Mechanical Timer timed female cord set which is on the left side of timer.
3. The other female cord set on timer (on the right) is hot all the time and is an extra plug.
4. The male cord set of timer plugs into the line voltage.

Operations

Calibration Procedure

Visit, www-tisch-env.com/calibration-worksheets, to download calibration worksheets. The calibration worksheets allow the user to input the data and automatically make the calculations. The manual calculation method is described in the following sections for your reference, however, it is highly recommended to download the calibration worksheets.

Proceed with the following steps to begin the calibration:

1. Calibration of the PUF Sampler is performed without a foam plug (TE-1010) or filter paper in the sampling module. However the empty glass cartridge must remain in the module to insure a good seal through the module.
2. Install the TE-5040A Calibrator (orifice) on top of the 4" Filter Holder. Tighten and make sure of no leaks.
3. Open both ports on top of manometer and connect tubing from manometer port to the pressure tap on the TE-5040A Calibrator. Leave the opposite side of manometer port open to the atmosphere.
4. Open ball valve fully (handle should be straight up), this is located inside of shelter directly above the blower motor.
5. Turn the system on by tripping the manual switch on the timer. Allow a few minutes for motor to warm-up.
6. Adjust and tighten the voltage control screw (variac) on the TE-5010 to obtain a reading of 70 inches on the dial of the Magnehelic Gage (or 80 whatever is desired). Do not change until completion of calibration.
7. With 70 inches on the gage as your first calibration point, record this figure and the orifice manometer reading on your data sheet. To read a manometer one side goes up and one goes down, add both sides together, this is your inches of water.
8. Close the ball valve slightly to readjust the dial gage down to 60 inches. Record this figure and the orifice manometer reading on your data sheet.

9. Using the above procedure, adjust the ball valve for readings at 50, 40, and 30 inches and record on data sheet. You should have 5 sets of numbers 10 numbers in all.
10. Manually turn sampler off.

To download the calibration worksheet please visit, www.tisch-env.com/calibration-worksheets and select the “TE-1000 PUF calibration worksheet.” The TE-1000 PUF Sampler Calibration Data Sheet has been attached with data filled in from a typical calibration. This includes the transfer standard orifice calibration relationship which was taken from the Orifice Calibration Worksheet that accompanies the calibrator orifice. Since this calibration is for a PUF sampler, the slope and intercept for this orifice uses **standard** flows rather than actual flows.

The five orifice manometer readings taken during the calibration have been recorded in the column on the data worksheet titled H₂O (in). The five Magnehelic Gage readings taken during the calibration have been recorded under the column titled FLOW (magn).

The orifice manometer readings need to be converted to the standard air flows they represent using the following equation:

$$Q_{std} = 1/m[\text{Sqrt}((H_2O)(Pa/760)(298/Ta))-b]$$

where:

Q_{std} = actual flow rate as indicated by the calibrator orifice, m³/min

H_2O = orifice manometer reading during calibration, in. H₂O

T_a = ambient temperature during calibration, K (K = 273 + C°)

298 = standard temperature, a constant that never changes, K

P_a = ambient barometric pressure during calibration, mm Hg

760 = standard barometric pressure, a constant that never changes, mm Hg

m = *Q*standard slope of orifice calibration relationship

b = *Q*standard intercept of orifice calibration relationship.

Once these standard flow rates have been determined for each of the five run points, they are recorded in the column titled Q_{std} , and are represented in cubic meters per minute.

The Magnehelic Gage readings taken during the calibration need to be corrected to the current meteorological conditions using the following equation:

$$\text{FLOW (corrected)} = \text{Sqrt}((\text{magn})(\text{Pa}/760)(298/\text{Ta}))$$

where:

FLOW (corrected) = Magnehelic Gage readings corrected to current Ta and Pa

magn = Magnehelic Gage readings during calibration

Pa = ambient barometric pressure during calibration, mm Hg

760 = standard barometric pressure, a constant, mm Hg

Ta = ambient temperature during calibration, K (K = 273 + C°)

298 = standard temperature, a constant, K

After each of the Magnehelic Gage readings have been corrected, they are recorded in the column titled FLOW (corrected).

Using Qstd and FLOW (corrected) as the x and y axis respectively, a slope, intercept, and correlation coefficient can be calculated using the least squares regression method. The correlation coefficient should never be less than 0.990 after a five point calibration. A coefficient below .990 indicates a calibration that is not linear and the calibration should be performed again. If this occurs, it is most likely the result of an air leak during the calibration.

The equations for determining the slope (m) and intercept (b) are as follows:

$$m = \frac{\frac{\sum xy}{n} - \frac{(\sum x)(\sum y)}{n^2}}{\frac{\sum x^2}{n} - \frac{(\sum x)^2}{n^2}} ; \quad b = \bar{y} - m\bar{x}$$

where: n = number of observations

$\bar{y} = \sum y/n$; $\bar{x} = \sum x/n$

$\sum$ = sum of

The equation for the coefficient of correlation (r) is as follows:

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]\left[\sum y^2 - \frac{(\sum y)^2}{n}\right]}}$$

where: n = number of observations
 $\sum$ = sum of

If you wanted to set this sampler at .242 m³/min (8.5 CFM or 242 LPM) (Make sure the ball valve is open fully, a 4" filter is in place, and the module is loaded) you would turn the voltage control screw or variac until the Magnehelic Gage read 60 inches. By making sure that the sampler is operating at a Magnehelic Gage reading that is within the acceptable range, it can be assumed that valid PUF data is being collected.

Example Problems

The following example problems use data from the attached calibration worksheet.

After all the sampling site information, calibrator information, and meteorological information have been recorded on the worksheet, standard air flows need to be determined from the orifice manometer readings taken during the calibration using the following equation:

$$1. Q_{std} = 1/m[\sqrt{(H_2O)(Pa/760)(298/Ta))}-b]$$

where:

Q_{std} = actual flow rate as indicated by the calibrator orifice, m³/min

H₂O = orifice manometer reading during calibration, in. H₂O

T_a = ambient temperature during calibration, K (K = 273 + C°)

298 = standard temperature, a constant that never changes, K

P_a = ambient barometric pressure during calibration, mm Hg

760 = standard barometric pressure, a constant that never changes, mm Hg

m = Q_{standard} slope of orifice calibration relationship

b = Q_{standard} intercept of orifice calibration relationship.

Note that the ambient temperature is needed in degrees Kelvin to satisfy the Qstd equation. Also, the barometric pressure needs to be reported in millimeters of mercury. In our case the two following conversions may be needed:

2. **degrees Kelvin = $[5/9 (\text{degrees Fahrenheit} - 32)] + 273$**

3. **millimeters of mercury = $25.4(\text{inches of H}_2\text{O}/13.6)$**

Inserting the numbers from the calibration worksheet run point number one we get:

4. $Q_{std} = 1/9.82823[\text{Sqrt}((7.5)(756.9/760)(298/294.8)) - (-.03871)]$

5. $Q_{std} = .1017477[\text{Sqrt}((7.5)(.996)(1.011)) + .03871]$

6. $Q_{std} = .1017477[\text{Sqrt}(7.55217) + .03871]$

7. $Q_{std} = .1017477[2.7481211 + .03871]$

8. $Q_{std} = .1017477[2.7868311]$

9. $Q_{std} = .284$

Throughout these example problems you may find that your answers vary some from those arrived at here. This is probably due to different calculators carrying numbers to different decimal points. The variations are usually slight and should not be a point of concern.

With the Q_{std} determined, the corrected Magnehelic Gage reading FLOW (corrected) for this run point needs to be calculated using the following equation:

10. $\text{FLOW (corrected)} = \text{Sqrt}((\text{magn})(\text{Pa}/760)(298/\text{Ta}))$

where:

FLOW (corrected) = Magnehelic Gage readings corrected to standard

magn = Magnehelic Gage readings during calibration

Pa = ambient barometric pressure during calibration, mm Hg.

760 = standard barometric pressure, mm Hg

Ta = ambient temperature during calibration, K (K = 273 + C°)

298 = standard temperature, K.

Inserting the data from run point one on the calibration worksheet we get:

11. $\text{FLOW (corrected)} = \text{Sqrt}((70)(756.9/760)(298/294.8))$

12. $\text{FLOW (corrected)} = \text{Sqrt}((70)(.996)(1.011))$

13. FLOW (corrected) = Sqrt(70.48692)

14. FLOW (corrected) = 8.39

This procedure should be completed for all five run points.

Using Qstd as our x-axis, and FLOW (corrected) as our y-axis, a slope, intercept, and correlation coefficient can be determined using the least squares regression method.

The equations for determining the slope (m) and intercept (b) are as follows:

$$15. \quad m = \frac{\frac{(\sum x)(\sum y)}{n} - \frac{\sum xy}{n}}{\frac{(\sum x)^2}{n} - \frac{\sum x^2}{n}} ; \quad b = \bar{y} - m\bar{x}$$

where: n = number of observations
 $\bar{y} = \sum y/n$; $\bar{x} = \sum x/n$
 $\sum$ = sum of.

The equation for the coefficient of correlation (r) is as follows:

$$16. \quad r = \frac{\frac{(\sum x)(\sum y)}{n} - \frac{\sum xy}{n}}{\sqrt{\left[\frac{(\sum x)^2}{n} - \frac{\sum x^2}{n} \right] \left[\frac{(\sum y)^2}{n} - \frac{\sum y^2}{n} \right]}}$$

where: n = number of observations
 $\sum$ = sum of

Before these can be determined, some preliminary algebra is necessary. $\sum x$, $\sum y$, $\sum x^2$, $\sum xy$, $(\sum x)^2$, $(\sum y)^2$, n , $\bar{y}$, and $\bar{x}$ need to be determined.

17. $\sum x = .284 + .266 + .249 + .230 + .200 = 1.229$

18. $\sum y = 8.39 + 7.77 + 7.09 + 6.35 + 5.50 = 35.1$

19. $\sum x^2 = (.284)^2 + (.266)^2 + (.249)^2 + (.230)^2 + (.200)^2 = .306313$

20. $\sum y^2 = (8.39)^2 + (7.77)^2 + (7.09)^2 + (6.35)^2 + (5.50)^2 = 251.6056$

21. $\Sigma xy = (.284)(8.39) + (.266)(7.77) + (.249)(7.09) + (.230)(6.35) + (.200)(5.50) = 8.77549$
22. $n = 5$
23. $\bar{x} = \Sigma x/n = .2458$
24. $\bar{y} = \Sigma y/n = 7.02$
25. $(\Sigma x)^2 = (1.229)^2 = 1.510441$
26. $(\Sigma y)^2 = (35.1)^2 = 1232.01$

Inserting the numbers:

$$27. \text{slope} = \frac{8.77549 - \frac{(1.229)(35.1)}{5}}{0.306313 - \frac{1.510441}{5}}$$

$$28. \text{slope} = \frac{8.77549 - \frac{35.36543.1379}{5}}{0.306313 - \frac{1.510441}{5}}$$

$$29. \text{slope} = \frac{8.77549 - 8.62758}{0.306313 - 0.302}$$

$$30. \text{slope} = \frac{0.14791}{0.004313}$$

$$31. \text{slope} = 34.293994$$

$$32. \text{intercept} = 7.02 - (34.293994)(.2458)$$

$$33. \text{intercept} = 7.02 - 8.4294637$$

$$34. \text{intercept} = -1.4094637$$

$$35. \text{correlation coeff.} = \frac{8.77549 - \frac{(1.229)(35.1)}{5}}{\sqrt{\left[.306313 - \frac{(1.229)^2}{5}\right] \left[251.6056 - \frac{(35.1)^2}{5}\right]}}$$

$$36. \text{ correlation coeff.} = \frac{8.77549 - \frac{(43.1379)}{5}}{\sqrt{[(.306313 - .3020882)] [(251.6056 - 246.402)]}}$$

$$37. \text{ correlation coeff.} = \frac{(8.77549 - 8.62758)}{\sqrt{[(.306313 - .3020882)] [(251.6056 - 246.402)]}}$$

$$38. \text{ correlation coeff.} = \frac{.14791}{\sqrt{(.0042248)(5.2036)}}$$

$$39. \text{ correlation coeff.} = \frac{.14791}{\sqrt{.0219841}}$$

$$40. \text{ correlation coeff.} = \frac{.14791}{.1482703}$$

$$41. \text{ correlation coeff.} = .9975699$$

A calibration that has a correlation coefficient of less than .990 is not considered linear and should be re-calibrated. Since the correlation coeff. is > .990 , we have a good calibration.

Unit Operation

1. The PUF Sampler may be operated at ground level or on roof tops. In urban or congested areas, it is recommended that the sampler be placed on the roof of a single story building. The sampler should be located in an unobstructed area, at least two meters from any obstacle to air flow. The exhaust hose should be stretched out in a down wind direction if possible.
2. The sampler should be operated for 24 hours in order to obtain average daily levels of airborne pesticides.
3. On and off times and weather conditions during sampling periods should be recorded. Air concentrations may fluctuate with time of day, temperature, humidity, wind direction and velocity and other climatological conditions.
4. Magnehelic Gage readings should be taken at the beginning and end of each sampling period to obtain an average magnehelic gage reading.
5. Blower motor brushes should be inspected frequently and replaced before expending. An electrical source of 110 volts, 15 amps is required.

Sampling Module

1. Release the three (3) swing bolts on the 4" filter holder (FH-2104) and remove the triangle cover (cover must be off when sampler is "ON") and hold down ring.
2. Install a clean 102mm dia.(4") quartz fiber filter (TE-QMA4) on the support screen in between the teflon gaskets and secure it with the hold down ring and swing bolts.
3. Unscrew together the 4" filter holder and the sampling module cap leaving the module tube in place with the glass cartridge exposed.
4. Load the glass cartridge with foam and or foam/granular solids and replace in the module tube. Fasten the glass cartridge with the module cap and 4" filter holder assembly while making sure that the module assembly, 4" filter holder and all fittings are snug.
5. The glass cartridge and quartz fiber filter should be removed from the sampler with forceps and clean gloved hands and immediately placed in a sealed container for transport to the laboratory. Similar care should be taken to prevent contamination of the filter paper and vapor trap (foam) when loading the sampler.
6. **It is recommended to have two (2) sampling modules (TE-1002) for each sampling system so that filter and foam exchange can take place in the laboratory.**

Sorbents

Two types of sampling media are recommended for use with the PUF Sampler: polyurethane foams and granular solid sorbents. Foams may be used separately or in combination with granular solids. The sorbent may be extracted and reused (after drying) without unloading the cartridge.

1. Polyurethane Foam (PUF):

- Part number TE-1010 three inch plug is recommended. Also available are two inch (TE-1011) and one inch (TE-1012). This type of foam is white and yellows on exposure to light. Color does not effect the collection efficiency of the material.

2. Granular Solids

- Porous (macroreticular) chromatography sorbents recommended. Pore sizes and mesh sizes must be selected to permit air flow rates of at least 200 liters/minute. Approximately 200 g of sorbent is recommended. ***If too much sorbent is used, the sampler flow rate may be affected.*** The granular solids may be sandwiched between two layers of foam to prevent loss during sampling and extraction.

Determination of Flow Rate

To figure out the total volume of air that flowed through the PUF sampler during your sampling run take a set-up magnehelic gage reading (when you set the sampler up manually turn it on and take a magnehelic gage reading; in our example it should be 60 inches) and a pick-up reading (after the sample has been taken again manually turn sampler on and take a magnehelic gage reading; for our example let's say it read 54 inches). Take $60 + 54 = 114$ $114/2 = 57$ so the magnehelic gage reading you would use is 57 inches. Put that into the formula (on bottom of worksheet):

$$1/m([\text{Sqrt}(\text{magn})(P_{av}/760)(298/T_{av})] - b)$$

m = sampler slope

b = sampler intercept

magn = average magnehelic gage reading

T_{av} = daily average temperature

P_{av} = daily average pressure

Sqrt = square root

Example:

$$m^3/\text{min} = 1/35.3693([\text{Sqrt}(57)(751.3/760)(298/293.2)] - (-1.6711))$$

$$m^3/\text{min} = .0282731 ([\text{Sqrt}(57)(.9885526)(1.016371)] + 1.6711)$$

$$m^3/\text{min} = .0282731 ([\text{Sqrt}(57.269962)] + 1.6711)$$

$$m^3/\text{min} = .0282731 [(7.5676919)] + 1.6711)$$

$$m^3/\text{min} = .0282731 (7.5676919 + 1.6711)$$

$$m^3/\text{min} = .0282731 (9.2387919)$$

$$m^3/\text{min} = .2612092$$

$$\text{lpm} = 261.2092$$

Total liters of air = lpm x 60 x hours that sampler ran

Let's say our sampler ran 23.9 hours

(end ETI reading - start ETI reading)

**** Make sure ETI is in hours otherwise convert to hours ****

Total liters of air = $261.2092 \times 60 \times 23.9 = 374,573.99$ liters of air.

Troubleshooting

note: this is a general troubleshooting guide, not all problem may apply to every sampler

<u>Problem</u>	<u>Solution</u>
Brush Motor Won't Turn On	-Check Motor brushes(Change every 500 hours) -Check Motor(Should be replaced after 2 brush changes about 1500 hours) -Check power supply -Ensure that all electrical connections are secure -Make sure timer is on -Make sure flow controller(if applicable) is adjusted properly -Check for loose or damaged wires -Check speed on TE-5010, ensure adjustment screw is turned clockwise to increase motor speed.
Brushless Motor Won't Turn On	-Ensure that all electrical connections are secure -Make sure flow controller(if applicable) is adjusted properly -Check power supply -Make sure timer is on -Check for loose or damaged wires
Mechanical timer not working	-Make sure trippers are set properly -Make sure that trippers are not pressed against switch at start up, the timer need to rotate a few degrees before the trippers hit the switch -Check for loose or damages wires -Check power supply -Check electrical hook up diagram to ensure correct installation -Check Motor
Digital timer not working	-Check timer settings -Make sure current date and time are correct -Make sure power cords are properly connected -Check fuse on main PC board (F3) -Check Power Supply -Check Motor

Mass Flow Controller not working	-Make sure timer is on -Check Motor/Motor brushes -Make sure 8 amp breaker is not popped -Make sure flow probe is installed correctly -Check all electrical connections -Check power supply
Elapsed Time Indicator not working	-Check Power Supply -Check electrical connections
Voltage Variator with ETI not working	-Check Power Supply -Check Electrical Connections -Check Motor
Flow Rate Too Low	-Check for leaks -Check filter media placement -Ensure only one piece of filter paper is installed -Check Flow Controller -Check flow valve(TE-1000PUF samplers only) -Ensure proper voltage is being supplied -Check calibration
Chart Recorder not working	-Replace pen point -Make sure pen point is touching chart -Make sure pen point is on "0" -Make sure tubing from motor is in place -Check Power Supply -Check motor
Air Leaks	-Make sure all gaskets are in place -Make sure all connections are secure -Makes sure connections are not over tightened -Check for damaged components: Filter holder screen, gaskets, motor flanges

Maintenance and Care

A regular maintenance schedule will allow a monitoring network to operate for longer periods of time without system failure. Our customers may find that the adjustments in routine maintenance frequencies are necessary due to the operational demands on their sampler(s). We recommend that the following cleaning and maintenance activities be observed until a stable operating history of the sampler has been established.

TE-1000 PUF

1. Make sure all gaskets (including motor cushion) are in good shape and that they seal properly.
2. The power cords should be checked for good connections and for cracks (replace if necessary).

CAUTION: DO NOT allow power cord or outlets to be immersed in water!

3. Inspect the filter screen and remove any foreign deposits.
4. Inspect the filter holder frame Teflon gasket each sample period and make sure of an airtight seal.
5. Check or replace TE-33384 or TE-33378 motor brushes every 400 to 500 running hours.
6. After replacing brushes two times, a new motor (TE-116336 or TE-116125) must be used.
7. Make sure elapsed time indicator is working properly.

Motor Brush Replacement

(110 volt Brush part #TE-33384)

(220 volt Brush part #TE-33378)

CAUTION: Ensure that all electrical power to the TE-PUF Sampler is disconnected prior to opening the motor housing. Unplug the motor power cord.

The following steps are accompanied by pictures to aid your understanding of motor brush replacement procedures. Please be aware that the pictures are standardized and may not match the equipment that you are using. Motor brush removal and replacement does not change based on motor or brush type, so do not be confused if your equipment differs from what is pictured.

1. Remove the motor mounting cover by removing the four bolts. This will expose the flange gasket and the motor. Turn motor over.
2. Remove ground wires from backplate and carefully lift the metal housing from the motor.
3. With a screwdriver, carefully remove the plastic fan cover by prying in between the brush and cover until both sides pop loose.
4. With a screwdriver, carefully pry the brass quick disconnect tabs away from the expended brushes.



5. With a screwdriver remove brush holder and release **TE-33384** brushes.



6. With new **TE-33384** brushes, carefully slide quick disconnect tabs firmly into tab slot until seated.



7. Push brush carbon against commutator until plastic brush housing falls into place on commutator end bracket.
8. Replace brush holder clamps onto brushes.



9. Assemble motor after brush replacement: snap plastic fan cover back into place, feed ground wires back through backplate, put housing back on to motor, pull cord set back to normal position, (**make sure wires do not get smashed between metal ring and housing.** fasten ground wires to backplate, turn motor over, tighten flange on top of housing and gasket.
10. Replace motor mounting cover on top of motor making sure to center gasket.

****WARNING** Change Brushes Before Brush Shunt Touches Commutator!**



**TE-116336
110v Motor**



**TE-33384(green)
110v Motor Brush**



**TE-116125
220v Motor**



**TE-33378(brown)
220v Motor Brush**

Seating Procedure

CAUTION: Direct application of full voltage after changing brushes will cause arcing, commutator pitting, and reduce overall life.

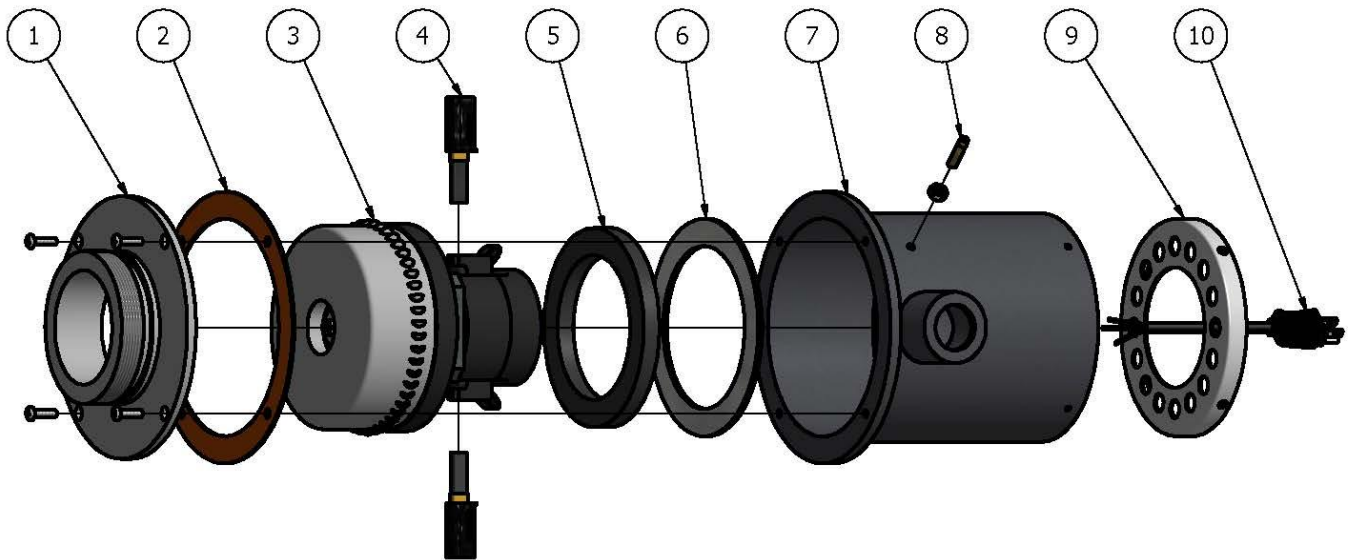
To achieve best performance from new **TE-33384** brushes they must be seated on the commutator before full voltage is applied. After brush change apply 50% voltage for fifteen to twenty minutes to accomplish this seating. Use of **TE-5010** Flow Selector on system provides the reduced voltage for brush seating.

Warranty

Instruments manufactured by Tisch Environmental, Inc. are guaranteed by warranty to be free of defects in materials and workmanship for one year after shipment from Tisch Environmental factories. The liability of Tisch Environmental, Inc. is limited to servicing or replacing any defective part of any instrument returned to the factory by the original purchaser. All service traceable to defects in original material or workmanship is considered warranty service and is performed free of charge. The expense of warranty shipping charges to and from our factory will be borne by Tisch Environmental. Service performed to rectify an instrument malfunction caused by abuse, acts of god or neglect, and service performed after the one-year warranty period will be charged to the customer at the current prices for labor, parts, and transportation. Brush-type and brushless motors will carry a warranty as far as the original manufacture will pass through its warranty to Tisch Environmental, Inc. The right is reserved to make changes in construction, design specifications, and prices without prior notice.

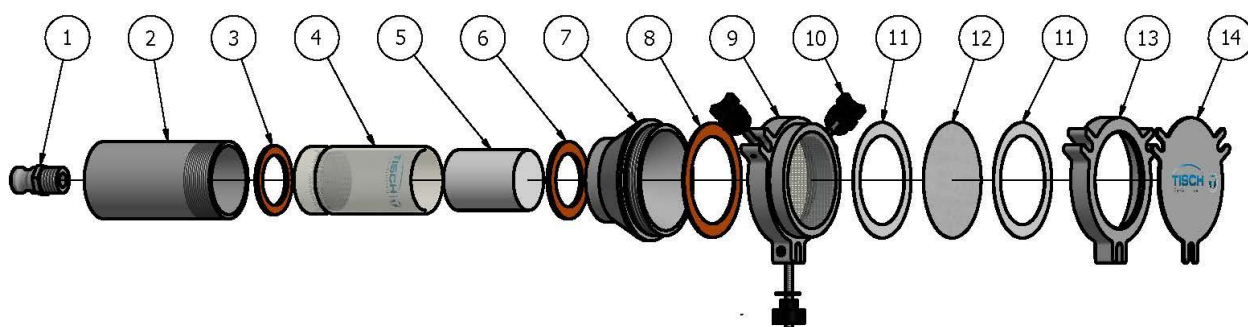
Assembly Drawings

TE-1004 Blower Motor Assembly



TE-1004 PUF Blower Motor Assembly			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TE-1004-1	Blower Motor Flange
2	1	TE-1004-2	Flange Gasket
3	1	TE-116336 TE-116125	Motor for 110V PUF System Motor for 220V PUF System
4	1	TE-33384 TE-33378	Motor Brushes for 110V Motor Motor Brushes for 220V Motor
5	1	TE-5005-4	Motor Cushion
6	1	TE-1004-8	Motor Spacer Ring
7	1	TE-1004-3	Aluminum Blower Motor Housing w/ Integral Side Exhaust
8	1	TE-1004-15	PUF Pressure Tap w/ Nut
9	1	TE-1004-7	Back Plate
10	1	TE-5010-4	Power Cord

TE-1002 Vapor/Particulate Module



TE-1002 Particulate/Vapor Sampling Module			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TE-1002-4	Module Plug Coupler
2	1	TE-1002-3	Module Body
3	1	TE-1002-8	Lower Module Gasket, Silicone 2 9/16" OD
4	1	TE-1009	Glass Cartridge w/ Stainless Steel Screens
5	1	TE-1010 TE-1011 TE-1012	3" Long Polyurethane Vapor Collection Substrate (Unwashed) 2" Long Polyurethane Vapor Collection Substrate (Unwashed) 1" Long Polyurethane Vapor Collection Substrate (Unwashed)
6	1	TE-1002-6	Upper Module Gasket, Silicone 2 7/8" OD
7	1	TE-1002-2	Module Reducer
8	1	TE-1008-8	Filter Holder Gasket, Silicone 4 1/2" OD
9	1	TE-1008-2	4" Filter Holder Body w/ Stainless Steel Screens
10	3	TE-1002-14	Plastic Thumb Nut, Brass Bolt, Washer, and S/S Bolt
11	2	TE-1008-5	Teflon Gasket
12	1	TE-QMA4	Micro-Quartz Filter Media 4" Round for PUF
13	1	TE-1008-1	4" Hold Down Frame
14	1	TE-1008-9	Aluminum Cover for 4" Filter Holder

Calibration Worksheet



TE-1000 PUF Calibration Worksheet

Site Information

Location: Cleves Oh:	Site ID: 145	Date: 1-Jul-15
Sampler: TE-1000	Serial No: 1116	Tech: Jim Tisch

Site Conditions

Barometric Pressure (in Hg):	29.80	Corrected Pressure (mm Hg):	756.9
Temperature (deg F):	71.0	Temperature (deg K):	294.8
Average Pressure (in Hg):	29.58	Corrected Average Pressure (mm Hg):	751.3
Average Temperature (deg F):	68.0	Average Temperature (deg K):	293.2

Calibration Orifice

Make: Tisch	Qstd Slope: 9.82823
Model: TE-5040A	Qstd Intercept: -0.03871
Serial#: 1185	Calibration Due Date: 15-Oct-14

Calibration Information

Plate or Test #	Pressure (in H ₂ O)	Qstd (m3/min)	Flow (magn)	Flow (corrected)	Linear Regression
1	7.50	0.284	70.0	8.39	Slope: 35.3693
2	6.60	0.266	60.0	7.77	Intercept: -1.6711
3	5.75	0.249	50.0	7.09	Corr. Coeff: 0.9978
4	4.90	0.230	40.0	6.35	
5	3.70	0.200	30.0	5.50	
					# of Observations: 5

Calculations

Qstd = $1/m[\text{Sqrt}((H_2O)(Pa/760)(298/Ta))-b]$
Flow (corrected) = $\text{Sqrt}((\text{magn})(Pa/Pstd)(Tstd/Ta))$

Qstd = standard flow rate
Flow (magn) = reading from magnehelic gauge
Flow (corrected) = corrected flow rate

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
Qstd = $1/m[\text{Sqrt}((H_2O)(Pa/760)(298/Ta))-b]$

m = sampler slope
b = sampler intercept
(magn) = magnehelic reading
Tav = daily average temperature
Pav = daily average pressure

Average Flow (magn):	36.0
Average Flow Over Sample (m3/min)	0.217306
Enter Total Time (hrs):	23.9
Total Flow Over Sample (m3/min)	311.6161029
Total Flow Over Sample (LPM)	311616.1029

NOTE: Ensure calibration orifice has been certified within 12 months of use

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com

Calibrator Certificate



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5040A

Date - May 04, 2015 Rootmeter S/N 0438320 Ta (K) - 294
Operator Jim Tisch Orifice I.D. - 2959 Pa (mm) - 755.65

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	6.7000	3.6	2.00
2	NA	NA	1.00	4.1130	10.0	5.50
3	NA	NA	1.00	3.2710	15.5	8.50
4	NA	NA	1.00	2.8040	21.0	11.50
5	NA	NA	1.00	2.4730	26.5	14.50
6	NA	NA	1.00	2.3050	30.2	16.50

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0029	0.1496	1.4197	0.9951	0.1485	0.8821
0.9944	0.2417	2.3543	0.9867	0.2399	1.4628
0.9871	0.3017	2.9268	0.9794	0.2994	1.8185
0.9797	0.3494	3.4044	0.9721	0.3467	2.1153
0.9724	0.3932	3.8227	0.9649	0.3901	2.3752
0.9675	0.4197	4.0778	0.9600	0.4165	2.5337
Qstd slope (m) =		9.82823	Qa slope (m) =		6.15427
intercept (b) =		-0.03871	intercept (b) =		-0.02405
coefficient (r) =		0.99988	coefficient (r) =		0.99988
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{ [SQRT(H2O(Pa/760) (298/Ta))] - b}
Qa = 1/m{ [SQRT H2O(Ta/Pa)] - b}

Addendum 4

Revisions to Supplement 4-1, Assessment of Alternatives for Open Detonation and Open Burning Activities

Executive Summary

The Alt Tech Evaluation then addresses the site-specific factors that must be considered in evaluating any potential alternative technology. These factors are generally encompassed within the concepts of operational safety, monitorability, and toxic byproducts. Site-specific factors of particular importance are: (1) the Laboratory's generation and treatment of *specialized* explosives waste; (2) safety; (3) the Laboratory's national security mission and its unique explosives expertise; and (4) byproducts (and protection of human health and the environment).

The Laboratory generates, in small volumes, explosives waste that is highly energetic and heterogenous, and that is potentially unstable and unpredictable (*i.e.*, *specialized* explosives waste). The specialized explosives waste presents unique treatment and safety considerations. The specialized explosives waste is capable of detonation (it is D003 waste characteristic for reactivity), but its exact morphology and properties are difficult to discern. It is *not susceptible to conventional assumptions* about the treatment of explosives waste. The Laboratory's thermal treatment Units are specifically designed to address the unique risks posed by, and to safely treat, the specialized explosives waste. Whether an alternative to the Laboratory's thermal treatment of specialized explosives waste is safe and available requires careful analysis of the unique treatment and safety considerations presented by specialized explosives waste.

Safety is of preeminent importance to the Laboratory. Safety considerations impact acutely not only the treatment of specialized explosives waste, but also its generation, handling, storage, and transportation. An alternative technology is not safe if it cannot address the unique risks posed by and safely treat specialized explosives waste. But an alternative technology is also not safe if it materially increases the handling or storage of the specialized explosives waste, or if off-site transport to the alternative technology is prohibited.

Safety determinations are made by explosives safety experts. The Laboratory is a Federally Funded Research and Development Center (FFRDC) and National Security Laboratory with national security missions and specialized expertise related to the research, development, testing, and evaluation of explosives. The Laboratory also conducts work supporting the United States nuclear weapons stockpile, which includes specialized expertise in explosives peculiar to nuclear weapons. The Laboratory's explosives expertise is specialized, unique, and relevant to this Alt Tech Evaluation.

The Laboratory thermally treats its specialized explosives waste in a manner protective of human health and the environment. With respect to byproducts, the Laboratory's Flash Pad thermal treatment Unit fits only incongruously into the definition of an open burn or open detonation unit.¹ Stereotypical OB/OD units "lack the controls needed for the efficient and complete combustion of wastes and the ability to control and measure the emissions of combustion products." EPA 2022(b); *see also* 40 C.F.R. § 260.10. All the Laboratory's thermal treatment Units, however, possess numerous controls, are designed and/or operated to efficiently and completely combust or consume the waste, and monitor for emissions. Various potential alternative technologies, in contrast, generate potentially toxic byproducts and secondary waste streams.

After addressing these site-specific factors, potential alternative technologies are identified, and an initial screening is conducted. The Alt Tech Evaluation is conducted on a waste stream-by-waste stream, technology-by-technology basis. Through initial screening, alternative technologies that may be potentially applicable treatment options are evaluated in greater detail. This more detailed analysis

¹ To facilitate compliance and to ensure its thermal treatment operations are protective of human health and the environment, the Laboratory has ~~presumed its made process improvements and engineered upgrades over the years to~~ thermal treatment operations ~~that~~ constitute OB and/or OD. The Laboratory's thermal treatment operations, ~~however, with the implementation of these improvements, can be considered are more appropriately identified as~~ an alternative technology to OB and/or OD. The Laboratory reserves its right to argue that its thermal treatment operations do not constitute OB and/or OD.

Table 5-1 Annual Amount of Explosives Waste Treated at the Flash Pad from 2013-2023 by Waste Stream, in pounds (lbs.) (with approximate % of yearly total noted)

	Explosives Machining Waste	Explosives-Contaminated Combustible Debris	Explosives Contaminated Noncombustible Debris		Excess Explosives ³	Explosives-Contaminated Solvents ⁴	Total (lbs.)	Total Explosives Only ⁵ (lbs.)
			Metal ¹	Sand ²				
2013	2,283 (99.5%)	11 (0.48%)	5 (0.02%)	0	0	0	2,299	NA ⁶
2014	935 (97%)	0	4 (0.04%)	0	21 (2.2%)	0	960	NA ⁶
2015	1,665 (90%)	0	0	195 (10%)	0	0	1,860	NA ⁶
2016	1,465 (88%)	71 (4%)	3 (0.2%)	130 (7.8%)	0	0	1,669	NA ⁶
2017	1,671 (96%)	30 (2%)	32 (2%)	0	0	0	1,733	NA ⁶
2018	1,538 (97%)	29 (2%)	21 (1%)	0	0	0	1,588	NA ⁶
2019	1,130 (88.6%)	10 (0.8%)	36 (2.8%)	100 (7.8%)	0	0	1,276	NA ⁶
2020	1,670 (41%)	10 (0.2%)	31 (0.8%)	2,400 (58%)	0	0	4,111	NA ⁶
2021	2,113 (67%)	810 (26%)	58 (2%)	170 (5%)	0	0	3,152	NA ⁶
2022	2,110 (53.5%)	1,306 (33.1%)	7 (0.2%)	520 (13.2%)	0	0	3,943	NA ⁶
2023	1,190 (55%)	24 (1%)	27 (1.25%)	920 (42.5%)	0	0	2,161	NA ⁶
2024	1,679 (59%)	534 (19%)	10 (0.4%)	600 (21%)	0	0	2,823	1,718
2025	1,462 (38%)	1,255 (28%)	10 (0.3%)	1,120 (29%)	0	0	3,847	2,606

¹ The weight listed is the weight (in lbs.) of the estimated explosives content that is suspected to contaminate the equipment not the total weight of the equipment or debris in the case of noncombustible metals. Only the explosive is being treated, therefore, it is what is counted and represents the number of times noncombustible debris was treated during the year.

² Sand is no longer reused and is sent offsite as waste; therefore, the total weight of sand and explosives is included in the quantity of waste treated, instead of only the estimated explosives content.

³ Generation rates of this waste stream are significantly decreased due to identification of alternative beneficial uses for excess explosives.

⁴ ~~This Explosive contaminated solvents waste stream~~ has largely been eliminated from being generated due to improvements in processes that must be treated as explosives waste and can be shipped offsite for disposal.

⁵ This is an estimate quantity by waste treatment event. Actual quantities cannot be obtained for some waste treatment events, therefore, a maximum of one pound of explosive content is utilized per treatment event.

⁶ NA = Not available

Addendum 5

**Ash and sand waste analytical data from
2021, 2022, and 2026**

2021 Ash Analytical Data

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 104828

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Toxicity Characteristics Metals							
Arsenic	As	Y	N	N	N/A	N/A	5 ppm
Barium	Ba	Y	N	Y	0 ppm	27.3 ppm	100 ppm
Cadmium	Cd	Y	N	Y	0 ppm	0.00682 ppm	1 ppm
Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
Lead	Pb	Y	N	Y	0 ppm	0.948 ppm	5 ppm
Mercury	Hg	Y	N	N	N/A	N/A	0.2 ppm
Selenium	Se	Y	N	Y	0 ppm	0.562 ppm	1 ppm
Silver	Ag	Y	N	N	N/A	N/A	5 ppm
Toxicity Characteristics Organics							
Benzene	71-43-2	N	Y	N/A	N/A	N/A	0.5 ppm
Carbon tetrachloride	56-23-5	N	Y	N/A	N/A	N/A	0.5 ppm
Chlorobenzene	108-90-7	N	Y	N/A	N/A	N/A	100 ppm
Chloroform	67-66-3	N	Y	N/A	N/A	N/A	6 ppm
o-Cresol	95-48-7	N	Y	N/A	N/A	N/A	200 ppm
m,p-cresol	65794-96-9	N	Y	N/A	N/A	N/A	200 ppm
1,4-Dichlorobenzene	106-46-7	N	Y	N/A	N/A	N/A	7.5 ppm
1,2-Dichloroethane	107-06-2	N	Y	N/A	N/A	N/A	0.5 ppm
1,1-Dichloroethylene	75-35-4	N	Y	N/A	N/A	N/A	0.7 ppm
2,4-Dinitrotoluene	121-14-2	N	Y	N/A	N/A	N/A	0.13 ppm
Hexachlorobenzene	118-74-1	N	Y	N/A	N/A	N/A	0.13 ppm
Hexachlorobutadiene	87-68-3	N	Y	N/A	N/A	N/A	0.5 ppm
Hexachloroethane	67-72-1	N	Y	N/A	N/A	N/A	3 ppm
Methyl ethyl ketone	78-93-3	N	Y	N/A	N/A	N/A	200 ppm
Nitrobenzene	98-95-3	N	Y	N/A	N/A	N/A	2 ppm
Pentachlorophenol	87-86-5	N	Y	N/A	N/A	N/A	100 ppm
Pyridine	110-86-1	N	Y	N/A	N/A	N/A	5 ppm
Tetrachloroethylene	127-18-4	N	Y	N/A	N/A	N/A	0.7 ppm
Trichloroethylene	79-01-6	N	Y	N/A	N/A	N/A	0.5 ppm
2,4,5-Trichlorophenol	95-95-4	N	Y	N/A	N/A	N/A	400 ppm

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 104828

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
2,4,6-Trichlorophenol	88-06-2	N	Y	N/A	N/A	N/A	2 ppm
Vinyl chloride	75-01-4	N	Y	N/A	N/A	N/A	0.2 ppm
Herbicides and Pesticides							
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm
Chlordane[alpha]	5103-71-9	N	Y	N/A	N/A	N/A	N/A
Chlordane[gamma]	5103-74-2	N	Y	N/A	N/A	N/A	N/A
2,4-D	94-75-7	N	Y	N/A	N/A	N/A	10 ppm
Endrin	72-20-8	N	Y	N/A	N/A	N/A	0.02 ppm
Heptachlor (& its epoxide)	76-44-8	N	Y	N/A	N/A	N/A	0.008 ppm
Lindane (gamma-BHC)	58-89-9	N	Y	N/A	N/A	N/A	0.4 ppm
Methoxychlor	72-43-5	N	Y	N/A	N/A	N/A	10 ppm
Toxaphene	8001-35-2	N	Y	N/A	N/A	N/A	0.5 ppm
2,4,5-TP (Silvex)	93-72-1	N	Y	N/A	N/A	N/A	0.5 ppm
Other							
Acidity or Alkalinity of a solution	pH	N	Y	N/A	N/A	N/A	N/A
Cyanide (Amenable)	CN(Amenable)	N	Y	N/A	N/A	N/A	N/A
Cyanide (Total)	CN(TOTAL)	N	Y	N/A	N/A	N/A	N/A
Cyanide, Reactive	CN(Reactive)	N	Y	N/A	N/A	N/A	N/A
Cyanide, weak acid dissociable	CN(WAD)	N	Y	N/A	N/A	N/A	N/A
Sulfide	S(-2)	N	Y	N/A	N/A	N/A	N/A
sulfide, Extractable	S(-2)Ext	N	Y	N/A	N/A	N/A	N/A
Sulfide, Reactive	S(-2)R	N	Y	N/A	N/A	N/A	N/A
Total Aroclors for sum of all aroclors	Tot Aroclor	N	Y	N/A	N/A	N/A	N/A

NOTE 1: The highest detected result is listed as maximum. If there are no detected results, the highest undetected result is chosen.

NOTE 2: The lowest detected result is listed as minimum. If there are no detected results, the lowest undetected result is chosen. If only one measurement exists, the minimum is listed as 0.

NOTE 3: Total Chlordane result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 4: Cresol-mixed result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 5: m-Cresol and p-Cresol results may have been calculated, see RCRA Characteristics Report for more information.

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 104828

Total
List

Report has colums hidden that were not pertinent to this report. Data has been sorted by validation Qualifier to show detects first.

WDS Record #	parameter_c ategory	analytical_method_cate gory	analytical_method	parameter_n ame	sampling_p lan_id	field_sample_id	detect _flag	report_result	report_ units	validation_ qualifier	validation_r eason_code s	analytical_group _name
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Barium	13493	WST16-21-218166	Y	2.7300E04	ug/L	NQ	NQ	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Lead	13493	WST16-21-218166	Y	948	ug/L	NQ	NQ	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Selenium	13493	WST16-21-218166	Y	562	ug/L	NQ	NQ	METALS_TCLP
104828	INORGANIC	GENERAL CHEMISTRY	EPA:170.0	Temperature	13493	WST16-21-218166	Y	2	deg C	NQ	NQ	
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Cadmium	13493	WST16-21-218166	Y	6.82	ug/L	J	J_LAB	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Arsenic	13493	WST16-21-218166	N	20	ug/L	U	U_LAB	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Chromium	13493	WST16-21-218166	N	30	ug/L	U	U_LAB	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:7470A_TCLP	Mercury	13493	WST16-21-218166	N	0.67	ug/L	U	U_LAB	METALS_TCLP
104828	INORGANIC	INORGANIC	SW-846:6020A_TCLP	Silver	13493	WST16-21-218166	N	3	ug/L	U	U_LAB	METALS_TCLP

Selected Samples Summary

There are 0 rejected results

RCRA

8	analytes pass
4	analytes pass as undetected
0	analytes fail

Detects

0	aroclor were detected
--	Total aroclor (ppm)
0	analytes with potential F-code
0	analytes with potential U-code
0	analytes with potential P-code

Non-wastewater LDR	0 pass	0 fail
Hazardous soil LDR	0 pass	0 fail
Residential Soil (mg/kg)	0 pass	0 fail
Industrial/Occupational Soil (mg/kg)	0 pass	0 fail
Construction Worker Soil (mg/kg)	0 pass	0 fail
Recreational Soil (mg/kg)	0 pass	0 fail
Soil background	0 pass	0 fail
Canyon Sediment background	0 pass	0 fail
Qbt 2,3,4 background	0 pass	0 fail
Qbt 1v background	0 pass	0 fail
Qbt1g, Qct, Qbo background	0 pass	0 fail

RAD

Total dose: mRem/year

--	Highest TRU per sample
0 out of 9	TRU isotopes analyzed
	Not analyzed for H3
	Not analyzed for Pu239
0	isotopes were analyzed
0	were detected
0	undetected

Residential SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Industrial SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Construction worker SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Recreational SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Soil	0 pass	0 fail	
Canyon sediment	0 pass	0 fail	
Qbt 2,3,4	0 pass	0 fail	
Qbt 1v	0 pass	0 fail	
Qbt 1g, Qct, Qbo	0 pass	0 fail	

Los Alamos National Laboratory Waste Data Summaries
Selected Samples Report
WDS # 104828

Selected Samples

Sample List	Associated Blanks
WST16-21-218166	

[illegible]

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 13493

EVENT NAME: RFA 264 - Gonzales - TA16-0411

SAMPLE ID: WST16-21-218166

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY)		2/2/21	FIELD MATRIX:	S	ok
TIME COLLECTED (HH:MM):		10:45	MEDIA:		
PRS ID:			SAMPLE TECH CODE:	DC	
LOCATION ID:	WST-RCRA		FIELD PREP:	NA	
LOCATION TYPE:	GENERIC		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	WST	
BOTTOM DEPTH:			EXCAVATED:		YES / ☒ NO / NA

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
15 <i>per</i>	TCIP <i>Tel Metals</i>	<i>1000</i> 125 ML POLY	1	ICE	Y	

SAMPLE COMMENTS:

Ash

LOCATION COMMENTS:

FIELD PARAMETERS:

Sample Time _____ HH:MM

FIELD SCREENING/MEASUREMENT RESULTS:

Alpha _____ dpm

Beta/Gamma _____ dpm

N/A

PID

Ambient

Reading

= _____ ppm

COLLECTED BY (PRINT):

Bryan Urigi / Fred Lopez

RELINQUISHED BY (Printed Name) (Signature)	Date/Time 2/2/21 11:00	RECEIVED BY (Printed Name) (Signature)	Date/Time 2/2/21 11:00
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Deciphering WDS Information

Tables 1 & 2 are the most common descriptors needed for reviewing data in the Waste Data Summaries (WDS) reports. When reviewing data refer to Validation Qualifier & Reason code, these have been reviewed and validated on site by the data administrator. If other qualifiers or reason codes are present call either Stas Marcazk or Susan Thomas for clarification if necessary.

Table 1

Validation Qualifier	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual
J+	detected but result is more uncertain than usual with a positive bias
J-	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual with a potential negative bias
U	The analyte is classified as not detected
UJ	The analyte is classified as not detected with an expectation that the reported result is more uncertain than usual
R	The reported sample result is classified as rejected due to serious noncompliance regarding quality control acceptance criteria. The presence or absence of the analyte cannot be verified based on routine validation alone.

Table 2

Validation Reason Code	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J_LAB	Accepted LAB results
U_LAB	Accepted LAB results
R5	Analyte is not detected because the amount reported is less than the MDC.
R33	Naturally Occurring Radionuclide

Additional Helpful Comments

If the Total List of All Data is needed and is included in the WDS it has hidden columns and has been sorted to show detects first. To review all data go to:
<https://www.locusfocus.com/eim/eim.cfm> and run the reports for WDS that you are reviewing.

pH shows ppm for units. The pH is unit-less value and when the report is updated/revised will show SU instead of ppm.

Reviewing the Toxicity Report

In the Arsenic example below TCLP (N) was not run but Total Metals(Y) was. The Y in detected column shows it was detected and then the results in ppm
In the Cadmium example TCLP (N) was not run but Total Metals (Y) was. The N in detected column shows it was not detected so N/A is both results columns.
In the Chlordane example neither TCLP (N) nor Total Metals (Y) was run. If N/A is in the detect column there are no results because the parameter was not checked for.

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Arsenic	As	N	Y	Y	0 ppm	0.00255 ppm	5 ppm
Cadmium	Cd	N	Y	N	N/A	N/A	1 ppm
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm

Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
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In the Chromium example above TCLP (Y) has been run and Total Metals was not (N). The N in detected column shows it was not detected so N/A is both results columns.
--

To review start with the Detected column and work left to verify TCPL or Total Metals, then review results. If only one sample was run in the WDS, the Min Result defaults to 0 ppm.

Note: When Total Metals (Solids)are sampled for, the results on the Toxicity Characteristics Report has already been divided by 20 and the Max and Min Results on the report is the information entered on the Waste Stream Profile.

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 105306

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Toxicity Characteristics Metals							
Arsenic	As	N	Y	N/A	N/A	N/A	5 ppm
Barium	Ba	N	Y	N/A	N/A	N/A	100 ppm
Cadmium	Cd	N	Y	N/A	N/A	N/A	1 ppm
Chromium	Cr	N	Y	N/A	N/A	N/A	5 ppm
Lead	Pb	N	Y	N/A	N/A	N/A	5 ppm
Mercury	Hg	N	Y	N/A	N/A	N/A	0.2 ppm
Selenium	Se	N	Y	N/A	N/A	N/A	1 ppm
Silver	Ag	N	Y	N/A	N/A	N/A	5 ppm
Toxicity Characteristics Organics							
Benzene	71-43-2	N	Y	N	N/A	N/A	0.5 ppm
Carbon tetrachloride	56-23-5	N	Y	N	N/A	N/A	0.5 ppm
Chlorobenzene	108-90-7	N	Y	N	N/A	N/A	100 ppm
Chloroform	67-66-3	N	Y	N	N/A	N/A	6 ppm
o-Cresol	95-48-7	N	Y	N	N/A	N/A	200 ppm
m,p-cresol	65794-96-9	N	Y	N	N/A	N/A	200 ppm
1,4-Dichlorobenzene	106-46-7	N	Y	N	N/A	N/A	7.5 ppm
1,2-Dichloroethane	107-06-2	N	Y	N	N/A	N/A	0.5 ppm
1,1-Dichloroethylene	75-35-4	N	Y	N	N/A	N/A	0.7 ppm
2,4-Dinitrotoluene	121-14-2	N	Y	N	N/A	N/A	0.13 ppm
Hexachlorobenzene	118-74-1	N	Y	N	N/A	N/A	0.13 ppm
Hexachlorobutadiene	87-68-3	N	Y	N	N/A	N/A	0.5 ppm
Hexachloroethane	67-72-1	N	Y	N	N/A	N/A	3 ppm
Methyl ethyl ketone	78-93-3	N	Y	Y	0 ppm	0.0001815 ppm	200 ppm
Nitrobenzene	98-95-3	N	Y	N	N/A	N/A	2 ppm
Pentachlorophenol	87-86-5	N	Y	N	N/A	N/A	100 ppm
Pyridine	110-86-1	N	Y	N	N/A	N/A	5 ppm
Tetrachloroethylene	127-18-4	N	Y	N	N/A	N/A	0.7 ppm
Trichloroethylene	79-01-6	N	Y	N	N/A	N/A	0.5 ppm
2,4,5-Trichlorophenol	95-95-4	N	Y	N	N/A	N/A	400 ppm
2,4,6-Trichlorophenol	88-06-2	N	Y	N	N/A	N/A	2 ppm

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Vinyl chloride	75-01-4	N	Y	N	N/A	N/A	0.2 ppm
Herbicides and Pesticides							
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm
Chlordane[alpha]	5103-71-9	N	Y	N/A	N/A	N/A	N/A
Chlordane[gamma]	5103-74-2	N	Y	N/A	N/A	N/A	N/A
2,4-D	94-75-7	N	Y	N/A	N/A	N/A	10 ppm
Endrin	72-20-8	N	Y	N/A	N/A	N/A	0.02 ppm
Heptachlor (& its epoxide)	76-44-8	N	Y	N/A	N/A	N/A	0.008 ppm
Lindane (gamma-BHC)	58-89-9	N	Y	N/A	N/A	N/A	0.4 ppm
Methoxychlor	72-43-5	N	Y	N/A	N/A	N/A	10 ppm
Toxaphene	8001-35-2	N	Y	N/A	N/A	N/A	0.5 ppm
2,4,5-TP (Silvex)	93-72-1	N	Y	N/A	N/A	N/A	0.5 ppm
Other							
Acidity or Alkalinity of a solution	pH	N	Y	N/A	N/A	N/A	N/A
Cyanide (Amenable)	CN(Amenable)	N	Y	N/A	N/A	N/A	N/A
Cyanide (Total)	CN(TOTAL)	N	Y	N/A	N/A	N/A	N/A
Cyanide, Reactive	CN(Reactive)	N	Y	N/A	N/A	N/A	N/A
Cyanide, weak acid dissociable	CN(WAD)	N	Y	N/A	N/A	N/A	N/A
Sulfide	S(-2)	N	Y	N/A	N/A	N/A	N/A
sulfide, Extractable	S(-2)Ext	N	Y	N/A	N/A	N/A	N/A
Sulfide, Reactive	S(-2)R	N	Y	N/A	N/A	N/A	N/A
Total Aroclors for sum of all aroclors	Tot Aroclor	N	Y	N/A	N/A	N/A	N/A

NOTE 1: The highest detected result is listed as maximum. If there are no detected results, the highest undetected result is chosen.

NOTE 2: The lowest detected result is listed as minimum. If there are no detected results, the lowest undetected result is chosen. If only one measurement exists, the minimum is listed as 0.

NOTE 3: Total Chlordane result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 4: Cresol-mixed result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 5: m-Cresol and p-Cresol results may have been calculated, see RCRA Characteristics Report for more information.

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 105306

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter category	analytical method category	analytical method	parameter name	sampling plan id	field sample id	detect flag	report result	report units	validation qualifier	validation reason codes	analytical group name
105306	ORGANIC	VOC	SW-846:8260D	Acetone	13283	207284	Y	0.05	mg/kg	NQ	NQ	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Bis(2-ethylhexyl)phthalate	13283	207284	Y	0.0151	mg/kg	J	J_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Butanone[2-]	13283	207284	Y	0.00363	mg/kg	J	J_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Di-n-butylphthalate	13283	207284	Y	0.0762	mg/kg	NQ	NQ	8270C
105306	ORGANIC	VOC	SW-846:8260D	Methylene Chloride	13283	207284	Y	0.01	mg/kg	NQ	NQ	8260B
105306	INORGANIC	GENERAL CHEMISTRY	EPA:170.0	Temperature	13283	WST16-20-207284	Y	6	deg C	NQ	NQ	
105306	ORGANIC	SVOC	SW-846:8270D	Acenaphthene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Acenaphthylene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Aniline	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Anthracene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Azobenzene	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Benzene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Benzo(a)anthracene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzo(a)pyrene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzo(b)fluoranthene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzo(g,h,i)perylene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzo(k)fluoranthene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzoic Acid	13283	207284	N	0.164	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Benzyl Alcohol	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Bis(2-chloroethoxy)methane	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Bis(2-chloroethyl)ether	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Bromobenzene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Bromochloromethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Bromodichloromethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Bromoform	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Bromomethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 105306

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter category	analytical method category	analytical method	parameter name	sampling plan id	field sample id	detect flag	report result	report units	validation qualifier	validation reason codes	analytical group name
105306	ORGANIC	VOC	SW-846:8260D	Butylbenzene[n-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Butylbenzene[sec-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Butylbenzene[tert-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Butylbenzylphthalate	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Carbon Disulfide	13283	207284	N	0.00167	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Carbon Tetrachloride	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Chloro-3-methylphenol[4-]	13283	207284	N	0.131	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Chloroaniline[4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Chlorobenzene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Chlorodibromomethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Chloroethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Chloroform	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Chloromethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Chloronaphthalene[2-]	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Chlorophenol[2-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Ether	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Chlorotoluene[2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Chlorotoluene[4-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Chrysene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dibenz(a,h)anthracene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dibenzofuran	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Dibromo-3-Chloropropane[1,2-]	13283	WST16-20-207284	N	0.000501	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dibromoethane[1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dibromomethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,3-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,4-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Dichlorobenzidine[3,3'-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 105306

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter category	analytical method category	analytical method	parameter name	sampling plan id	field sample id	detect flag	report result	report units	validation qualifier	validation reason codes	analytical group name
105306	ORGANIC	VOC	SW-846:8260D	Dichlorodifluoromethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloroethane[1,1-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloroethane[1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloroethene[1,1-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloroethene[cis-1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloroethene[trans-1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Dichlorophenol[2,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropane[1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropane[1,3-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropane[2,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropene[1,1-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropene[cis-1,3-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Dichloropropene[trans-1,3-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Diethylphthalate	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dimethyl Phthalate	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dimethylphenol[2,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dinitro-2-methylphenol[4,6-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dinitrophenol[2,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dinitrotoluene[2,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Dinitrotoluene[2,6-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Di-n-octylphthalate	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Diphenylamine	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Ethylbenzene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Fluoranthene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Fluorene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Hexachlorobenzene	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Hexachlorobutadiene	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Hexachlorocyclopentadiene	13283	207284	N	0.0985	mg/kg	UJ	SV12e	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Hexachloroethane	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 105306

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter category	analytical method category	analytical method	parameter name	sampling plan id	field sample id	detect flag	report result	report units	validation qualifier	validation reason codes	analytical group name
105306	ORGANIC	VOC	SW-846:8260D	Hexanone[2-]	13283	207284	N	0.00167	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Indeno(1,2,3-cd)pyrene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Iodomethane	13283	207284	N	0.00167	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Isophorone	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Isopropylbenzene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Isopropyltoluene[4-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Methyl-2-pentanone[4-]	13283	207284	N	0.00167	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Methylnaphthalene[2-]	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Methylphenol[2-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Methylphenol[3-,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Naphthalene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitroaniline[2-]	13283	207284	N	0.108	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitroaniline[3-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitroaniline[4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitrobenzene	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitrophenol[2-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitrophenol[4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitrosodimethylamine[N-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Nitroso-di-n-propylamine[N-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Oxybis(1-chloropropane)[2,2'-]	13283	WST16-20-207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Pentachlorophenol	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Phenanthrene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Phenol	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Propylbenzene[1-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Pyrene	13283	207284	N	0.00985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Pyridine	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Styrene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Tetrachloroethane[1,1,1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 105306

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter category	analytical method category	analytical method	parameter name	sampling plan id	field sample id	detect flag	report result	report units	validation qualifier	validation reason codes	analytical group name
105306	ORGANIC	VOC	SW-846:8260D	Tetrachloroethane[1,1,2,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Tetrachloroethene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Toluene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	trifluoroethane[1,1,2-]	13283	207284	N	0.00167	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Trichlorobenzene[1,2,4-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Trichloroethane[1,1,1-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Trichloroethane[1,1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Trichloroethene	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Trichlorofluoromethane	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	SVOC	SW-846:8270D	Trichlorophenol[2,4,5-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	SVOC	SW-846:8270D	Trichlorophenol[2,4,6-]	13283	207284	N	0.0985	mg/kg	U	U_LAB	8270C
105306	ORGANIC	VOC	SW-846:8260D	Trichloropropane[1,2,3-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Trimethylbenzene[1,2,4-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Trimethylbenzene[1,3,5-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Vinyl Chloride	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Xylene[1,2-]	13283	207284	N	0.000334	mg/kg	U	U_LAB	8260B
105306	ORGANIC	VOC	SW-846:8260D	Xylene[1,3-]+Xylene[1,4-]	13283	207284	N	0.000668	mg/kg	U	U_LAB	8260B

Selected Samples Summary

There are 3 rejected results

RCRA

22	analytes pass
21	analytes pass as undetected
0	analytes fail

Detects

0	aroclor were detected
--	Total aroclor (ppm)
2	analytes with potential F-code
4	analytes with potential U-code
0	analytes with potential P-code

Non-wastewater LDR	5 pass	0 fail
Hazardous soil LDR	5 pass	0 fail
Residential Soil (mg/kg)	5 pass	0 fail
Industrial/Occupational Soil (mg/kg)	5 pass	0 fail
Construction Worker Soil (mg/kg)	5 pass	0 fail
Recreational Soil (mg/kg)	5 pass	0 fail
Soil background	0 pass	0 fail
Canyon Sediment background	0 pass	0 fail
Qbt 2,3,4 background	0 pass	0 fail
Qbt 1v background	0 pass	0 fail
Qbt1g, Qct, Qbo background	0 pass	0 fail

RAD

Total dose: mRem/year

--	Highest TRU per sample
0 out of 9	TRU isotopes analyzed
	Not analyzed for H3
	Not analyzed for Pu239
0	isotopes were analyzed
0	were detected
0	undetected

Residential SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Industrial SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Construction worker SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Recreational SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Soil	0 pass	0 fail	
Canyon sediment	0 pass	0 fail	
Qbt 2,3,4	0 pass	0 fail	
Qbt 1v	0 pass	0 fail	
Qbt 1g, Qct, Qbo	0 pass	0 fail	

Los Alamos National Laboratory Waste Data Summaries
Selected Samples Report
WDS # 105306

Selected Samples

Sample List	Associated Blanks	Associated Duplicates
WST16-20-207284		

[illegible]

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 13283

EVENT NAME: RFA 200 - Gonzales - TA-16

SAMPLE ID: WST16-20-207284

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY)	OK	07/08/2021	FIELD MATRIX:	S	OK
TIME COLLECTED (HH:MM):		10:10	MEDIA:		
PRS ID:		OK	SAMPLE TECH CODE:	M	
LOCATION ID:	WST-RCRA		FIELD PREP:	NA	
LOCATION TYPE:	GENERIC		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	WST	
BOTTOM DEPTH:			EXCAVATED:		YES (NO) / NA

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
	8260B	125 ML SEPTUM AMBER GLASS	1	ICE	y	
	8270C	250 ML AMBER GLASS	1	ICE	y	

SAMPLE COMMENTS:

Burn grounds (3) 55 gal poly drum

LOCATION COMMENTS:

FIELD PARAMETERS:

Sample Time _____ HH:MM

FIELD SCREENING/MEASUREMENT RESULTS:

N/A

Alpha _____ dpm

Ambient

Beta/Gamma _____ dpm

PID

= _____ ppm

Reading

COLLECTED BY (PRINT):

Terrence Garcia (Bryan Vig.)

RELINQUISHED BY (Printed Name) Terrence Garcia (Signature)	Date/Time 7/8/21 11:13	RECEIVED BY (Printed Name) Bryan Vig. (Signature)	Date/Time 7/8/21 11:13
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Deciphering WDS Information

Tables 1 & 2 are the most common descriptors needed for reviewing data in the Waste Data Summaries (WDS) reports. When reviewing data refer to Validation Qualifier & Reason code, these have been reviewed and validated on site by the data administrator. If other qualifiers or reason codes are present call either Stas Marcazk or Susan Thomas for clarification if necessary.

Table 1

Validation Qualifier	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual
J+	detected but result is more uncertain than usual with a positive bias
J-	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual with a potential negative bias
U	The analyte is classified as not detected
UJ	The analyte is classified as not detected with an expectation that the reported result is more uncertain than usual
R	The reported sample result is classified as rejected due to serious noncompliance regarding quality control acceptance criteria. The presence or absence of the analyte cannot be verified based on routine validation alone.

Table 2

Validation Reason Code	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J_LAB	Accepted LAB results
U_LAB	Accepted LAB results
R5	Analyte is not detected because the amount reported is less than the MDC.
R33	Naturally Occurring Radionuclide

Additional Helpful Comments

If the Total List of All Data is needed and is included in the WDS it has hidden columns and has been sorted to show detects first. To review all data go to:
<https://www.locusfocus.com/eim/eim.cfm> and run the reports for WDS that you are reviewing.

pH shows ppm for units. The pH is unit-less value and when the report is updated/revised will show SU instead of ppm.

Reviewing the Toxicity Report

In the Arsenic example below TCLP (N) was not run but Total Metals(Y) was. The Y in detected column shows it was detected and then the results in ppm
In the Cadmium example TCLP (N) was not run but Total Metals (Y) was. The N in detected column shows it was not detected so N/A is both results columns.
In the Chlordane example neither TCLP (N) nor Total Metals (Y) was run. If N/A is in the detect column there are no results because the parameter was not checked for.

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Arsenic	As	N	Y	Y	0 ppm	0.00255 ppm	5 ppm
Cadmium	Cd	N	Y	N	N/A	N/A	1 ppm
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm

Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
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In the Chromium example above TCLP (Y) has been run and Total Metals was not (N). The N in detected column shows it was not detected so N/A is both results columns.
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To review start with the Detected column and work left to verify TCPL or Total Metals, then review results. If only one sample was run in the WDS, the Min Result defaults to 0 ppm.

Note: When Total Metals (Solids)are sampled for, the results on the Toxicity Characteristics Report has already been divided by 20 and the Max and Min Results on the report is the information entered on the Waste Stream Profile.

2022 TA-16 Flash Pad Ash Analytical Data

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 106762

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Toxicity Characteristics Metals							
Arsenic	As	Y	N	Y	0 ppm	0.026 ppm	5 ppm
Barium	Ba	Y	N	Y	0 ppm	10.9 ppm	100 ppm
Cadmium	Cd	Y	N	Y	0 ppm	0.00309 ppm	1 ppm
Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
Lead	Pb	Y	N	Y	0 ppm	0.0136 ppm	5 ppm
Mercury	Hg	Y	N	N	N/A	N/A	0.2 ppm
Selenium	Se	Y	N	N	N/A	N/A	1 ppm
Silver	Ag	Y	N	N	N/A	N/A	5 ppm
Toxicity Characteristics Organics							
Benzene	71-43-2	N	Y	N/A	N/A	N/A	0.5 ppm
Carbon tetrachloride	56-23-5	N	Y	N/A	N/A	N/A	0.5 ppm
Chlorobenzene	108-90-7	N	Y	N/A	N/A	N/A	100 ppm
Chloroform	67-66-3	N	Y	N/A	N/A	N/A	6 ppm
o-Cresol	95-48-7	N	Y	N/A	N/A	N/A	200 ppm
m,p-cresol	65794-96-9	N	Y	N/A	N/A	N/A	200 ppm
1,4-Dichlorobenzene	106-46-7	N	Y	N/A	N/A	N/A	7.5 ppm
1,2-Dichloroethane	107-06-2	N	Y	N/A	N/A	N/A	0.5 ppm
1,1-Dichloroethylene	75-35-4	N	Y	N/A	N/A	N/A	0.7 ppm
2,4-Dinitrotoluene	121-14-2	N	Y	N	N/A	N/A	0.13 ppm
Hexachlorobenzene	118-74-1	N	Y	N/A	N/A	N/A	0.13 ppm
Hexachlorobutadiene	87-68-3	N	Y	N/A	N/A	N/A	0.5 ppm
Hexachloroethane	67-72-1	N	Y	N/A	N/A	N/A	3 ppm
Methyl ethyl ketone	78-93-3	N	Y	N/A	N/A	N/A	200 ppm
Nitrobenzene	98-95-3	N	Y	N	N/A	N/A	2 ppm
Pentachlorophenol	87-86-5	N	Y	N/A	N/A	N/A	100 ppm
Pyridine	110-86-1	N	Y	N/A	N/A	N/A	5 ppm
Tetrachloroethylene	127-18-4	N	Y	N/A	N/A	N/A	0.7 ppm
Trichloroethylene	79-01-6	N	Y	N/A	N/A	N/A	0.5 ppm

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
2,4,5-Trichlorophenol	95-95-4	N	Y	N/A	N/A	N/A	400 ppm
2,4,6-Trichlorophenol	88-06-2	N	Y	N/A	N/A	N/A	2 ppm
Vinyl chloride	75-01-4	N	Y	N/A	N/A	N/A	0.2 ppm
Herbicides and Pesticides							
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm
Chlordane[alpha]	5103-71-9	N	Y	N/A	N/A	N/A	N/A
Chlordane[gamma]	5103-74-2	N	Y	N/A	N/A	N/A	N/A
2,4-D	94-75-7	N	Y	N/A	N/A	N/A	10 ppm
Endrin	72-20-8	N	Y	N/A	N/A	N/A	0.02 ppm
Heptachlor (& its epoxide)	76-44-8	N	Y	N/A	N/A	N/A	0.008 ppm
Lindane (gamma-BHC)	58-89-9	N	Y	N/A	N/A	N/A	0.4 ppm
Methoxychlor	72-43-5	N	Y	N/A	N/A	N/A	10 ppm
Toxaphene	8001-35-2	N	Y	N/A	N/A	N/A	0.5 ppm
2,4,5-TP (Silvex)	93-72-1	N	Y	N/A	N/A	N/A	0.5 ppm
Other							
Acidity or Alkalinity of a solution	pH	N	Y	N/A	N/A	N/A	N/A
Cyanide (Amenable)	CN(Amenable)	N	Y	N/A	N/A	N/A	N/A
Cyanide (Total)	CN(TOTAL)	N	Y	N/A	N/A	N/A	N/A
Cyanide, Reactive	CN(Reactive)	N	Y	N/A	N/A	N/A	N/A
Cyanide, weak acid dissociable	CN(WAD)	N	Y	N/A	N/A	N/A	N/A
Sulfide	S(-2)	N	Y	N/A	N/A	N/A	N/A
sulfide, Extractable	S(-2)Ext	N	Y	N/A	N/A	N/A	N/A
Sulfide, Reactive	S(-2)R	N	Y	N/A	N/A	N/A	N/A
Total Aroclors for sum of all aroclors	Tot Aroclor	N	Y	N/A	N/A	N/A	N/A

NOTE 1: The highest detected result is listed as maximum. If there are no detected results, the highest undetected result is chosen.

NOTE 2: The lowest detected result is listed as minimum. If there are no detected results, the lowest undetected result is chosen. If only one measurement exists, the minimum is listed as 0.

NOTE 3: Total Chlordane result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 4: Cresol-mixed result may have been calculated, see RCRA Characteristics Report for more information.

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
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NOTE 5: m-Cresol and p-Cresol results may have been calculated, see RCRA Characteristics Report for more information.

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 106762

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by **Detect Flag** to show detects first.

WDS Record #	parameter_ category	analytical_method_ category	analytical_method	parameter_name	sampling_ plan_id	field_sample_id	detect_ flag	report_ result	report_ units	valida tion_q ualifie	validation_ reason_co des	analytical_group_ name
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Arsenic	14755	WST15-22-259910	Y	26.0	ug/L	J	J_LAB	METALS_TCLP
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Barium	14755	WST15-22-259910	Y	10900	ug/L	NQ	NQ	METALS_TCLP
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Cadmium	14755	WST15-22-259910	Y	3.09	ug/L	J	J_LAB	METALS_TCLP
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	HMX	14755	WST15-22-259910	Y	75.2	mg/kg	NQ	NQ	NMED Explosives List
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Lead	14755	WST15-22-259910	Y	13.6	ug/L	J	J_LAB	METALS_TCLP
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	RDX	14755	WST15-22-259910	Y	2.63	mg/kg	J+	HE12f	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	TATB	14755	WST15-22-259910	Y	5.64	mg/kg	J-	HE12e	NMED Explosives List
106762	INORGANIC	GENERAL CHEMISTRY	EPA:170.0	Temperature	14755	WST15-22-259910	Y	6	deg C	NQ	NQ	
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	2,4-Diamino-6- nitrotoluene	14755	WST15-22-259910	N	0.493	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	2,6-Diamino-4- nitrotoluene	14755	WST15-22-259910	N	0.65	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	3,5-Dinitroaniline	14755	WST15-22-259910	N	0.296	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Amino-2,6- dinitrotoluene[4-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Amino-4,6- dinitrotoluene[2-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Chromium	14755	WST15-22-259910	N	30.0	ug/L	U	U_LAB	METALS_TCLP
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrobenzene[1,3-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrotoluene[2,4-]	14755	WST15-22-259910	N	0.148	mg/kg	U	U_LAB	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrotoluene[2,6-]	14755	WST15-22-259910	N	0.148	mg/kg	U	U_LAB	NMED Explosives List

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 106762

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by **Detect Flag** to show detects first.

WDS Record #	parameter_ category	analytical_method_ category	analytical_method	parameter_name	sampling_ plan_id	field_sample_id	detect_ flag	report_ result	report_ units	valida tion_q ualifie	validation_ reason_co des	analytical_group_ name
106762	INORGANIC	INORGANIC	SW-846:7470A_TCLP	Mercury	14755	WST15-22-259910	N	0.670	ug/L	U	U_LAB	METALS_TCLP
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrobenzene	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[2-]	14755	WST15-22-259910	N	0.148	mg/kg	U	U_LAB	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[3-]	14755	WST15-22-259910	N	0.148	mg/kg	U	U_LAB	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[4-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	PETN	14755	WST15-22-259910	N	0.246	mg/kg	U	U_LAB	NMED Explosives List
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Selenium	14755	WST15-22-259910	N	15.0	ug/L	U	U_LAB	METALS_TCLP
106762	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Silver	14755	WST15-22-259910	N	3.00	ug/L	UJ	I6a	METALS_TCLP
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Tetryl	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Trinitrobenzene[1,3,5-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Trinitrotoluene[2,4,6-]	14755	WST15-22-259910	N	0.148	mg/kg	UJ	HE12e	NMED Explosives List
106762	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Tris (o-cresyl) phosphate	14755	WST15-22-259910	N	0.296	mg/kg	UJ	HE12e	NMED Explosives List

Selected Samples Summary

There are 0 rejected results

RCRA

10	analytes pass
6	analytes pass as undetected
0	analytes fail

Detects

0	aroclor were detected
--	Total aroclor (ppm)
0	analytes with potential F-code
0	analytes with potential U-code
0	analytes with potential P-code

Non-wastewater LDR	0 pass	0 fail
Hazardous soil LDR	0 pass	0 fail
Residential Soil (mg/kg)	3 pass	0 fail
Industrial/Occupational Soil (mg/kg)	3 pass	0 fail
Construction Worker Soil (mg/kg)	3 pass	0 fail
Recreational Soil (mg/kg)	2 pass	0 fail
Soil background	0 pass	0 fail
Canyon Sediment background	0 pass	0 fail
Qbt 2,3,4 background	0 pass	0 fail
Qbt 1v background	0 pass	0 fail
Qbt1g, Qct, Qbo background	0 pass	0 fail

RAD

Total dose: mRem/year

--	Highest TRU per sample
0 out of 9	TRU isotopes analyzed
	Not analyzed for H3
	Not analyzed for Pu239
0	isotopes were analyzed
0	were detected
0	undetected

Residential SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Industrial SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Construction worker SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Recreational SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
Soil	0 pass	0 fail	
Canyon sediment	0 pass	0 fail	
Qbt 2,3,4	0 pass	0 fail	
Qbt 1v	0 pass	0 fail	
Qbt 1g, Qct, Qbo	0 pass	0 fail	

Los Alamos National Laboratory Waste Data Summaries
Selected Samples Report
WDS # 106762

Selected Samples

Sample List	Associated Blanks	Associated Duplicates
WST15-22-259910		

**Material Potentially Presenting an
Explosive Hazard (MPPEH) Chain-of-Custody****Part 1:**

Generator's Name ANGELA ECHAVE (175513)	Contact Number 7. 6695	Original Location TH 16 BG
Certification: ☒ Material Documented as Safe (MDAS) ☐ Material Documented as an Explosive Hazard (MDEH)		
Certification Method VISUAL & SPOT TEST		
Quantity	Description (include property #s, model #s, serial #s, condition, markings, etc.) RFA 970 Ash + 972 Carbon	

Part 2:

Date	Location	Purpose for Change in Custody*	
Released by (print name)		Signature	Date
Received by (print name)		Signature	Date

* Purpose for change in custody may be one of the following:

- Release as MDAS
- Transfer as MDEH
- Decontamination
- Treatment
- Offsite Shipment

Signing this form indicates that the releaser/receiver have/will ensure that MPPEH, MDEH, and MDAS are separated or clearly identifiable at all stages of processing until the material is released or discarded.

Certifier (print name) ANGELA ECHAVE	Signature 	Date 10/3/22
Verifier (print name)	Signature	Date
Additional Comments:		

[illegible]

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 14755

EVENT NAME: RFA 970 - Paul Gonzales - TA-15-1508-0016

SAMPLE ID: WST15-22-259910

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):		10/3/22	FIELD MATRIX:	S	6 ft
TIME COLLECTED (HH:MM):		10:15	MEDIA:		
SWMU/AOC:			SAMPLE TECH CODE:	M	
LOCATION ID:	WST-RCRA		FIELD PREP:	NA	
LOCATION TYPE:	GENERIC		FIELD QC TYPE:	REG	
TOP DEPTH:	1 ft		SAMPLE USAGE:	WST	
BOTTOM DEPTH:	1 ft		EXCAVATED:		YES / ~~NO~~ / NA

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
15 Days ↓	METALS_TCL P	500 ML POLY	1	NONE	Y ↓	
	NMED Explosives list	250 ML AMBER GLASS	1	ICE	Y ↓	

SAMPLE COMMENTS:

Ash

LOCATION COMMENTS:

FIELD PARAMETERS:

Sample Time _____ HH:MM

NA

COLLECTED BY (PRINT):

Bryan Vazquez / Fred Lopez / P. Smith

RELINQUISHED BY (Printed Name) (Signature)	Date/Time 10/3/22 12:00	RECEIVED BY (Printed Name) (Signature)	Date/Time 10/3/22 12:00
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Deciphering WDS Information

Tables 1 & 2 are the most common descriptors needed for reviewing data in the Waste Data Summaries (WDS) reports. When reviewing data refer to Validation Qualifier & Reason code, these have been reviewed and validated on site by the data administrator. If other qualifiers or reason codes are present call either Stas Marcazk or Susan Thomas for clarification if necessary.

Table 1

Validation Qualifier	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual
J+	detected but result is more uncertain than usual with a positive bias
J-	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual with a potential negative bias
U	The analyte is classified as not detected
UJ	The analyte is classified as not detected with an expectation that the reported result is more uncertain than usual
R	The reported sample result is classified as rejected due to serious noncompliance regarding quality control acceptance criteria. The presence or absence of the analyte cannot be verified based on routine validation alone.

Table 2

Validation Reason Code	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J_LAB	Accepted LAB results
U_LAB	Accepted LAB results
R5	Analyte is not detected because the amount reported is less than the MDC.
R33	Naturally Occurring Radionuclide

Additional Helpful Comments

The Total List of All Data Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.. To review all data go to: <https://www.locusfocus.com/eim/eim.cfm> and run the reports for WDS that you are reviewing.

pH shows ppm for units. The pH is unit-less value and when the report is updated/revised will show SU instead of ppm.

Reviewing the Toxicity Report

In the Arsenic example below TCLP (N) was not run but Total Metals(Y) was. The Y in detected column shows it was detected and then the results in ppm
In the Cadmium example TCLP (N) was not run but Total Metals (Y) was. The N in detected column shows it was not detected so N/A is both results columns.
In the Chlordane example neither TCLP (N) nor Total Metals (Y) was run. If N/A is in the detect column there are no results because the parameter was not checked for.

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Arsenic	As	N	Y	Y	0 ppm	0.00255 ppm	5 ppm
Cadmium	Cd	N	Y	N	N/A	N/A	1 ppm
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm

Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
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In the Chromium example above TCLP (Y) has been run and Total Metals was not (N). The N in detected column shows it was not detected so N/A is both results columns.
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To review start with the Detected column and work left to verify TCPL or Total Metals, then review results. If only one sample was run in the WDS, the Min Result defaults to 0 ppm.

Note: When solids are sampled for any RCRA component, the results on the Toxicity Characteristics Report has already been divided by 20 and the Max and Min Results on the report is the information entered on the Waste Stream Profile.

2026 Ash Analytical Data

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 112590 (Draft)

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Toxicity Characteristics Metals							
Arsenic	As	Y	N	N	N/A	N/A	5 ppm
Barium	Ba	Y	N	Y	0 ppm	1.27 ppm	100 ppm
Cadmium	Cd	Y	N	N	N/A	N/A	1 ppm
Chromium	Cr	Y	N	Y	0 ppm	0.0583 ppm	5 ppm
Lead	Pb	Y	N	Y	0 ppm	0.0872 ppm	5 ppm
Mercury	Hg	Y	N	N	N/A	N/A	0.2 ppm
Selenium	Se	Y	N	N	N/A	N/A	1 ppm
Silver	Ag	Y	N	N	N/A	N/A	5 ppm
Toxicity Characteristics Organics							
Benzene	71-43-2	N	Y	N	N/A	N/A	0.5 ppm
Carbon tetrachloride	56-23-5	N	Y	N	N/A	N/A	0.5 ppm
Chlorobenzene	108-90-7	N	Y	N	N/A	N/A	100 ppm
Chloroform	67-66-3	N	Y	N	N/A	N/A	6 ppm
o-Cresol	95-48-7	N	Y	N/A	N/A	N/A	200 ppm
m,p-cresol	65794-96-9	N	Y	N/A	N/A	N/A	200 ppm
1,4-Dichlorobenzene	106-46-7	N	Y	N	N/A	N/A	7.5 ppm
1,2-Dichloroethane	107-06-2	N	Y	N	N/A	N/A	0.5 ppm
1,1-Dichloroethylene	75-35-4	N	Y	N	N/A	N/A	0.7 ppm
2,4-Dinitrotoluene	121-14-2	N	Y	N	N/A	N/A	0.13 ppm
Hexachlorobenzene	118-74-1	N	Y	N/A	N/A	N/A	0.13 ppm
Hexachlorobutadiene	87-68-3	N	Y	N/A	N/A	N/A	0.5 ppm
Hexachloroethane	67-72-1	N	Y	N/A	N/A	N/A	3 ppm
Methyl ethyl ketone	78-93-3	N	Y	N	N/A	N/A	200 ppm
Nitrobenzene	98-95-3	N	Y	N	N/A	N/A	2 ppm
Pentachlorophenol	87-86-5	N	Y	N/A	N/A	N/A	100 ppm
Pyridine	110-86-1	N	Y	N/A	N/A	N/A	5 ppm
Tetrachloroethylene	127-18-4	N	Y	N	N/A	N/A	0.7 ppm
Trichloroethylene	79-01-6	N	Y	N	N/A	N/A	0.5 ppm
2,4,5-Trichlorophenol	95-95-4	N	Y	N/A	N/A	N/A	400 ppm
2,4,6-Trichlorophenol	88-06-2	N	Y	N/A	N/A	N/A	2 ppm

Los Alamos National Laboratory Waste Data Summaries
WPF Toxicity Characteristics Report
WDS # 112590 (Draft)

WPF Toxicity Characteristics

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Vinyl chloride	75-01-4	N	Y	N	N/A	N/A	0.2 ppm
Herbicides and Pesticides							
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm
Chlordane[alpha]	5103-71-9	N	Y	N/A	N/A	N/A	N/A
Chlordane[gamma]	5103-74-2	N	Y	N/A	N/A	N/A	N/A
2,4-D	94-75-7	N	Y	N/A	N/A	N/A	10 ppm
Endrin	72-20-8	N	Y	N/A	N/A	N/A	0.02 ppm
Heptachlor (& its epoxide)	76-44-8	N	Y	N/A	N/A	N/A	0.008 ppm
Lindane (gamma-BHC)	58-89-9	N	Y	N/A	N/A	N/A	0.4 ppm
Methoxychlor	72-43-5	N	Y	N/A	N/A	N/A	10 ppm
Toxaphene	8001-35-2	N	Y	N/A	N/A	N/A	0.5 ppm
2,4,5-TP (Silvex)	93-72-1	N	Y	N/A	N/A	N/A	0.5 ppm
Other							
Acidity or Alkalinity of a solution	pH	N	Y	N/A	N/A	N/A	N/A
Cyanide (Amenable)	CN(Amenable)	N	Y	N/A	N/A	N/A	N/A
Cyanide (Total)	CN(TOTAL)	N	Y	N/A	N/A	N/A	N/A
Cyanide, Reactive	CN(Reactive)	N	Y	N/A	N/A	N/A	N/A
Cyanide, weak acid dissociable	CN(WAD)	N	Y	N/A	N/A	N/A	N/A
Sulfide	S(-2)	N	Y	N/A	N/A	N/A	N/A
sulfide, Extractable	S(-2)Ext	N	Y	N/A	N/A	N/A	N/A
Sulfide, Reactive	S(-2)R	N	Y	N/A	N/A	N/A	N/A
Total Aroclors for sum of all aroclors	Tot Aroclor	N	Y	N/A	N/A	N/A	N/A

NOTE 1: The highest detected result is listed as maximum. If there are no detected results, the highest undetected result is chosen.

NOTE 2: The lowest detected result is listed as minimum. If there are no detected results, the lowest undetected result is chosen. If only one measurement exists, the minimum is listed as 0.

NOTE 3: Total Chlordane result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 4: Cresol-mixed result may have been calculated, see RCRA Characteristics Report for more information.

NOTE 5: m-Cresol and p-Cresol results may have been calculated, see RCRA Characteristics Report for more information.

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 112590 (Draft)

Total List of All Data

Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.

WDS Record #	parameter_c ategory	analytical_method_ category	analytical_method	parameter_name	samplin g_plan_i d	field_sample_id	detect _flag	report_res ult	report_u nits	validati on_qual ifier	validation_ reason_co des	analytical_group_n ame
112590	ORGANIC	VOC	SW-846:8260D	Acetone	17885	WST16-26-402336	Y	1.59	mg/kg	NQ	NQ	8260B
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Barium	17885	WST16-26-402336	Y	1270	ug/L	NQ	NQ	METALS_TCLP
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Chromium	17885	WST16-26-402336	Y	58.3	ug/L	J	J_LAB	METALS_TCLP
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	HMX	17885	WST16-26-402336	Y	2.76	mg/kg	NQ	NQ	NMED Explosives list
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Lead	17885	WST16-26-402336	Y	87.2	ug/L	NQ	NQ	METALS_TCLP
112590	INORGANIC	GENERAL CHEMISTRY	EPA:170.0	Temperature	17885	WST16-26-402336	Y	2	deg C	NQ	NQ	
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	2,4-Diamino-6-nitrotoluene	17885	WST16-26-402336	N	0.962	mg/kg	UJ	HE12e	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	2,6-Diamino-4-nitrotoluene	17885	WST16-26-402336	N	1.27	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	3,5-Dinitroaniline	17885	WST16-26-402336	N	0.577	mg/kg	UJ	HE12e	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Amino-2,6-dinitrotoluene[4-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Amino-4,6-dinitrotoluene[2-]	17885	WST16-26-402336	N	0.288	mg/kg	UJ	HE12e	NMED Explosives list
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Arsenic	17885	WST16-26-402336	N	20.0	ug/L	U	U_LAB	METALS_TCLP
112590	ORGANIC	VOC	SW-846:8260D	Benzene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Bromobenzene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Bromochloromethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Bromodichloromethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Bromoform	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Bromomethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Butanone[2-]	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Butylbenzene[n-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Butylbenzene[sec-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Butylbenzene[tert-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Cadmium	17885	WST16-26-402336	N	3.00	ug/L	U	U_LAB	METALS_TCLP
112590	ORGANIC	VOC	SW-846:8260D	Carbon Disulfide	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Carbon Tetrachloride	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B

Los Alamos National Laboratory Waste Data Summaries
Total List of All Data Report
WDS # 112590 (Draft)

Total List of All Data

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WDS Record #	parameter_c ategory	analytical_method_ category	analytical_method	parameter_name	samplin g_plan_i d	field_sample_id	detect _flag	report_res ult	report_u nits	validati on_qual ifier	validation_ reason_co des	analytical_group_n ame
112590	ORGANIC	VOC	SW-846:8260D	Chlorobenzene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chlorodibromomethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chloroethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chloroform	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chloromethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chlorotoluene[2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Chlorotoluene[4-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dibromo-3-Chloropropane[1,2-]	17885	WST16-26-402336	N	0.121	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dibromoethane[1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dibromomethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,3-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichlorobenzene[1,4-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichlorodifluoromethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloroethane[1,1-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloroethane[1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloroethene[1,1-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloroethene[cis-1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloroethene[trans-1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropane[1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropane[1,3-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropane[2,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropene[1,1-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropene[cis-1,3-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Dichloropropene[trans-1,3-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrobenzene[1,3-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrotoluene[2,4-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Dinitrotoluene[2,6-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list

Total List of All Data

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WDS Record #	parameter_c ategory	analytical_method_ category	analytical_method	parameter_name	samplin g_plan_i d	field_sample_id	detect _flag	report_res ult	report_u nits	validati on_qual ifier	validation_ reason_co des	analytical_group_n ame
112590	ORGANIC	VOC	SW-846:8260D	Ethylbenzene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Hexanone[2-]	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Iodomethane	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Isopropylbenzene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Isopropyltoluene[4-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	INORGANIC	INORGANIC	SW-846:7470A_TCLP	Mercury	17885	WST16-26-402336	N	0.670	ug/L	U	U_LAB	METALS_TCLP
112590	ORGANIC	VOC	SW-846:8260D	Methyl-2-pentanone[4-]	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Methylene Chloride	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrobenzene	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[2-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[3-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Nitrotoluene[4-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	PETN	17885	WST16-26-402336	N	0.481	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	VOC	SW-846:8260D	Propylbenzene[1-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	RDX	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Selenium	17885	WST16-26-402336	N	15.0	ug/L	U	U_LAB	METALS_TCLP
112590	INORGANIC	INORGANIC	SW-846:6020B_TCLP	Silver	17885	WST16-26-402336	N	3.00	ug/L	UJ	I6a	METALS_TCLP
112590	ORGANIC	VOC	SW-846:8260D	Styrene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	TATB	17885	WST16-26-402336	N	0.577	mg/kg	UJ	HE12e	NMED Explosives list
112590	ORGANIC	VOC	SW-846:8260D	Tetrachloroethane[1,1,1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Tetrachloroethane[1,1,2,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Tetrachloroethene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Tetryl	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	VOC	SW-846:8260D	Toluene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B

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WDS Record #	parameter_c ategory	analytical_method_ category	analytical_method	parameter_name	samplin g_plan_i d	field_sample_id	detect _flag	report_res ult	report_u nits	validati on_qual ifier	validation_ reason_co des	analytical_group_n ame
112590	ORGANIC	VOC	SW-846:8260D	Trichloro-1,2,2-trifluoroethane[1,1,2-]	17885	WST16-26-402336	N	0.405	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trichloroethane[1,1,1-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trichloroethane[1,1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trichloroethene	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trichlorofluoromethane	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trichloropropane[1,2,3-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trimethylbenzene[1,2,4-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Trimethylbenzene[1,3,5-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Trinitrobenzene[1,3,5-]	17885	WST16-26-402336	N	0.288	mg/kg	U	U_LAB	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Trinitrotoluene[2,4,6-]	17885	WST16-26-402336	N	0.288	mg/kg	UJ	HE12e	NMED Explosives list
112590	ORGANIC	LCMS/MS HIGH EXPLOSIVES	SW-846:8330B	Tris (o-cresyl) phosphate	17885	WST16-26-402336	N	0.577	mg/kg	UJ	HE12e	NMED Explosives list
112590	ORGANIC	VOC	SW-846:8260D	Vinyl Chloride	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Xylene[1,2-]	17885	WST16-26-402336	N	0.0808	mg/kg	U	U_LAB	8260B
112590	ORGANIC	VOC	SW-846:8260D	Xylene[1,3-]+Xylene[1,4-]	17885	WST16-26-402336	N	0.162	mg/kg	U	U_LAB	8260B

Selected Samples Summary

There are 69 rejected results

RCRA

21	analytes pass
18	analytes pass as undetected
0	analytes fail

Detects

0	aroclor were detected		
--	Total aroclor (ppm)		
0	analytes with potential F-code		
0	analytes with potential U-code		
0	analytes with potential P-code		
	Non-wastewater LDR	1 pass	0 fail
	Hazardous soil LDR	1 pass	0 fail
	Residential Soil (mg/kg)	2 pass	0 fail
	Industrial/Occupational Soil (mg/kg)	2 pass	0 fail
	Construction Worker Soil (mg/kg)	2 pass	0 fail
	Recreational Soil (mg/kg)	2 pass	0 fail
	Soil background	0 pass	0 fail
	Canyon Sediment background	0 pass	0 fail
	Qbt 2,3,4 background	0 pass	0 fail
	Qbt 1v background	0 pass	0 fail
	Qbt1g, Qct, Qbo background	0 pass	0 fail

RAD

Total dose: -- mRem/year

--	Highest TRU per sample			
0 out of 9	TRU isotopes analyzed			
	Not analyzed for H3			
	Not analyzed for Pu239			
0	isotopes were analyzed			
0	were detected			
0	undetected			
	Residential SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
	Industrial SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
	Construction worker SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
	Recreational SAL	0 below 15 mRem/y	0 between 15 and 25 mRem/y	0 over 25 mRem/y
	Soil	0 pass	0 fail	
	Canyon sediment	0 pass	0 fail	
	Qbt 2,3,4	0 pass	0 fail	
	Qbt 1v	0 pass	0 fail	
	Qbt 1g, Qct, Qbo	0 pass	0 fail	

Los Alamos National Laboratory Waste Data Summaries
Selected Samples Report
WDS # 112590 (Draft)

Selected Samples

Sample List	Associated Blanks	Associated Duplicates
WST16-26-402336		

[illegible]

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**EVENT ID:** 17885**EVENT NAME:** RFA 2256 - Luciana Vigil-Holterman - TA-16-0441**SAMPLE ID:** WST16-26-402336**WORK ORDER:**

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):	NA	06/16/2026	FIELD MATRIX:	S	OK
TIME COLLECTED (HH:MM):	↓	09:35	MEDIA:	—	↓
SWMU/AOC:	↓	—	SAMPLE TECH CODE:	M	↓
LOCATION ID:	WST-RCRA	OK	FIELD PREP:	—	↓
LOCATION TYPE:	GENERIC	↓	FIELD QC TYPE:	REG	↓
TOP DEPTH:	NA		SAMPLE USAGE:	WST	↓
BOTTOM DEPTH:			EXCAVATED:		YES / NO / <u>NA</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
28 day TAT	8260B	125 ML SEPTUM AMBER GLASS	1	ICE	Y	
↓	8270E	250 ML AMBER GLASS	1	ICE	Y	14d HT
↓	METALS_TCL P	500 ML POLY	1	NONE	Y	
↓	NMED Explosives list	250 ML AMBER GLASS	1	ICE	Y	

SAMPLE COMMENTS:

Ash & debris from waste treatment activities

LOCATION COMMENTS:

at TA-16 Flash pad

Sampled from 55 gallon poly W928164

COMPLETED BY (PRINT):

Sita Stanfield

COLLECTED BY (PRINT):

M. B. Iken. PJ Martinez

REVIEWED BY (PRINT):

RELINQUISHED BY (Printed Name) (Signature) Sita Stanfield	Date/Time 06/16/2026 10:45	RECEIVED BY (Printed Name) (Signature) Denise Salazar	Date/Time 6/16/26 10:45
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Thomas, Susan Marie

From: Marczak, Stanislaw
Sent: Wednesday, November 26, 2025 1:47 PM
To: Thomas, Susan Marie
Subject: Draft WDS

Susan, the “draft” in the title of WDSes refers only to the fact, that total amount of waste was not entered into Waste Data Summary in EIM. All analytical results listed in WDS tables are NOT DRAFT. These are final analytical results.

Deciphering WDS Information

Tables 1 & 2 are the most common descriptors needed for reviewing data in the Waste Data Summaries (WDS) reports. When reviewing data refer to Validation Qualifier & Reason code, these have been reviewed and validated on site by the data administrator. If other qualifiers or reason codes are present call either Stas Marcazk or Susan Thomas for clarification if necessary.

Table 1

Validation Qualifier	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual
J+	detected but result is more uncertain than usual with a positive bias
J-	The analyte is classified as detected but the report concentration value is expected to be more uncertain than usual with a potential negative bias
U	The analyte is classified as not detected
UJ	The analyte is classified as not detected with an expectation that the reported result is more uncertain than usual
R	The reported sample result is classified as rejected due to serious noncompliance regarding quality control acceptance criteria. The presence or absence of the analyte cannot be verified based on routine validation alone.

Table 2

Validation Reason Code	Descriptions
NQ	No validation qualifer flag is associated with this result is classified as detected
J_LAB	Accepted LAB results
U_LAB	Accepted LAB results
R5	Analyte is not detected because the amount reported is less than the MDC.
R33	Naturally Occurring Radionuclide

Additional Helpful Comments

The Total List of All Data Report has columns hidden that were not pertinent to this report. Data has been sorted by Detect Flag to show detects first.. To review all data go to: <https://www.locusfocus.com/eim/eim.cfm> and run the reports for WDS that you are reviewing.

pH shows ppm for units. The pH is unit-less value and when the report is updated/revised will show SU instead of ppm.

Reviewing the Toxicity Report

In the Arsenic example below TCLP (N) was not run but Total Metals(Y) was. The Y in detected column shows it was detected and then the results in ppm
In the Cadmium example TCLP (N) was not run but Total Metals (Y) was. The N in detected column shows it was not detected so N/A is both results columns.
In the Chlordane example neither TCLP (N) nor Total Metals (Y) was run. If N/A is in the detect column there are no results because the parameter was not checked for.

Parameter Name	Parameter Code	TCLP	Total	Detected	Min Result (ppm)	Max Result (ppm)	Regulatory Limit (ppm)
Arsenic	As	N	Y	Y	0 ppm	0.00255 ppm	5 ppm
Cadmium	Cd	N	Y	N	N/A	N/A	1 ppm
Chlordane	57-74-9	N	Y	N/A	N/A	N/A	0.03 ppm

Chromium	Cr	Y	N	N	N/A	N/A	5 ppm
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In the Chromium example above TCLP (Y) has been run and Total Metals was not (N). The N in detected column shows it was not detected so N/A is both results columns.
--

To review start with the Detected column and work left to verify TCPL or Total Metals, then review results. If only one sample was run in the WDS, the Min Result defaults to 0 ppm.

Note: When solids are sampled for any RCRA component, the results on the Toxicity Characteristics Report has already been divided by 20 and the Max and Min Results on the report is the information entered on the Waste Stream Profile.

Addendum 6

Revisions to Supplement 4-2, Open Detonation Unit Groundwater Monitoring and Surface Drainage Information

Document:

LANL Part B Permit Application

Date:

April 2025

Table 4.2-3 Stormwater Data above Target Action Levels 2011-2026

<u>SMA</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Filtration</u>	<u>Result</u>	<u>Units</u>	<u>Target Action Level</u>
<u>F-SMA-2</u>	<u>08/15/2011</u>	<u>Aluminum</u>	<u>F</u>	<u>866</u>	<u>ug/L</u>	<u>750</u>
		<u>Copper</u>	<u>F</u>	<u>72.5</u>	<u>ug/L</u>	<u>4.3</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>140</u>	<u>pCi/L</u>	<u>15</u>
	<u>07/15/2014</u>	<u>Copper</u>	<u>F</u>	<u>10.8</u>	<u>ug/L</u>	<u>4.3</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>112</u>	<u>pCi/L</u>	<u>15</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>58.9</u>	<u>pCi/L</u>	<u>15</u>
	<u>08/26/2021</u>	<u>Aluminum</u>	<u>F</u>	<u>839</u>	<u>ug/L</u>	<u>750</u>
		<u>Copper</u>	<u>F</u>	<u>8.87</u>	<u>ug/L</u>	<u>4.3</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>37.2</u>	<u>pCi/L</u>	<u>15</u>
		<u>Selenium</u>	<u>UF</u>	<u>6.91</u>	<u>ug/L</u>	<u>5</u>
	<u>07/27/2022</u>	<u>Aluminum</u>	<u>UF</u>	<u>120000</u>	<u>ug/L</u>	<u>1241</u>
		<u>Copper</u>	<u>F</u>	<u>10.7</u>	<u>ug/L</u>	<u>6.69</u>
		<u>Selenium</u>	<u>UF</u>	<u>14.2</u>	<u>ug/L</u>	<u>5</u>
<u>A-SMA-3</u>	<u>07/25/2013</u>	<u>Aluminum</u>	<u>F</u>	<u>997</u>	<u>ug/L</u>	<u>750</u>
		<u>Copper</u>	<u>F</u>	<u>245</u>	<u>ug/L</u>	<u>4.3</u>
		<u>Mercury</u>	<u>UF</u>	<u>9.04</u>	<u>ug/L</u>	<u>0.77</u>
		<u>Selenium</u>	<u>UF</u>	<u>12.1</u>	<u>ug/L</u>	<u>5</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>136</u>	<u>pCi/L</u>	<u>15</u>
		<u>Total PCB</u>	<u>UF</u>	<u>3.06</u>	<u>ug/L</u>	<u>0.00064</u>
	<u>08/10/2018</u>	<u>Copper</u>	<u>F</u>	<u>50.2</u>	<u>ug/L</u>	<u>4.3</u>
		<u>Gross alpha</u>	<u>UF</u>	<u>90.8</u>	<u>pCi/L</u>	<u>15</u>
		<u>Total PCB</u>	<u>UF</u>	<u>3.4</u>	<u>ug/L</u>	<u>0.00064</u>
	<u>08/26/2024</u>	<u>Copper</u>	<u>F</u>	<u>6.94</u>	<u>ug/L</u>	<u>5.29</u>

Notes: The aluminum and copper TALs changed in 2022 when the Individual Permit was renewed.

Samples were collected in conjunction with the LANL Individual Permit

F = filtered, UF = unfiltered

Addendum 7

Revisions to Appendix 1, Summary Table of Proposed Changes to the 2010 Los Alamos National Laboratory Hazardous Waste Facility Permit

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Permit Parts 1 – 11**

Permit Section	Proposed modification	Justification
		created an administrative burden for the Permittee with very little (or no) additional benefit. Please see Section 6.3 of the Permit Renewal Application for further description.
1.16, Transfer of Land Ownership	The provisions of this Permit Section shall apply to any transfer in fee of Facility property subject to the requirements of this Permit to another entity. ~~This Section does not apply to Facility property subject to requirements of Section III.Y of the Consent Order.~~	The Permittees propose to revise this section to reflect that there is not a section regarding land transfer within the Consent Order.
1.17.2, Demolition Activities Update	~~1.~~ 1.17 NOTICE OF DEMOLITION ACTIVITIES On or before September 30 of each year, the Permittees shall provide notice to the Department of buildings and other fixed structures that may contain hazardous material scheduled to be demolished in the following federal fiscal year (October 1 through September 30). This notice shall be provided at least 30 days prior to demolition of any such building or structure. <u>On or before March 31, every year, the Permittees shall update the scheduled list or shall notify the Department in writing that no such additional demolitions have been scheduled.</u> <u>1.17.1</u> Content and Format of Notice The Notice under this Permit Section shall include a list in the form of a table that contains the following general information for each building or fixed structure that may contain hazardous material to be demolished, to the extent it is available at the time it is submitted: (1) The Technical Area (TA) and building number; (2) A brief statement of current and historic uses of the building or fixed structure;	The Permittees propose a change to frequency of reporting for demolition activities that would include only a single update to the annual report, due September 30 every year. The proposed change reduces the administrative reporting and review burden on Permittees and the Department while at the same time ensuring adequate notice is provided. Based on experience over the last several years, a twice per year reporting requirement will capture the majority of demolition projects. The supplemental notice provision captures any “in between” projects. At the request of NMED, a requirement to report on building demolition dates was also proposed for inclusion within Permit Section 1.17.1. The results of the consolidation of reporting resulted in the removal of the former Permit

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Permit Parts 1 – 11**

Permit Section	Proposed modification	Justification
	(3) The approximate dates of operations of the building or fixed structure; (4) A list of any solid waste management units (SWMU) or Areas of Concern (AOC) within 50 feet of the footprint of the building or fixed structure; (5) The categories (e.g., chemical residues, RCRA metals, asbestos, high explosives residues, mixed waste) of potential wastes expected to be present <u>and the processes or conditions that may result in the presence of hazardous material</u> in the building or fixed structure; (6) The date or the quarter in which the demolition is scheduled to begin or anticipated to begin; and (7) ~~Any buildings or fixed structures provide the dates buildings have been demolished since the last notification or if the building is no longer planned to be demolished identified in the previous fiscal year that were not demolished.~~ ~~The list shall be accompanied by an attachment that shall describe the processes or conditions that may result in the presence of hazardous material in each building or fixed structure.~~ 2. ~~Demolition Activities Update~~ <del>On or before the last day of each quarter (December 31, March 30~~31~~, June 30, and September 30) every year, the Permittees shall update the list to include any additional buildings and fixed structures that may contain hazardous material scheduled for demolition, or shall notify the Department in writing that no such additional demolitions have been scheduled. In the event a demolition project is identified after the previous notice due date, but will occur prior to the next notice due date, the Permittees shall submit a supplemental notice conforming to Section 1.17.1 not less than 30 days prior to demolition.</del> <u>3.1.17.2</u> Actions	Section 1.17.2 and renumbering of the former Permit Section 1.17.3. Please see Section 6.3 of the Permit Renewal Application for further description.

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Permit Parts 1 – 11**

Permit Section	Proposed modification	Justification
	Based on the list, the Department may identify in writing those buildings or fixed structures for which it requires notice. If a demolition completion report is prepared for any building or fixed structure identified by the Department, the Permittees shall provide to the Department a copy of the report within 30 days after such final report is written.	
2.4.7, Waste Characterization Review	(4) Recharacterize a hazardous waste stream whenever the Permittees are notified by a receiving off-site facility that the characterization of a hazardous waste they obtained from the Permittees' Facility does not match a pre-approved waste analysis certification or accompanying waste manifest or shipping paper. The Permittees shall notify the Department in writing within ~~fifteen~~<u>three</u> days of their receipt of the notice of the discrepancy from a receiving facility.	The Permittees propose to adjust the notification requirement from three days to fifteen days to account for the communication time between the off-site facility and the Facility and to account for the time to process the waste discrepancy notice and to align better with the regulatory requirement for notification. Please see Section 6.3 of the Permit Renewal Application for further discussion of this change.
2.5, Security	The Permittees shall maintain and ensure the effectiveness of all security fences, entry gates, and entry stations surrounding the permitted units as specified in Figures 4 through ~~10 and 55~~<u>14</u> in Attachment N (<i>Figures</i>).	The Permittees propose a figure update.
2.8, Special Requirements for Ignitable, Reactive, or Incompatible Waste	The Permittees shall ensure that containers holding ignitable or reactive wastes are located at least 15 meters from the facility boundary defined as the technical area (TA) specific ~~boundary boundaries~~ identified in Figures ~~11, 22, 24, and 38~~ <u>2</u> in Permit Attachment N (<i>Figures</i>). At TA-63, the Permittees shall ensure that containers holding ignitable or reactive waste are located at least 15 meters from the <u>Transuranic Waste Facility (TWF)</u> fence line, as shown in Figure ~~1455~~ in Permit ~~attachment~~<u>Attachment</u> N (<i>Figures</i>) (<i>see</i> 40 CFR §§ 264.176 and 270.32(b)(2)).	The Permittees propose to modify language to be grammatically correct when referring to multiple technical area boundaries. Also, note that figure number updates are consolidated in a separate table of this appendix for completeness.
2.8.1, Ignitable and Reactive	(4) use only non-sparking tools <u>or non-sparking processes</u> when managing hazardous waste containers that contain ignitable or reactive wastes;	The Permittees propose the addition of "non-sparking processes" to the requirements for

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Permit Parts 1 – 11**

Permit Section	Proposed modification	Justification
2.11.3, Distribution	The Permittees shall also distribute copies of the current Contingency Plan to the State of New Mexico’s Department of Homeland Security and Emergency Management (DHSEM) ~~Area 3 Emergency~~ <u>Local Preparedness</u> Coordinator.	The Permittees propose an update to the applicable position at the Department of Homeland Security and Emergency Management.
2.12.2, Facility Operating Record	(11) if applicable, for hazardous wastes left in the ground after closure (<i>i.e.</i> , disposal units), the information required of a treatment facility under 40 CFR § 268.7(~~cb~~), which is incorporated herein by reference;	The Permittees propose correction of a typographical error to track the correct regulatory citation.
3.5, Management of Containers	(2) The Permittees shall establish and maintain lines of demarcation which identify the boundaries of all permitted CSUs. The line may be identified by paint, tape, <u>signs</u> , or other permanent, visible marking on the floor or base material (<i>see</i> 40 CFR § 270.32(b)(2)). Permanent fences marking the unit boundary, or rooms or buildings whose walls constitute the boundary of the permitted units, satisfy this requirement.	The Permittees propose to include signs to be used as lines of demarcation for hazardous waste management units.
3.5.1, Storage Configuration and Minimum Aisle Space	(1) The Permittees shall maintain adequate aisle space at all times, <u>at minimum two feet</u> , to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the permitted units. Additionally, emergency egress aisles with a minimum aisle space of two feet must be maintained at all personnel doors (<i>see</i> 40 CFR § 264.35).	Permittees propose the language change at the request of NMED.
3.10.2, Secondary Containment	~~3.10.2 Secondary Containment~~ ~~The Permittees shall paint the floors in Rooms 9010, 9020, and 9030 within the TA-3-29 permitted unit with an epoxy sealant. The sealant must be maintained in accordance with Permit Section 3.7.1 of this Part and the manufacturer’s specifications.~~	The Permittees propose to remove this permit condition because containers with free liquids stored within the hazardous waste management unit at TA-3-29 are managed on secondary containment pallets as allowed for in Permit Section 3.7, <i>Containment Systems</i> . The requirement to paint and maintain floors in these specific rooms at TA-3-29 with an epoxy

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Attachment A**

Permit Attachment Section	Proposed modification	Justification
A.1.1.1, TA-3-29 Room 9010	Room 9010 measures 21 feet <u>(ft)</u> , ~~by~~ 8 inches <u>(in.)</u> wide by 106 ~~feet~~ <u>ft.</u> , 9 ~~inches~~ <u>(in.)</u> long (see Figure ~~413~~ in Permit Attachment N (<i>Figures</i>)).	The Permittees propose correction of a typographical error in the room dimensions at the beginning of the section.
A.1.2, Security and Access	~~Bilingual (i.e., English and Spanish) warning signs are also posted at the entrances to each portion of the permitted unit within the building and can be seen from any approach to these locations. The legends on the signs indicate "Danger: Hazardous Waste Storage Area" and "Unauthorized Persons Keep Out." The signs are legible from a distance of at least 25 ft.~~	Permittees propose the removal of a duplicative permit condition that is included within Permit Section 2.5.1, <i>Warning Signs</i> . This language is deleted so that the requirement is included in only one area of the Permit.
A.1.3, Emergency Equipment	The Permittees propose this section for deletion. Please see the revision included within Supplement 1-2, <i>Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions</i> .	Permittees propose the removal of a duplication within the Permit. A listing of emergency equipment is included within Permit Attachment D, <i>Contingency Plan</i> that is more concise and directive than the deletions proposed to the plan.
A.2, TA-16 and Subsections	The Permittees propose to include the Technical Area-specific unit descriptions, including the dimensions, materials of construction, and security procedures for the open burning unit at Technical Area 16. Subsections include A.2.1 and A.2.2. Please see the revisions included within Supplement 1-2, <i>Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions</i> .	The Permittees propose these additions to incorporate the operations for an open burning treatment at LANL. Application requirements for this unit are described or included in Section 5 of this Permit Renewal Application.
A.3, TA-36 and Subsections	The Permittees propose to include the Technical Area-specific unit descriptions, including the dimensions, materials of construction, and security procedures for the open detonation unit at Technical Area 36. Subsections include A.3.1 and A.3.2. Please see the revisions included within Supplement 1-2, <i>Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions</i> .	The Permittees propose these additions to incorporate the operations for an open detonation treatment unit at TA-36 at LANL. Application requirements for these units are described or included in Section 4 of this Permit Renewal Application.

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Attachment A**

Permit Attachment Section	Proposed modification	Justification
A.5.3, Security and Access	The Permittees' proposed deletions to the end of this section are associated with emergency equipment and procedures. Please see the revision included within Supplement 1-2, <i>Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions</i> .	Permittees propose the removal of duplication within the Permit. A listing of emergency equipment is included within Permit Attachment D, <i>Contingency Plan</i> , that is more concise and the deletion removes duplication of emergency procedures.
A.6, TA-54	Waste containers are transported to the permitted units at Areas L, G, and West by flatbed trucks, closed-box trucks, or trailers. The permitted units have design features that promote safe unloading and handling of waste containers from these trucks and trailers. Ramps are typically located at vehicle entrances to the dome structures at the Area L and Area G permitted units. Shed 31 at Area L and Shed 8 at Area G have sloped entryways for container-handling equipment. The storage domes have roll-up or roll-away vehicle access doors. The loading dock at TA-54 West allows access from the transport vehicles to the loading dock platform. ~~These design features facilitate safe handling of containers in and out of the permitted units.~~	Permittees propose the removal of a duplicative sentence within this section.
A.6.1.3, Area L, Storage Shed 31	~~The total capacity of the three sumps is approximately 285 gallons, which exceeds the amount necessary to hold 10% of the total storage capacity of the shed (1,320 gallons).~~	Permittees propose the removal of a duplicative sentence within this section.
A.6.1.4, TA-54-32	These sump capacities exceed the ~~amount~~ <u>volume</u> necessary to hold 10% of the ~~17,160-gallon~~ maximum storage capacity ~~for~~ <u>at</u> TA-54-32.	Permittees propose the language change at the request of NMED.
A.6.2.2, Pad 1, Northwest Bay of Building 412	Containers holding hazardous or mixed waste with free liquids will be stored on portable spill pallets ~~or pans~~ <u>with sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater, to meet the</u> ~~which meet the secondary container~~ requirements of 40 CFR 264.175(b)(3).	Permittees propose the language change at the request of NMED.

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Attachment D**

Permit Attachment Section	Proposed modification	Justification
Throughout the document	Numbering of paragraphs within most sections has been removed and formatting and other grammatical edits have been made for consistency. These changes do not make technical changes to the document. Please see specific revisions within Supplement 1-4, <i>Permittees' Proposed Changes to Attachment D, Contingency Plan</i> .	The Permittees propose these edits in the cases where paragraphs do not require numbering as they are not instructions or steps that need to be followed in sequential order. Technical edits proposed are all reflected in the redline document, but may not be specifically highlighted in this table because formatting changes are difficult to highlight in table format.
Introduction	The Permittees shall implement the provisions of this Plan and the applicable provisions of Permit Part 2 (<i>General Facility Conditions</i>) immediately to minimize hazards whenever there is a fire, explosion, or <u>any unplanned sudden or non-sudden</u> release of hazardous ~~or mixed~~ waste or hazardous ~~or mixed~~ waste constituents that could threaten human health or the environment.	Permittees propose the language change at the request of NMED.
Renamed D.1, Hazardous Waste Emergency Response Resources	D.1 HAZARDOUS ~~AND MIXED~~ WASTE EMERGENCY RESPONSE RESOURCES ~~4.~~ —The management of hazardous and mixed waste emergency incidents at the Facility resides within the Permittees' emergency management <u>and emergency response</u> organizations. <u>edits:</u> <u>Additional Facility resources that may provide assistance in an emergency include personnel from health physics, industrial hygiene, environment compliance, emergency response, and radiation protection personnel at the Facility. These personnel as well as other resources are discussed in Attachment Sections D.1.2, D.1.3, D.1.64, and D.1.65 of this Attachment.</u>	The Permittees propose the renaming of the section and adding "emergency response" organization in addition to the emergency management organization for completeness. Proposal of additional technical edits and corrections are also included.
D.1.1, Emergency Management	The Incident Response Commander ~~will~~ <u>responds</u> to emergency incidents involving the release of hazardous ~~or mixed~~ waste to the environment, including spills, fires, and explosions.	The Permittees propose this change to reflect present tense, rather than future tense.

**Summary Table of Proposed Changes to Los Alamos National Laboratory Hazardous Waste Facility Permit
Attachment D**

Permit Attachment Section	Proposed modification	Justification
D.6, Fire	Information related to the various fire alarms at the specific units is included in Attachment Tables ~~D-3 through D-15~~ ~~TA-3, D-1; TA-50, D-1; TA-54, Area L, D-1; TA-54, Area G, D-2; TA-54 West, D-3; TA-55 Building 4 First Floor, D-1; TA-55 Building 4 Basement, D-2; TA-55 Container Storage Pad, D-3; TA-55-0355 Pad, D-4; and TA-63 Transuranic Waste Facility, D-1.~~	The Permittees propose the rearrangement and renaming of the tables of emergency equipment included within the contingency plan for clarity, to remove inconsistent and redundant information, and to remove subtitle pages within the attachment. The changes proposed to this section reflect proposed revisions later in the contingency plan.
D.9.2, Evacuation Plan	Attachment Table D- ~~23~~ lists the criteria for evacuation, persons responsible for initiating evacuations, and reentry conditions.	The Permittees propose to update the table numbering based on the deletion of a table.
D.9.2, Evacuation Plan and Figures D-3 through D-5	<u>Predetermined site evacuation routes are used whenever possible. The primary evacuation routes are the same as the main access roadways to and from LANL. Figure D-3 shows the primary evacuation routes along with their associated evacuation section.</u>	Permittees propose the language change at the request of NMED.
D.11, Emergency Response Records and Reports	The Permittees shall ensure that any emergency that requires implementation of this Plan will be documented and reported in accordance with <u>requirements of 40 CFR § 264.56 and</u> Permit Sections 1.9.12, 1.9.13, and 2.11.6.3. This information will be maintained in the facility operating record.	The Permittees propose to add a reference to the regulation for completeness and correction of a typographical error.

Addendum 8

Revisions to Supplement 1-2, Permittees' Proposed Changes to Attachment A, Technical Area Unit Descriptions

ATTACHMENT A

TECHNICAL AREA ~~(TA)~~– UNIT DESCRIPTIONS

ATTACHMENT A

This attachment contains Technical Area (TA)-specific unit descriptions, including the dimensions, materials of construction, and security procedures, ~~and emergency equipment~~ of each unit provided by the Permittees in their permit application. Emergency equipment formerly described within this permit attachment is included and update in Permit Attachment D, Contingency Plan, Tables D-3 through D-16.

A.1 TA-3

TA-3 is located in the northern portion of the Facility on South Mesa between Los Alamos Canyon on the north and Two Mile Canyon on the south. Sandia and Mortandad Canyons head on the east margin of TA-3 forming steep cliffs at the top of canyon walls.

A.1.1 TA-3 Building 29

TA-3-29, the Chemistry Metallurgy Research Building (CMR), was established in 1952 as a research facility (*see* Figure ~~412~~ in Permit Attachment N (*Figures*)). It is a three story structure containing offices, laboratories, and one permitted container storage unit located in the basement at TA-3 ~~building, Building 29, of~~ Wing 9 (TA-3-29). The TA-3-29 permitted unit consists of a room (9010) and portions of two other rooms (9020 and 9030) where storage of hazardous and mixed waste occurs. The following provides a description of the permitted unit.

A.1.1.1 TA-3-29 Room 9010

Room 9010 measures 21 feet (ft.), ~~by~~ 8 inches (in.) wide by 106 ~~feet~~ft., 9 ~~inches~~(in.) long (*see* Figure ~~413~~ in Permit Attachment N (*Figures*)). The floor is concrete and is painted with an epoxy sealant. Waste storage takes place in the lower ~~level~~ portion of Room 9010 but may also take place in or near the two room enclosures 9010A and 9010B.

The northern enclosure is approximately 10 ft. wide by 24 ft. long; the southern enclosure measures approximately 17 ft. wide by 54 ft. long. The enclosures have ceilings, walls with windows, and doors for entry through airlocks; the enclosures are anchored to the floor. The wall to floor joints are sealed with grout. Floors and the lower six inches of the interior enclosure walls are coated with an epoxy sealant. Each enclosure includes emergency and communication equipment as well as ventilation, fire sprinkler, water, and electrical support functions connected to the main building systems. The enclosures are kept at negative pressure by the building's exhaust system via exhaust ports in the enclosures which are ducted through high-efficiency particulate air filters to provide radioactive material air release protection.

A.1.1.2 TA-3-29 Portion of Room 9020

Room 9020 is approximately 27 ~~feet~~ft. wide by 141 ~~feet~~ft. long. The permitted container storage area measures 19 ~~feet~~ft. wide by 25 ~~feet~~ft. long (*see* Figure 14 in Permit Attachment N

A.4.1.5A.6.1.4 TA-54-32

TA-54-32 (see Figure 269 in Attachment N (*Figures*)) consists of a concrete pad that is 116.5 ~~feetft.~~ long by 15.5 ~~feetft.~~ wide. The structure is covered by a 117.75 ~~feetft.~~-long by 25.75 ~~feetft.~~-wide canopy. The canopy provides protection from the weather. The concrete pad is bermed by a 1-~~feetft.~~-wide, 6- to 8-~~inchin.~~-high concrete curb. This curbed area is divided into six separate containment cells to segregate wastes with different hazard classes. The curb prevents run-on of storm water. Each containment cell consists of a recessed sump covered with grate flooring on which containers are stored; this prevents contact with liquids that may have accumulated in the sumps. The cells are separated by metal partitions above the flooring. The concrete sumps are treated with chemical-resistant epoxy filler-sealer and protective coating, providing an impervious seal to contain any potential leaks, spills, or accumulation of precipitation. Cells 1 and 6 are approximately 26.5 ~~feetft.~~ long by 13.5 ~~feetft.~~ wide by 1 ~~feetft.~~ deep, with a sump capacity of 2,675 gallons each. Cells 3 and 5 are approximately 16.8 ~~feetft.~~ long by 13.5 ~~feetft.~~ wide by 1 ~~feetft.~~ deep, with a sump capacity of 1,700 gallons each. Cells 2 and 4 are approximately 13.5 ~~feetft.~~ long by 11.2 ~~feetft.~~ wide by 1 ~~feetft.~~ deep, with a sump capacity of approximately 1,130 gallons each. These sump capacities exceed the ~~amount~~volume necessary to hold 10% of the 17,160-gallon maximum storage capacity ~~for~~at TA-54-32.

A.4.1.6A.6.1.5 TA-54-35

TA-54-35 (see Figure 269 in Attachment N (*Figures*)) consists of a concrete pad that measures 31.5 ~~feetft.~~ long by 31.5 ~~feetft.~~ wide. The area is covered by a 136 ft.-long, 48 ~~feetft.~~-wide canopy that provides protection from the weather. The pad has a 6-~~inchin.~~-high concrete berm that prevents run-on and runoff of liquids. The bermed area has an elevated ramp on one side to allow access for equipment to move waste containers. The ramp also helps to prevent run-on of precipitation and runoff of any accumulated liquids. The bermed secondary containment area of the pad is approximately 29.5 ~~feetft.~~ long by 24.5 ~~feetft.~~ wide by 8 ~~inchesin.~~ deep. Stored waste containers are elevated on pallets to prevent contact with any potential accumulated liquids. The secondary containment capacity of the bermed area is approximately 3,570 gallons, which exceeds the amount necessary to hold 10% of the maximum storage capacity for TA-54-35 (15,840 gallons)

A.4.1.7A.6.1.6 TA-54-36

TA-54-36 (see Figure 269 in Attachment N (*Figures*)) is a 33-~~feetft.~~-long by 31.5-~~feetft.~~-wide concrete pad. It is covered by a 136 ~~feetft.~~-long, 48 ~~feetft.~~-wide canopy that provides protection from the weather. The pad is surrounded by a 1-~~feetft.~~-wide berm that varies from 6 ~~inchesin.~~ to 1 ft. in height. The berm prevents run-on and runoff of liquids. The bermed secondary containment area of the pad is approximately 30.5 ~~feetft.~~ long by 30 ~~feetft.~~ wide by 9 ~~inchesin.~~ deep. The pad also contained a Perma-Con® structure which has been removed and disposed. The secondary containment capacity of the bermed area is approximately 4,595 gallons, which exceeds the amount necessary to hold 10% of the maximum storage capacity for TA-54-36 (13,200 gallons).

Northwest Bay of Building 412

Waste treatment, storage, and repackaging are performed in a pre-engineered containment tent adjacent to the primary confinement structure located in the northwest bay of Building 412 (Attachment N, Figure 2719). The containment tent measures approximately 30 ft. long by 27 ft. wide by 15 ft. high. The containment tent is equipped with a HEPA filtration system and a fire-detection system. Additional emergency and safety equipment for Building 412 are listed in Attachment D, Contingency Plan. Attached to the containment tent are a radiological buffer area (RBA), dress-out room, and control room. The RBA measures 15 ft. long by 10 ft. wide. The RBA entrance allows safe transport of containers into the containment tent. Waste-handling activities do not take place within the dress-out room or the control room. The dress-out room measures approximately 10 ft. wide by 20 ft. long. The control room measures approximately 10 ft. wide by 17 ft. long.

Mobile equipment such as gantry cranes, fume hoods, dedicated ventilation units, drum shakers and drum lifts are used in the treatment and repackaging processes. Containers holding hazardous or mixed waste with free liquids will be stored on portable spill pallets ~~or pans~~ with sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater, to meet the ~~which meet the secondary container~~ requirements of 40 CFR 264.175(b)(3). Containers vary in size and will determine the quantity of waste to be treated. These include 55-gallon drums, 85-gallon drums, and standard waste boxes (SWBs).

Waste characterization data shall be used to determine whether waste is amenable to stabilization and whether pretreatment via neutralization is necessary. Neutralization may be performed as pre-treatment option via pH adjustment to facilitate subsequent treatment via stabilization with zeolite.

When deemed necessary, neutralization will be performed in containers in the containment tent within TA-54-0412. Whenever possible, treatment will take place within the existing fume hoods to protect human health and the environment. The neutralization step will consist of verifying pH and adding hydrochloric acid (HCl) or sodium hydroxide (NaOH) to bring the waste within a pH range of 3-10 to ensure that waste is amenable to stabilize with zeolite. The liquids will then be stabilized with a minimum ratio of 3:1 (three parts zeolite to one-part liquid waste). In cases where there is insufficient volume of liquid waste, the neutralization step of the treatment process will not be performed, and these minute quantities of liquids will only be stabilized with zeolite or a WIPP-approved absorbent.

Debris waste (i.e., waste containing no liquids) does not require additional treatment and will either be placed back into the parent container or placed directly into the daughter container with the treated waste.

~~A.4.2.3~~A.6.2.3 Pad 3

The 4 ~~in. inch~~ thick asphalt pad 3 is approximately 339 ~~feetft.~~ long and 50 ~~feetft.~~ wide. Storage Dome 48, located at the eastern end of pad 3, is 285 ~~feetft.~~ long and 50 ~~feetft.~~ wide and has a peak height of 24 ~~feetft.~~ (see Figure 3020 in Attachment N (Figures)). The design and materials of construction for dome 48 are the same as the other domes at TA-54. The dome is

Addendum 9

**Revisions to Supplement 1-4, Permittees'
Proposed Changes to Attachment D,
Contingency Plan**

ATTACHMENT D

~~GENERAL~~-CONTINGENCY PLAN

This Attachment presents contingency measures applicable to all permitted hazardous ~~or mixed~~ waste management units. The Permittees shall implement the provisions of this Plan and the applicable provisions of Permit Part 2 (*General Facility Conditions*) immediately to minimize hazards whenever there is a fire, explosion, or any unplanned sudden or non-sudden release of hazardous ~~or mixed~~-waste or hazardous ~~or mixed~~-waste constituents that could threaten human health or the environment.

D.1 HAZARDOUS ~~AND MIXED~~-WASTE EMERGENCY RESPONSE RESOURCES

~~1.~~—The management of hazardous ~~and mixed~~-waste emergency incidents at the Facility resides within the Permittees' emergency management and emergency response organizations. During an emergency situation, line management (*i.e.*, the Line Manager of the affected area) works with an Incident Response Commander from the emergency management organization. The Incident Response Commander has primary responsibility for managing emergency response operations, directing the Emergency Operations Support Center (EOSC) to make appropriate notifications, and activating the emergency response organizations. The Incident Response Commander has authority to assume the role of Incident Commander (IC) during an emergency and typically assumes full responsibility for management of the emergency response operations at the scene. (Personnel from other organizations, such as the Federal Bureau of Investigation or the Los Alamos Fire Department [LAFD], may also assume the role of IC, depending upon the type of emergency and responding organizations.) Additional Facility resources that may provide assistance in an emergency include personnel from health physics, industrial hygiene, environment compliance, emergency response, and radiation protection ~~personnel~~ at the Facility. These personnel as well as other resources are discussed in ~~Attachment~~ Sections D.1.2, D.1.3, D.1.~~64~~, and D.1.6-5 of this Attachment.

~~2.~~—Laboratory-contracted support services and other agencies shall also be available for assistance during emergencies. These are discussed in ~~Attachment~~ Section D.1.5 and include the contracted services for security and the LAFD. These contracted services, if changed, shall be replaced and/or supplemented with functionally equivalent contracted services required to assume the same duties and responsibilities described in this section. Other outside response agencies are discussed in Section D.1.7 and include the Los Alamos Police Department (LAPD) and the Los Alamos Medical Center (LAMC). The LAPD and the LAMC each provide assistance under a memorandum of understanding with the U.S. Department of Energy (DOE).

~~3.~~—The Permittees shall use the Incident Command System (ICS) in response to all emergencies. The ICS is based on the on-scene management response structure protocols of the National Incident Management System (NIMS). The NIMS is a national standard that provides a solid foundation for an effective and integrated emergency response both locally and nationally, if necessary.

immediate deployment. Should an EOC be activated during an emergency, additional emergency personnel can be requested by the IC through the EOSC.

~~2.~~ Assignment as the Incident Response Commander is rotated. The Incident Response Commander can be reached 24 hours a day by contacting the EOSC at 505-667-2400.

~~3.~~ The Incident Response Commander ~~responds will respond~~ to emergency incidents involving the release of hazardous ~~or mixed~~ waste to the environment, including spills, fires, and explosions. With input from the appropriate Facility groups, the Incident Response Commander shall initially assess the possible hazards to human health or the environment and, if assuming incident command, shall use whatever response personnel and/or emergency equipment necessary to control and contain the waste. In the event of an emergency, the Incident Response Commander typically becomes the IC with full responsibility for field activities. As described previously, the exception to this is when on-site personnel can adequately address the emergency and maintain incident command internally.

~~4.~~ The Incident Response Commander responding to an emergency shall have access to various tools to include Emergency Actions Levels with prescribed protective actions and ~~ChemLog with~~ a current chemical inventory of the appropriate building(s) in the area in which the incident is occurring. Access to these tools shall be maintained at the facility and made available to the Incident Response Commander and other emergency response members at the EOC. Additionally, this information may be gained from the facility manager where a waste management unit is located. The various response groups shall obtain specific information, if necessary, relating to the facilities involved (including the layout of all affected buildings; the location of evacuation routes, equipment, and personnel; properties of the materials/wastes managed at the facility; and the hazards associated with these materials/wastes) from other site-specific information.

~~5.~~ The Permittees shall ensure that the names, addresses, and telephone numbers ~~listed below are of~~ the current Primary and Alternate Incident Response Commanders are kept up-to-date and provided to the New Mexico Environment Department – Hazardous Waste Bureau.

~~6.~~ To assure timely notifications and immediate response during an emergency, the Permittees shall ensure that the telephone numbers 911 or 505-667-2400 are contacted to obtain the on-call Incident Response Commander. The names listed below are the current Primary and Alternate Incident Response Commanders. Addresses and phone numbers are provided to the New Mexico Environment Department under separate cover as Controlled Unclassified Information defined by 32 CFR Part 2002.

Primary:

Aaron Brick

Alternates:

J. Ted Collins (Ted)
Robert Thornton III

D.1.2 Hazardous Materials Response

~~1.~~ Hazardous Materials (HAZMAT) personnel are responsible for the aggressive mitigation of chemical, radiological, and hazardous waste, ~~and mixed waste~~ emergencies, including field decontamination of responders and response equipment. At the request of the IC, the HAZMAT personnel may provide limited field decontamination support for victims. HAZMAT personnel are capable of providing a decontamination station at the scene of a hazardous material incident to process people working in a contaminated area and is ~~are~~ prepared to perform decontamination of personnel. HAZMAT personnel shall meet the training criteria for emergency response personnel specified in the Code of Federal Regulations, Title 29, §1910.120(q)(6)(iii), (iv), and (v). HAZMAT personnel act as part of the ICS reporting directly to IC, or the Operations Section Chief if the position is staffed.

~~2.~~ During an emergency response, the HAZMAT personnel may also provide site field monitoring to determine the nature and extent of contamination, provide information on correct handling of chemicals, make recommendations on protective clothing and equipment, and provide exposure and treatment information to responders. The field monitoring team leader supervises field monitoring activities to determine the boundaries of the potential release. The HAZMAT personnel may obtain resources from environmental monitoring groups, such as health physics and industrial hygiene personnel.

D.1.3 Environmental Regulation and Waste Management Compliance Response

At the scene, representatives and technical advisors from the environmental regulation and waste compliance personnel and other response personnel are coordinated by the IC. In addition to their post-emergency duties, they may also be responsible for on-scene emergency operations such as planning. Depending on the type of emergency and the associated hazards, an individual from the most relevant personnel shall provide technical support and shall ensure the Permittees' compliance with applicable federal, state, and local regulations.

D.1.3.1 Ecology Personnel

Ecology personnel provide field surveys of soil, foodstuffs, and biota to determine environmental effects of exposure after an emergency.

D.1.3.2 Meteorology and Air Quality Personnel

Meteorology and air quality personnel provide field surveys of air to determine environmental impacts and dose equivalent to members of the public after a radiological emergency. In addition, they provide expertise in meteorology to project short- and long-term environmental effects of emergency conditions.

notifications as soon as possible so that exposure levels and decontamination requirements can be established. The affected person will then be transported to the occupational medical facility or to LAMC for evaluation. If possible, the material involved in the exposure will be ascertained, and the information will be given to the medical staff.

~~2.~~ Other potential exposures will necessitate evacuation of the area, if appropriate, or under any of the following conditions:

- ~~1.~~ Irritation of the eyes, breathing passages, or skin
- ~~2.~~ Difficulty in breathing
- ~~3.~~ Nausea, lightheadedness, vertigo, or blurred vision.

~~3.~~ The affected person will be transferred to the occupational medical facility or to LAMC if there is a serious injury. An industrial health and safety, radiation protection, or HAZMAT representative will attempt to ascertain what, if any, exposure occurred and what corrective measure is appropriate.

D.9 PROTECTIVE ACTIONS

A permitted unit shall be evacuated upon the voice command to evacuate the area or upon the sounding of the evacuation or fire alarm. The IC may call for sheltering in place when evacuation is impractical due to significant airborne hazards. Shelter in place may be possible in a designated area or in a building where all exterior windows and doors may be closed and outdoor air ventilation equipment turned off. Once the airborne hazard has decreased, personnel would then be evacuated.

D.9.1 Emergency Process Shutdown Prior To Evacuation

Personnel are instructed to shut down equipment prior to evacuating a building/area unless an immediate building/area evacuation is announced or signaled. To ensure efficient shutdown, training and exercises addressing the shutdown process are performed. In the case of an immediate evacuation, a selected team may shut down designated equipment in an evacuated area upon approval of command. The team will be equipped with proper equipment and PPE. If they are on location, radiation protection, industrial health and safety, and/or HAZMAT personnel will provide advice and assistance.

D.9.2 Evacuation Plan

~~1.~~ Emergency situations may warrant the shutdown and evacuation of areas or buildings in order to protect personnel and property, to anticipate the emergency condition, or to enhance the appropriate response. ~~Attachment~~ Table ~~D-2D-3~~ lists the criteria for evacuation, persons responsible for initiating evacuations, and reentry conditions.

~~2.~~ To initiate the evacuation of a building/area, the evacuation or fire alarm is sounded and/or the public address (PA) system may be used. Evacuation alarms cannot be silenced and reset by site personnel. Only the Fire Alarm Maintenance Section and the LAFD Battalion Chief can

silence and reset alarms. To evacuate a portion of a building or area, use of the PA system may be more appropriate. The PA system will notify the occupants of the area to be evacuated and will advise personnel throughout the building of the existence of a problem in a specific area. Once evacuation has been initiated and if conditions allow, personnel will turn off all equipment that could contribute to the hazard if left unattended. All personnel will then proceed from the affected area to the assembly/muster area.

~~3.~~ In the event of evacuation of a building, an outbuilding, or an outlying work area, the responsible Line Manager (or his/her designee) will determine a control point at the closest safe location (e.g., considering wind direction). The designated area will be outside the affected area and will serve as an assembly/muster area where the Line Manager (or designee) can oversee evacuation operations and work to prevent further spread of the hazard.

~~4.~~ As personnel exit an affected building/area, a primary sweep of the building/area may be performed to ensure that all personnel have evacuated. If the building/area is evacuated, a Group Leader designee will take attendance at the assembly/muster area and report personnel accountability to the IC. The evacuation procedure is as follows:

1. The person discovering the accident or emergency will call 911 if the event is life-threatening or LAFD is required, or 505-667-2400 for all other evacuations. The person will then notify line management.
2. Site-specific BEPs and/or emergency action procedures will be followed concerning evacuation, sweep, personnel accountability, and equipment shutdown procedures.

~~5.~~ A responsible on-site person may direct the initial evacuation and the fire alarm system may be activated. Emergency operations personnel will be notified and dispatched immediately. A responsible on-site person may implement and direct the evacuation process until the Incident Response Commander or LAFD arrives at the scene to assume that responsibility.

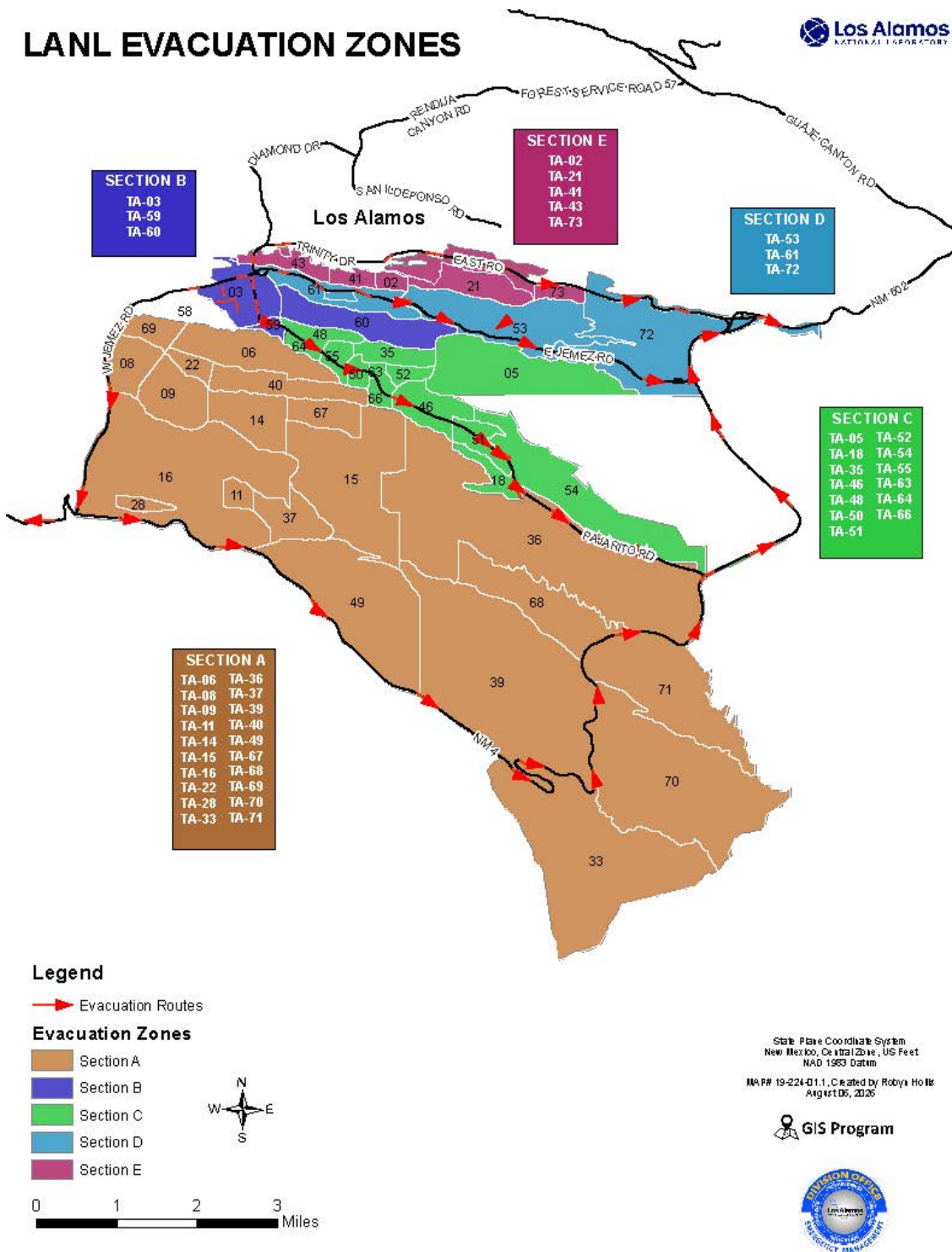
Predetermined site evacuation routes are used whenever possible. The primary evacuation routes are the same as the main access roadways to and from LANL. Figure D-3 shows the primary evacuation routes along with their associated evacuation section.

D.10 SALVAGE AND CLEANUP

~~1.~~ Appropriate environmental compliance representatives will survey the affected area before salvage and cleanup begin. They will conduct visual inspections and sampling, as appropriate, of the affected area to determine whether cleanup is complete. If gases or fumes, electrical or radiological problems, or other conditions present a hazardous situation, personnel or selected teams equipped with proper PPE will reenter the area to perform designated decontamination tasks, repairs, and salvage to allow the return to normal operations. After an emergency, the IC will turn the operation over to a designated Recovery Manager, who will:

1. Provide for proper handling of recovered waste, contaminated soil or surface water, or any other material that results from a spill, fire, or explosion. Contaminated material will be managed appropriately and temporarily stored at one of the hazardous ~~or mixed~~ waste storage areas at the Facility. Waste management personnel will be responsible for

Figure D-3
Evacuation Planning Map



Addendum 10

**Revisions to Supplement 3-1, Permittees'
Proposed Changes to Attachments G.1
through G.31, Closure Plans**

ATTACHMENT G.2
TECHNICAL AREA 36-8
OPEN DETONATION UNIT
CLOSURE PLAN

There are two basic categories of explosives that may be treated at the TA-36-8 OD Unit. The first category consists of explosives-contaminated waste; the second category consists of explosives waste. Generally, explosives-contaminated waste includes make-up room wastes and infrequently firing site debris. Make-up room waste can consist of explosives-contaminated debris such as paper towels, gloves, swabs, and similar materials that contain no tangible pieces of explosives but are used in the preparation of shots in the preparation building. Firing site debris that is potentially contaminated with explosives consists of wood scraps, cardboard, burlap, Plexiglas®/Lexan®, plastic, glass, styrofoam, electrical cables, and metallic foils used for pin switches or metals such as target plates. Explosives waste generally includes identifiable scrap explosives that are safe to handle. These materials include explosives assemblies and explosives, identifiable booster charge scrap, and any other process wastes that have the potential to react.

3.0 ESTIMATE OF MAXIMUM WASTE TREATED

Since RCRA Subtitle C regulations became effective in November 1980, an average of approximately 1,100 pounds of waste has been treated annually at the TA-36-8 OD Unit. Based on the 1,100 pound per year rate for treated wastes, it is estimated that approximately 35,20033,000 pounds of waste have been treated at the TA-36-8 OD Unit through 20120. When the actual treatment quantities are added for 2013 and 2014, a maximum of 35,499 pounds of waste have been treated at the TA-36-8 OD Unit through 2025.

4.0 GENERAL CLOSURE INFORMATION

4.1 Closure Performance Standard

As required by Permit Section 9.2, the TA-36-8 OD Unit will be closed to meet the following performance standards:

- a. Remove all hazardous waste residues and hazardous constituents; and
- b. Ensure contaminated media do not contain concentrations of hazardous constituents greater than the clean-up levels established in accordance with Permit Sections 11.4 and 11.5. For soils, the clean-up levels will be established based on residential use. LANL will also demonstrate that there is no potential to contaminate groundwater.

If LANL is unable to achieve either of the clean closure standards above, they will:

- c. Coordinate cleanup closure activities for the TA-36-8 OD Unit with the corrective action cleanup processes at TA-36 in its entirety;
- d. Comply with Closure Requirements in 40 CFR 264265.113(b)(1)(ii)(C) and (2);
- e. Minimize the need for further maintenance;
- f. Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground, groundwater, surface waters, or to the atmosphere; and
- g. Comply with the closure requirements of Permit Part 9 (Closure) and 40 CFR Part 264 Subparts G and X for miscellaneous units.

Closure of the TA-36-8 OD Unit will be deemed complete when: 1) all surfaces and equipment have been decontaminated, or otherwise properly disposed of; 2) closure has been certified by an

will be signed by LANL and by an independent professional engineer registered in the State of New Mexico (see 40 CFR § 264.115).

The report will document the units' closure and contain, at a minimum, the following information:

1. a copy of the certification pursuant to 40 CFR § 264.115;
2. any variance, and the reason for the variance, from the activities approved in this closure plan;
3. documentation of the records review and structural assessment conducted;
4. a summary of all sampling results, showing:
 - a. sample identification;
 - b. sampling location;
 - c. data reported;
 - d. detection limit for each analyte;
 - e. a measure of analytical precision (e.g., uncertainty, range, variance);
 - f. identification of analytical procedure;
 - g. identification of analytical laboratory;
5. a QA/QC statement on analytical data validation and decontamination verification;
6. the location of the file of supporting documentation, including:
 - a. field logbooks;
 - b. laboratory sample analysis reports;
 - c. QA/QC documentation; and
 - d. chain-of-custody forms;
7. storage or disposal location of hazardous waste resulting from closure activities;
8. a copy of the Human Health and Ecological Risk Assessment Reports, if a site-specific risk assessment was conducted pursuant to Section 11.5 of the Permit, for the units; and
9. a certification statement of the accuracy of the Closure Report.

~~Documentation supporting the independent registered professional engineer's certification must be furnished to NMED before LANL is released from the closure financial assurance requirements in 40 CFR § 264.143. If LANL leaves waste in place, they will submit to NMED a survey plat as required by 40 CFR § 264.116 in conjunction with the closure certification report.~~

9.0 REFERENCES

- DOE 1995. *DOE Methods for Evaluating Environmental and Waste Management Samples*, DOE/EM-0089T, Rev. 2, Pacific Northwest Laboratory, Richland, Washington.
- EPA 2002. *RCRA Waste Sampling Draft Technical Guidance Planning, Implementation, and Assessment*, EPA530-D-02-002, U.S. Environmental Protection Agency, Office of Solid Waste, U.S. Government Printing Office, Washington, DC.
- EPA 1986 (and all approved updates). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA-SW-846, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington, DC.
- NIOSH 1994. *NIOSH Manual of Analytical Methods*, National Institute for Occupational Health and Safety 4th ed. Issue 1.

ATTACHMENT G.3
TECHNICAL AREA 39-6
OPEN DETONATION UNIT
CLOSURE PLAN

of reactivity by OD. OD of waste is accomplished by using a predetermined amount of explosive (fuel) to initiate the detonation. The detonation may create temperatures ranging from 4,500 to 9,000 degrees Fahrenheit (2,500 to 5,600 degrees Celsius) (Erickson et. al., 2005).

There are two basic categories of explosives waste that may be managed at the TA-39-6 OD Unit. The first category consists of explosives-contaminated waste; the second category consists of explosives waste. Generally, explosives-contaminated waste includes make-up room wastes and infrequently firing site debris. Make-up room waste can consist of explosives contaminated debris such as paper towels, gloves, swabs, and similar materials that contain no tangible pieces of explosives but are used in the preparation of shots in the preparation building. Firing site debris that is potentially contaminated with explosives consists of wood scraps, cardboard, burlap, Plexiglas®/Lexan®, plastic, glass, styrofoam, electrical cables, and metallic foils used for pin switches or metals such as target plates. Explosives waste generally includes identifiable excess explosives that are safe to handle. These materials include explosives assemblies and explosives, identifiable booster charge scrap, and any other process wastes that have the potential to react.

3.0 ESTIMATE OF MAXIMUM WASTE TREATED

Since RCRA Subtitle C regulations became effective in November 1980, an average of approximately 260 pounds of waste has been treated annually at the TA-39-6 OD Unit. Based on the 260 pound per year rate for treated wastes, it is estimated that ~~8,320~~^{7,800} pounds of waste have been treated at the TA-39-6 OD Unit through 2012⁹. When the actual treatment quantities are added for 2013 and 2014, a maximum of 8,327 pounds of waste have been treated at the TA-36-8 OD Unit through 2025.

4.0 GENERAL CLOSURE INFORMATION

4.1 Closure Performance Standard

As required by Permit Section 9.2, the TA-39-6 OD Unit will be closed to meet the following performance standards:

- a. Remove all hazardous waste residues and hazardous constituents; and
- b. Ensure contaminated media do not contain concentrations of hazardous constituents greater than the clean-up levels established in accordance with Permit Sections 11.4 and 11.5. For soils the cleanup levels will be established based on residential use. LANL will also demonstrate that there is no potential to contaminate groundwater.

If LANL is unable to achieve either of the clean closure standards above, they will:

- c. Coordinate cleanup closure activities for the TA-39-6 OD Unit with the corrective action cleanup processes at TA-39 in its entirety;
- d. Comply with Closure Requirements in 40 CFR ~~264~~²⁶⁵.113(b)(1)(ii)(C) and (2);
- e. Minimize the need for further maintenance;
- f. Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground, groundwater, surface waters, or to the atmosphere; and

- results of all chemical analyses and other characterization activities.

LANL will submit the Report to NMED no later than 60 days after completion of closure of the units. NMED may require interim reports that document the progress of closure. The certification will be signed by LANL and by an independent professional engineer registered in the State of New Mexico (see 40 CFR § 264.115).

The report will document the units' closure and contain, at a minimum, the following information:

1. a copy of the certification pursuant to 40 CFR § 264.115;
2. any variance, and the reason for the variance, from the activities approved in this closure plan;
3. documentation of the records review and structural assessment conducted;
4. a summary of all sampling results, showing:
 - a. sample identification;
 - b. sampling location;
 - c. data reported;
 - d. detection limit for each analyte;
 - e. a measure of analytical precision (e.g., uncertainty, range, variance);
 - f. identification of analytical procedure;
 - g. identification of analytical laboratory;
5. a QA/QC statement on analytical data validation and decontamination verification;
6. the location of the file of supporting documentation, including:
 - a. field logbooks;
 - b. laboratory sample analysis reports;
 - c. QA/QC documentation; and
 - d. chain-of-custody forms;
7. storage or disposal location of hazardous waste resulting from closure activities;
8. a copy of the Human Health and Ecological Risk Assessment Reports, if a site-specific risk assessment was conducted pursuant to Section 11.5 of the Permit, for the units; and
9. a certification statement of the accuracy of the Closure Report.

~~Documentation supporting the independent registered professional engineer's certification must be furnished to NMED before LANL is released from the closure financial assurance requirements in 40 CFR § 264.143. If LANL leaves waste in place, they will submit to NMED a survey plat as required by 40 CFR § 264.116 in conjunction with the closure certification report.~~

9.0 REFERENCES

- DOE 1995. *DOE Methods for Evaluating Environmental and Waste Management Samples*, DOE/EM-0089T, Rev. 2, Pacific Northwest Laboratory, Richland, Washington.
- EPA 2002. *RCRA Waste Sampling Draft Technical Guidance Planning, Implementation, and Assessment*, EPA530-D-02-002, U.S. Environmental Protection Agency, Office of Solid Waste, U.S. Government Printing Office, Washington, DC.

ATTACHMENT G.23
TECHNICAL AREA 55, BUILDING 4
INDOOR STORAGE TANK UNIT
CLOSURE PLAN

Table G.23-3

Potential Waste Materials, Waste Types, and Disposal Options

<u>Potential Waste Materials</u>	<u>Waste Types</u>	<u>Disposal Options</u>
<u>Personal protective equipment (PPE)</u>	<u>Non-regulated solid waste</u>	<u>Subtitle D landfill</u>
	<u>Hazardous waste</u>	<u>The PPE will be treated to meet Land Disposal Restriction (LDR) treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
	<u>Low-level radioactive solid waste</u>	<u>Either an authorized on-site radioactive waste disposal area that is not undergoing closure under RCRA or its state analog, or an authorized off-site radioactive waste disposal facility.</u>
	<u>Mixed waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill or the Waste Isolation Pilot Plant (WIPP), as appropriate.</u>
<u>Decontamination wash water</u>	<u>Non-regulated liquid waste</u>	<u>Sanitary sewer</u>
	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
	<u>Radioactive liquid waste</u>	<u>Radioactive Liquid Waste Treatment Facility (RLWTF)</u>
	<u>Mixed waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill or WIPP, as appropriate.</u>
<u>Metal</u>	<u>Non-regulated solid waste</u>	<u>Subtitle D landfill or recycled</u>
	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
	<u>Low-level radioactive solid waste</u>	<u>Either an authorized on-site radioactive waste disposal area that is not undergoing closure under RCRA or its</u>

Table G.23-3
Potential Waste Materials, Waste Types, and Disposal Options

<u>Potential Waste Materials</u>	<u>Waste Types</u>	<u>Disposal Options</u>
		~~state analog, or an authorized off-site radioactive waste disposal facility.~~
	<u>Mixed waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, or WIPP, as appropriate.</u>
<u>Discarded concrete</u>	<u>Low-level radioactive solid waste</u>	~~Either an authorized on-site radioactive waste disposal area that is not undergoing closure under RCRA or its state analog, or an authorized off-site radioactive waste disposal facility.~~
	<u>Mixed waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill or WIPP, as appropriate.</u>
	<u>Non-regulated solid waste</u>	<u>Subtitle D landfill, recycled, or reused</u>
	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
<u>Discarded waste management equipment</u>	<u>Low-level radioactive solid waste</u>	~~Either an authorized on-site radioactive waste disposal area that is not undergoing closure under RCRA or its state analog, or an authorized off-site radioactive waste disposal facility.~~
	<u>Mixed waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill or WIPP, as appropriate.</u>
	<u>Non-regulated solid waste</u>	<u>Subtitle D landfill</u>
	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
<u>Sampling equipment</u>	<u>Low-level radioactive solid waste</u>	~~Either an authorized on-site radioactive waste disposal area that is not undergoing closure under RCRA or its state analog, or an authorized off-site radioactive waste disposal facility.~~

ATTACHMENT G.28
OPEN BURNING TREATMENT UNIT
TECHNICAL AREA 16-388 FLASH PAD CLOSURE PLAN

1.0 INTRODUCTION

This closure plan describes the activities necessary to close one of the hazardous waste open burning treatment units at Technical Area (TA) 16 at the Los Alamos National Laboratory (LANL or the Facility), hereinafter referred to as the “TA-16-388 Flash Pad” or “the unit”. The information provided in this closure plan addresses the closure requirements specified in the Code of Federal Regulations (CFR), Title 40, Part 264265, Subparts G and PX for the thermal treatment units operated at the Facility under the Resource Conservation and Recovery Act (RCRA) and the New Mexico Hazardous Waste Act. Closure of the open burning treatment unit will be completed in accordance with Section 4.1 of this closure plan.

2.0 DESCRIPTION OF UNIT TO BE CLOSED

TA-16 is located in the southwestern quadrant of the Facility at the West end of the Pajarito Plateau near the foothills of the Jemez Mountains. It is managed by the owner/operator’s high explosives engineering personnel who are responsible for the safe treatment, storage, and handling of explosives waste and explosives-contaminated wastes generated by the explosives production facilities at LANL.

2.1 Description of the Unit and the Wastes Treated at the Unit

The TA-16 Burn Ground is located in the northeast corner of TA-16. It is located on the mesa and drains to the north, east, and south and is bordered on the northern side by Cañon de Valle and on the southern side by Water Canyon.

The OB unit, known as the TA-16-388 Flash Pad, consists of a 22-foot (ft) by 22-ft concrete pad set on a secondary containment area. The base of the pad is 12 inches thick. The entire concrete pad is on a 45-mil Hypalon liner, which is 6 inches below the bottom of the pad and curved up to ground level on all 4 sides, extending out 2 ft from the pad perimeter. Inset one foot from the edge of the concrete pad along the two sides and back is a 3-ft-high, 8-inch-thick, integrally-poured concrete wall. The pad is slanted down toward the back concrete wall. The TA-16-388 Flash Pad is also equipped with a retractable steel cover that covers the unit when not in use (Figure G.28-1). The unit is surrounded by a chain-link fence and brick retaining wall. An entry gate is located directly in front of the loading area.

Three 5-ft long forced air propane burners with adjustable mounts are mounted on the concrete wall. These propane burners provide the heat source for treatment activities at the unit. A burner is mounted outside the wall on each side and the back of the pad. One to three burners can be used, depending on the amount and configuration of the material to be treated. Most treatment events utilize two burners. The total capacity of the propane supply system is approximately 7 million British thermal units per hour (BTU/hr). Therefore, the output of each burner is dependent on how many are used for a burn. Usually, they are operated at approximately 2 million BTU/hr. This provides adequate heat to bring the material being flashed to a temperature sufficient to destroy explosives, typically to a temperature above 400 degrees centigrade (°C) (see Section 2.2.3). The burners and other components are maintained, modified, and/or replaced, as needed to ensure proper operation and treatment effectiveness.

The TA-16-388 Flash Pad is used to treat dry explosives; wet explosives; and waste that is contaminated with explosives to destroy the characteristic of reactivity (D003). Descriptions of waste streams that may be treated by OB at the unit are discussed in Section 2.4.1 of this permit modification request. The maximum treatment capacity of the TA-16-388 Flash Pad is 200 pounds (lbs) of explosives for each treatment; however, burns are usually much smaller to assure that all materials are sufficiently heated to destroy the explosives. The maximum treatment capacity for contaminated liquids (e.g., solvent) is approximately 100 gallons. However, the amount of liquid waste treated per burn is adjusted to the amount of liquid that can be treated in a single day. This amount is usually 5 to 30 gallons, considerably less than the maximum treatment capacity. Additionally, the treatment quantity is limited to the quantity of waste treated and does

not include the quantity of fuel (i.e. propane) or the weight of metal equipment when a large piece of equipment is treated for explosives contamination.

The TA-16-388 Flash Pad is used exclusively for OB waste treatment operations, and no other activities. Following waste placement at the unit, open burning operations are conducted from Building 16-389 (the control building). Operations at the unit require visual surveys and post-burn covering of the unit. This practice minimizes the potential for precipitation contacting untreated hazardous waste, if any exists.

3.0 ESTIMATE OF MAXIMUM WASTE TREATED

The maximum treatment capacity of explosives waste at the TA-16-388 Flash Pad was 1,000 pounds per burn or 50 gallons per burn until 2012, when it was reduced to 200 pounds per burn. Additionally, large pieces of equipment that are flashed at the unit may weigh in excess of 10,000 pounds. Only the estimated quantity of explosives are counted as the quantity treated by OB.

4.0 GENERAL CLOSURE INFORMATION

4.1 Closure Performance Standard

The TA-16-388 Flash Pad will be closed to meet the following performance standards (40 CFR § ~~264265~~.111):

- minimize the need for further maintenance;
- control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters, or to the atmosphere; and
- comply with the closure requirements of 40 CFR Part ~~264265~~ Subparts G and ~~PX~~.

This will be accomplished through one of two methods:

- a) ensure that contaminated media do not contain concentrations of hazardous constituents that are greater than the clean-up levels established in the *New Mexico Environment Department Risk Assessment Guidance for Site Investigations and Remediation* (updated 2012) (NMED, 2012), and in LANL's *Screening Level Ecological Risk Assessment Methods* (LANL, 2012a) (as updated and approved by the NMED). For soils, the cleanup levels shall be established based on residential use; or
- b) conduct a human health and ecological risk evaluation utilizing the screening levels described above and utilizing the objectives set forth in the *New Mexico Environment Department Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012).

If the owner/operator is unable to achieve any one of the risk-based clean closure standards in (a) or (b) above, they must:

- control the migration of hazardous waste residues, hazardous constituents, and, as applicable, contaminated media such that they do not pose an unacceptable risk to human health and the environment; and
- control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off,

or hazardous waste decomposition products to the ground, groundwater, surface waters, or to the atmosphere.

The owner/operator shall demonstrate that the unit does not pose an unacceptable risk by complying with the post closure requirements in 40 CFR § ~~264~~265.117 as well as conduct the following to protect human health and the environment:

- maintain the integrity and effectiveness of the unit by making repairs necessary to correct the effects of erosion, animal intrusion, or other events that compromise the unit;
- maintain surface water controls to prevent run-on and run-off from eroding or otherwise causing damage;
- conduct corrective action as necessary to protect human health and the environment;
- maintain fencing, security signs and locks;
- maintain training, operating, inspection, and monitoring, and other required records; and
- submit an annual report to the NMED providing the results of the required inspections, sampling results, and a summary of any needed repairs and whether repairs were effective.

Closure of the unit will be deemed complete when: 1) all surfaces and equipment have been decontaminated, or otherwise properly managed as waste; 2) closure has been completed in accordance with the closure plan and been certified by an independent, professional engineer licensed in the State of New Mexico; and 3) closure certification has been submitted to, and approved by, the NMED.

4.2 Closure Schedule

This closure plan schedule is intended to address the closure requirements for the TA-16-388 Flash Pad. The following section provides the schedule of closure activities (see also Table G.28-1 in this closure plan).

Closure activities will begin according to the requirements in 40 CFR § ~~264~~265.112 (d)(2). However, pursuant to 40 CFR § ~~265~~264.112(e), removing hazardous wastes decontaminating or dismantling equipment, in accordance with an approved closure plan, may be conducted at any time before or after notification of closure.

The owner/operator shall complete the records review (review) and structural assessment (assessment), as described in Sections 5.1.1 and 5.1.2 of this closure plan, and shall notify the Department at least 20 days prior to the scheduled assessment so the Department may have the opportunity to participate in the assessment. The notification shall include the date on which the owner/operator expects to conduct the assessment.

The owner/operator shall complete all closure activities, including submittal of a final closure certification report to the Department for review and approval, in accordance with this closure plan (see 40 CFR § ~~265~~264.113(b)). In the event that this timeframe cannot be met, the owner/operator may request from the Department an extension in accordance with 40 CFR § ~~265~~264.113(c)(2) (see 40 CFR § ~~265~~264.113(b)(1)(i)).

4.3 Amendment of the Closure Plan

The owner/operator may amend this closure plan in accordance with the requirements in 40 CFR § ~~264~~265.112(c), which is incorporated herein by reference. If the results of the review or assessment require

5.2 Decontamination and Removal of Structures and Equipment

In accordance with 40 CFR § ~~264265~~.112(b)(4) (which is incorporated herein by reference), the unit's related equipment and materials (e.g., concrete pad) will be decontaminated, or removed and managed according to Section 7.0 of this closure plan. The concrete pad and liner will remain at the unit and will be reused for other programmatic activities. All surfaces and related equipment that are removed and not intended for recycle will not require decontamination, will be considered solid and potentially hazardous waste when removed, and will be disposed of in accordance with Section 7.0. Decontamination activities will ensure the removal of all hazardous waste residues and hazardous waste constituents from the unit to meet the closure performance standards in Section 4.1.

5.2.1 Removal of Structures and Related Equipment

The burn tray, the three propane burners, and the metal retractable cover (and its mechanisms) will all be removed from the unit at closure (but after the structural assessment) and may be recycled.

Removal of the concrete walls, concrete pad, and Hypalon liner may also be removed if not needed for other programmatic work.

5.2.2 Decontamination of Structures and Related Equipment

The unit's concrete pad will be decontaminated by hot water/steam cleaning or pressure washing with a solution consisting of a surfactant detergent (e.g., Alconox[®]) and water mixed in accordance with the manufacturer's recommendations. Portable berms or other devices (e.g., absorbent socks, plastic sheeting, wading pools) will collect excess wash water and provide containment during the decontamination process; however, no excess water is expected to be generated. If results of the solid concrete chip or soil samples (see Section 6.1) from below the pad indicate contamination from the unit, the entire concrete pad will be removed and disposed of according to Section 7.0.

No equipment at the unit is expected to be left in place. However, if equipment, identified during the assessment, is expected to be left in place, it will be decontaminated by pressure washing or hot water and sampled according to Section 6.1.

5.2.3 Equipment Used During Decontamination Activities

Reusable protective clothing, tools, and equipment used during decontamination activities will be cleaned with a wash water solution that consists of a surfactant detergent and water mixed in accordance with the manufacturers recommendations. The tools and equipment will be wiped down with the wash water solution and rinsed. Residue and disposable equipment will be containerized, characterized, and managed as waste in accordance with Section 7.0.

6.0 SAMPLING AND ANALYSIS PLAN

This SAP identifies the specific sampling and analysis requirements for this unit and describes the sampling, analysis, and quality assurance/ quality control (QA/QC) methods that will be used to demonstrate that the owner/operator has met the closure performance standards in Section 4.1. The owner/operator shall comply with all the requirements in Section 6.0.

This SAP is designed to verify decontamination of surfaces, equipment, and materials; and determine whether a release of hazardous constituents to any environmental media has occurred. The SAP includes:

- 1) A list of hazardous constituents of concern (see Table G.28-2) for which soil and chip samples will be analyzed. This list includes all hazardous constituents defined as:
 - a) any constituent identified in 40 CFR Part 261 Appendix VII that caused the United States Environmental Protection Agency (USEPA) to list a hazardous waste in 40 CFR Part 261 Subpart D;
 - b) any constituent identified in 40 CFR Part 261, Appendix VIII; or
 - c) any constituent identified in 40 CFR Part 264 Appendix IX, perchlorate, and nitrates.
- 2) The list of hazardous constituents of concern shall be utilized to select the analytical methods capable of detecting those constituents.
- 3) A site plan for verification and soil samples. The site plan includes Figure G.28-2 depicting the boundaries of the unit and verification and soil sampling locations. The locations include ten grab sample locations that represent locations immediately around the unit, locations of known spills, or other releases of hazardous waste or hazardous constituents during operation of the unit, and locations where run-off likely occurred from the unit.
- 4) The type of samples to be collected (e.g., wipe, soil, surface water) and the rationale for the selection of the sample type.
- 5) Sampling methods including a description of the approved EPA sampling methods and procedures that will be used to collect each type of sample as specified in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA, 1986).
- 6) A description of the approved EPA SW-846 laboratory analytical methods that will be used to measure hazardous constituent concentrations (see Table G.28-4).
- 7) description of the quality assurance and quality control (QA/QC) procedures that include, but are not limited to:
 - a) field duplicates, trip blanks, equipment blanks;
 - b) a description of methods for decontamination of re-usable sampling equipment; and
 - c) a description of all sample preservation, handling, labeling, and chain-of-custody procedures.

6.1 Sampling Activities

Sampling activities will be conducted in order to demonstrate that unit-related equipment and soils in and around the unit meet the closure performance standards in Section 4.1. All samples will be collected and analyzed in accordance with the procedures in Sections 6.2, 6.3, and 6.4 of this closure plan.

- All metal equipment will be flashed prior to shipment off-site.
- The concrete pad will be hot water/steam cleaned or pressure washed.
- Soil samples will be collected from locations in and around the unit from the sample locations depicted in Figure G.28-2.
- An additional soil sample location will be collected under the concrete pad and liner if they are removed.

6.4.4 Data Reporting Requirements

Analytical results will include all pertinent information about the condition and appearance of the sample-as-received. Analytical reports will include:

- a. a summary of analytical results for each sample;
- b. results from QC samples such as blanks, spikes, and calibrations;
- c. reference to standard methods or a detailed description of analytical procedures; and
- d. raw data printouts for comparison with summaries.

The laboratory will describe the analysis in sufficient detail so that the data user can understand how the sample was analyzed.

7.0 WASTE MANAGEMENT

By removing any hazardous waste or hazardous waste constituents during closure, the owner/operator may become a generator of hazardous waste. The owner/operator shall control, handle, characterize, and dispose of all wastes generated during closure activities in accordance with this Section (7.0), Facility waste management procedures, and in compliance with applicable state, federal, and local requirements (see 40 CFR § ~~265~~264.114). These wastes may include, but are not limited to:

- (a) demolition debris;
- (b) concrete;
- (c) containerized waste;
- (d) personnel protective equipment;
- (e) soil;
- (f) decontamination wash water; and
- (g) decontamination waste.

The different types of wastes generated at closure, including the unit's decontaminated structures and related equipment, and their disposition options (e.g., reuse, recycling, or disposal) are listed in Table G.28-3 of this closure plan.

8.0 CLOSURE CERTIFICATION REPORT

Upon completion of the closure activities at the unit, the owner/operator shall submit, by registered mail, a closure certification report for Department review and approval. The Report shall document that the unit has been closed in compliance with the specifications in this closure plan. The Report shall summarize all activities conducted during closure including, but not limited to:

- a) the results of the records review and structural assessment;
- b) the results of all investigations;
- c) remediation waste management;
- d) decontamination;
- e) decontamination verification and soil sampling activities; and
- f) results of all chemical analyses and other characterization activities.

The owner/operator shall submit the closure certification report to the Department no later than 60 days after completion of closure of the unit. The Department may require interim reports that document the progress of closure. The certification must be signed by the owner/operator and by an independent professional engineer registered in the State of New Mexico (see 40 CFR § ~~264~~265.115).

The report shall document the unit's closure and contain, at a minimum, the following information:

- a) a copy of the certification pursuant to 40 CFR § ~~265~~264.115;
- b) any variance, and the reason for the variance, from the activities approved in this closure plan;
- c) documentation of the records review and structural assessment conducted;
- d) a summary of all sampling results, showing:
 - 1. sample identification;
 - 2. sampling location;
 - 3. data reported;
 - 4. detection limit for each analyte;
 - 5. a measure of analytical precision (e.g., uncertainty, range, variance);
 - 6. identification of analytical procedure;
 - 7. identification of analytical laboratory;
- e) a QA/QC statement on analytical data validation and decontamination verification;
- f) the location of the file of supporting documentation, including:
 - 1. field logbooks;
 - 2. laboratory sample analysis reports;
 - 3. QA/QC documentation; and
 - 4. chain-of-custody forms;
- g) storage or disposal location of hazardous waste resulting from closure activities;
- h) a copy of the Human Health and Ecological Risk Assessment Reports, if a site-specific risk assessment was conducted pursuant to Section 4.1 for the unit; and
- i) a certification statement supporting the accuracy of the closure certification report.

Documentation supporting the independent registered professional engineer's certification must be furnished to the Department before the closure of the unit is approved.

Table G.28-3

Potential Waste Materials, Waste Types, and Disposal Options

<u>Potential Waste Materials</u>	<u>Waste Types</u>	<u>Disposal Options</u>
<u>Discarded sampling and decontamination equipment</u>	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>
<u>Discarded Hypalon liner</u>	<u>Non-regulated solid waste</u>	<u>Subtitle D landfill</u>
	<u>Hazardous waste</u>	<u>Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.</u>

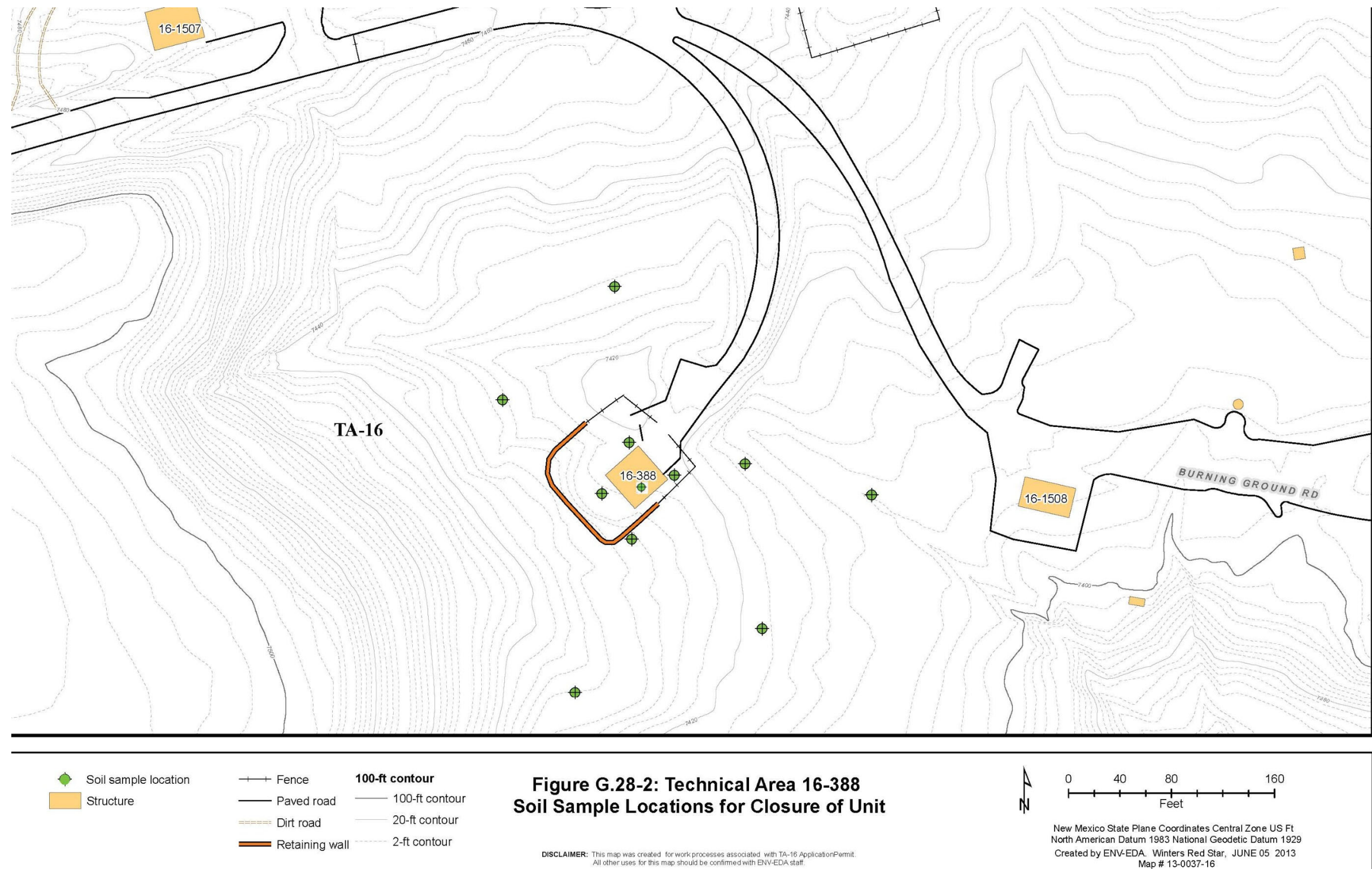


Figure G.28-2: Technical Area 16-388 Soil Sample Locations for Closure of Unit

Addendum 11

**Revisions to Supplement 1-7, Permittees'
Proposed Changes to Attachment J, Hazardous
Waste Management Units**

ATTACHMENT J
HAZARDOUS WASTE MANAGEMENT UNITS

Unit Identifier	Process Codes	Operating Capacity	General Information	Type of Unit
TA-54-38 West Indoor	S01	4,950 gal	Includes High Bay and Low Bay Total square footage – 4,060	Indoor
TA-54-38 West Outdoor Pad	S01 T04	29,160 gal 3,441 gal/day	Includes loading dock and Pad surrounding Includes treatment process for macroencapsulation Total square footage – 37,900	Outdoor (not associated with a regulated unit)
TA-54-38 West Outdoor Pad	S01	13,410 gal	Excess storage capacity Included in total square footage above	Outdoor (not associated with a regulated unit)
TA-55-4, B40	S01 T04	21,500 gal 3,441 gal/day	Located in basement Referred to as Area 1 Includes treatment process for macroencapsulation Total square footage – 3,380	Indoor
TA-55-4, K13	S01	2,500 gal	Located in basement Referred to as Area 4 Total square footage - 208	Indoor
TA-55-4, B05	S01	3,600 gal	Located in basement Referred to as Area 5 Non-liquid wastes only Total square footage - 260	Indoor
TA-55-4, B45	S01 T04	11,000 gal 3,441 gal/day	Located in basement Non-liquid wastes only Includes treatment process for macroencapsulation Total square footage - 788	Indoor

Unit Identifier	Process Codes	Operating Capacity	General Information	Type of Unit
TA-55-4, B13	S01	4,950 gal	Located in basement Non-liquid waste only Total square footage - 495.83	Indoor
TA-55-4, G12	S01	5,225 gal	Located in basement Non-liquid waste only Total square footage - 512.98	Indoor
TA-55-4, Vault	S01	4,000 gal	Located in basement Referred to as Area 6 Total square footage – 4,020	Indoor
<u>TA-55 Mixed Waste Storage Tank System</u>	<u>S02</u>	<u>Storage - 137 gal</u>	<u>TA-55-4 Unit divided into two components (Evaporator Glovebox Storage Tank System and Cementation Storage Tank System)</u> <u>Ancillary equipment and secondary containment.</u> <u>Total square footage – 4,500</u>	<u>Indoor</u>
<u>TA-55 Mixed Waste Stabilization Unit</u>	<u>T04</u>	<u>Treatment - 150 gal / day</u>	<u>TA-55-4 Total square footage – 4,500</u>	<u>Indoor</u>
TA-55-4 Outdoor Storage Pad	S01 T04	135,000 gal 3,441 gal/day	Located outside and west of TA-55-4 Includes treatment process for macroencapsulation Total square footage – 11,100	Outdoor (not associated with a regulated unit)
TA-55-355 Pad	S01 T04	84,370 gal 3,441 gal/day	Includes canopy and pad Includes treatment process for macroencapsulation Total square footage - 13,390	Outdoor (not associated with a regulated unit)
TA-60, Building 17	S01	17,600 gal	Located in the southern wing of Building 17 (TA-60-0017)	Indoor