**Department of Energy**
Richland Operations Office
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0074029

OCT 2 2007

07-SED-0363

Mr. John P. Martell, Manager
Radioactive Air Emissions Section
State of Washington
Department of Health
Office of Radiation Protection
P.O. Box 47827
Olympia, Washington 98504-7827

Dear Mr. Martell:

TRANSMITTAL OF A REQUEST FOR APPROVAL OF ALTERNATIVE EFFLUENT FLOW RATE MEASUREMENT PROCEDURES AND SITE SELECTION AND SAMPLE EXTRACTION PROCEDURES – 209-E FACILITY

The purpose of this letter is to transmit the "Request for Approval of Alternative Effluent Flow Rate Measurement Procedures and Site Selection and Sample Extraction Procedures – 209-E Facility" (Alternate Monitoring Plan). Your staff reviewed and discussed the enclosed Alternate Monitoring Plan in draft form with U.S. Department of Energy, Richland Operations Office (RL), and Fluor Hanford, Inc. (FHI) personnel on August 1, 2007. The Washington Department of Health (WDOH) comments are incorporated in the enclosed final version.

We have appreciated the professionalism with which the Richland Department of Health personnel have worked with FHI and RL concerning the 209-E Facility 296-P-31 stack designation. As you know, it remains RL's position that 296-P-31 is a minor stack and should not be subject to major stack requirements. However, there are no regulatory definitions for some key terms, including "pollution control equipment" and "abatement control equipment." That lack of definition has led to ambiguity regarding the appropriate method for calculating the potential-to-emit. Beginning as early as 2002, WDOH and Hanford staff worked together to explore various avenues for resolving this ambiguity and the designation of 296-P-31. Ultimately, we concluded using the alternative monitoring procedures set forth in the Federal Facility License (FF-01), Section 2.4(3), was the best regulatory path forward. The attached document is the culmination of this multi-year effort.

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EDMC

If you have any questions, please contact me, or your staff may contact Rob G. Hastings, Acting Assistant Manager for Safety and Engineering, on (509) 376-9824.

Sincerely,

David A. Brockman
Manager

SED:MFJ

Enclosure

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Administrative Record (files: 209-E Facility/ Stack 296-P-31; EU ID 210/Criticality Laboratory)
Environmental Portal, A3-95, LMSI

FH-0701672 R1

ENCLOSURE TO ATTACHMENT

**Request for Approval of Alternative Effluent Flow Rate Measurement Procedures and Site Selection and Sample Extraction Procedures – 209-E Facility, including the Stake Probe Inspection Instructions and an Engineering Change Form**

consisting of 26 pages, including this coversheet

# Request for Approval of Alternative Effluent Flow Rate Measurement Procedures and Site Selection and Sample Extraction Procedures – 209-E Facility

This document represents a request for approval of alternative effluent flow rate measurement and effluent sampling for the 209-E Facility stack. The document also provides supporting information to demonstrate that: (1) upgrading effluent sampling to current standards is not practical, (2) the alternative procedures will not underestimate emissions, and (3) the alternative procedures are fully documented.

## A. Facility Background

The 209-E Building was operated from 1960 until 1988 to study conditions resulting in criticality so criticality accidents could be avoided. Many different types of nuclear criticality experiments were performed in the 209-E Building, including research on solutions, solids, fuel elements in lattice assemblies in water and in solutions of fissionable materials. The operations ceased in 1988 with contamination in the building confined almost entirely to gloveboxes and vessels. Since then the building and its contents have been in surveillance and maintenance status, with no handling of radioactive material and very minimal airborne potential indicated, as further addressed below.

## B. Regulatory Background

The 209-E Facility is currently listed as a major, actively ventilated, radioactive air emission unit in the U.S. Department of Energy (DOE) Hanford Site Radioactive Air Emissions License FF-01, with an Emission Unit ID: 210 and a stack number of 296-P-31. The FF-01 License is also included in the Hanford Site Air Operating Permit, issued to DOE by the State of Washington, Department of Ecology (Ecology et al. 2006). A major emission unit has a potential to emit radionuclides into the air in quantities that could exceed 1% (0.1 mrem/yr) of the standard (10 mrem/yr effective dose equivalent) assuming all pollution control did not exist but the facility operations were otherwise normal. Because the 209-E Facility is listed as a major emission unit, the 296-P-31 stack flow rate and emissions must be measured in accordance with the *Washington Administrative Code* (WAC) Chapter 246-247, Radiation Protection – Air Emissions. The WAC 246-247 adopts by reference the effluent flow rate and effluent stream sampling requirements of the *Title 40 Code of Federal Regulations* (CFR) Part 61, "Subpart H--National Emissions Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities." Pertinent excerpts from these regulations are provided in the following.

**Excerpted from 40 CFR 61.93 Emission monitoring and test procedures [adopted by reference in WAC 246-247-035 and WAC 246-247-075]:**

(b) Radionuclides emission rates from existing point sources (stacks or vents) shall be measured in accordance with the following requirements or with the requirements of paragraph (c) of this section, or other procedures for which EPA has granted prior approval:

(1) Effluent flow rate measurements shall be made using the following methods:

(i) *Reference Method 2 of appendix A to part 60 of this chapter shall be used to determine velocity and volumetric flow rates for stacks and large vents.*

Not Met. The requisite measurement location eight diameters downstream from the nearest flow disturbance cannot be met with the existing system without installing new ports in the stack. An alternative flow measurement procedure is proposed.

(ii) *Reference Method 2A of appendix A to part 60 of this chapter shall be used to measure flow rates through pipes and small vents.*

Not applicable to 209-E stack as the stack is 2 feet in diameter.

(iii) *The frequency of the flow rate measurements shall depend upon the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.*

Met. The flow rate of the 296-P-31 stack is relatively constant.

(2) Radionuclides shall be directly monitored or extracted, collected and measured.

(i) *Reference Method 1 of appendix A to Part 60 of this chapter shall be used to select monitoring or sampling sites.*

Method 1 requirement, "Sampling and/or velocity measurements are performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance."

Met. The sampling location for sample extraction is 2.2 diameters upstream and approximately 2 diameters downstream of a flow disturbance. This does not meet the described eight diameter requirement but does meet the requirements for an alternative location.

(ii) *The effluent stream shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in ANSI N13.1-1969 "Guide to Sampling Airborne Radioactive materials in Nuclear Facilities".*

Met. The system currently operates with continuous sampling. The current sampler meets the intent of ANSI N13.1-1969 Appendix A requirements as discussed below.

(iii) *Radionuclides shall be collected and measured using procedures based on the principles of measurements described in appendix B, Method 114. Use of methods based on principles of measurement different from those described in appendix B, Method 114 must have prior approval from the Administrator. EPA reserves the right to approve measurement procedures.*

Met. Samples are collected and analyzed per appendix B, Method 114.

(iv) *A quality assurance program shall be conducted that meets the performance requirements described in appendix B, Method 114.*

Met. The quality control program is conducted to meet requirements described in appendix B, method 114.

(3) When it is impractical to measure the effluent flow rate at an existing source in accordance with the requirements of paragraph (b)(1) of this section or to monitor or sample an effluent stream at an existing source in accordance with the site selection and sample extraction requirements of paragraph (b)(2) of this section, the facility owner or operator may use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures provided that:

(i) It can be shown that the requirements of paragraph (b)(1) or (2) of this section are impractical for the effluent stream.
(ii) The alternative procedure will not significantly underestimate the emissions.
(iii) The alternative procedure is fully documented.
(iv) The owner or operator has received prior approval from EPA.

A request for alternative procedure is documented below.

**Excerpted from WAC 246-247-035 National standards adopted by reference for sources of radionuclide emissions:**

(1) The following federal standards, as in effect on July 1, 2004, are adopted by reference except as provided in subsections (2) and (3) of this section.

These standards apply in addition to other requirements of this chapter.

(a) For federal facilities:

...

(ii) 40 CFR Part 61, Subpart H - National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities.

**Excerpted from WAC 246-247-075 Monitoring, testing and quality assurance:**

(1) All radioactive air emissions monitoring, testing, and quality assurance requirements of 40 CFR 61, Subparts H and I (as effective on October 9, 2002), are adopted by reference, as applicable as specified by the referenced subparts...

(2) Equipment and procedures used for the continuous monitoring of radioactive air emissions shall conform, as applicable, to the guidance contained in ANSI N13.1, ANSI N42.18, ANSI N323, ANSI N317, reference methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17 of 40 CFR Part 60, Appendix A, 40 CFR Part 52, Appendix E, and any other methods approved by the department.

...

(4) The department may allow a facility to use alternative monitoring procedures or methods if continuous monitoring is not a feasible or reasonable requirement.

## C. 209-E Effluent Sampling System Description

1. A comparison (CP-25132) of the existing stack 296-P-31 emissions sampling equipment to the guidance of ANSI N13.1-1969 was completed in response to Washington State Department of Health (WDOH) letter number AIR 04-1201, Item B.3. A copy of the document CP-25132 is attached for purposes of describing the system and its capabilities.
2. As explained in the CP-25132, the effluent stream is well mixed. The Reynolds (Re) number is approximately 1.0E+05 at the sampling location (see Section A3.1 of CP-25132) at a flow rate of 600 feet per minute (fpm). The average flow rate is normally 1.8 times that value.
3. The stack has operated as a very low emissions stack for many years, with annual emissions providing an estimated average dose to the maximally exposed individual (MEI) of 5.9E-09 mrem/yr.
4. Recently, destructive filter analysis of the pre-filter and first stage of high-efficiency particulate air (HEPA) filtration at the stack demonstrated very low challenge to stack filters has occurred over the past several years (HNF-26241).
5. The building is in surveillance and maintenance (S&M) mode meaning very infrequent entries into the building with no work activity other than essential maintenance; there is very little disturbance if any of the residual source material.
6. The stack flow rate is relatively low compared to other stacks on site [1100 cubic feet per minute (cfm) for 209-E vs 36,000 cfm for T Plant or 257,000 cfm for Z-Plant].
7. The sample system is operated in continuous mode, operating at near isokinetic flow as recommended by ANSI N13.1-1969.
8. The inspection of the sample probe in January 2005, conducted in accordance with Table 2 of the 40 CFR 61, Appendix B, Method 114 found the system to be acceptable without cleaning, and this after several (>10) years of continuous use.
9. The sample extraction site is 2.2 duct diameters downstream of the last major flow disturbance. This is less than the minimum of 5 diameters recommended in ANSI N13.1-1969. However, the effluent stream would be expected to be well mixed at the sampling point due to the mixing effects of the fan and the high Re number at the sampling location (see Section 4.2.2 of CP-25132).Therefore, samples taken at this location should be representative with respect to the airstreams in the duct. The system does meet the requirements for an alternate location of greater than 2 duct diameters downstream of a flow disturbance.
10. The current sample extraction probe is a multi nozzle probe and is described in Section A3.4 of CP-25132.
11. The sample line length is minimized. (see Section B1 of CP-25132) such that deposition loss is not a factor.

## D. Request for Approval of Alternative Stack Flow Measurement Method

1. The stack flow measurement at the sample location cannot meet 40 CFR 60, Method 2 or 2A of Appendix A as required by 40 CFR 61.93(b)(1)) because the sample location is not at least 8 duct diameters downstream from any flow disturbance. Relocation of the sampling system is not cost effective. WDOH has agreed to a request for an alternative monitoring plan (see Section C.5 above).
2. Because the flow measurement method at the sample location cannot reasonably be met, it is proposed that the design capacity of the exhaust fan (5500 cfm) will be used to report the effluent flow rate. Approval to use the maximum design capacity is requested as an alternative to flow measurement based on the following:
   a. The fan capacity of the 295-P-31 stack exhaust fan is 5500 cfm. The HEPA filter design capacity is 5200 cfm. Flow measurements taken over the last 6 years show an average flow rate of 1100 cfm. This measured average flow rate is 70% less than the design-based effluent

flow rate of 5500 cfm, meeting the intent of 40 CFR 61.93 (b)(3)(ii) requirement to not significantly underestimate flow rate and thus emissions.

3. This Request for Approval of Alternative Flow Measurement Method is made in accordance with 40 CFR 61.93(b)(3) and its adoption by reference in WAC 246-247-035(1)(a)(ii) and WAC 246-247-075(1) and (4).

## E. Evaluation of Installation with ANSI N13.1-1969 Appendix A

The following is an evaluation of the installation with the guidance contained in ANSI N13.1-1969 Appendix A.

A.1 General

Evaluation – Meets guidance. The sample holder (Figure 1) is fastened directly to the sampling probe, which practically eliminates line length and bends, very similar to the first example design shown in ANSI N13.1-1969, Appendix A, Figure A2.

A2. Selection of Sampling Position along Duct or Stack

Evaluation –Does not meet guidance. The sample location is less than the recommended 5 diameters from the last major flow disturbance. However, at this location, the Re number is high, (>1.0E+05). This is sufficient velocity and turbulence to prevent stratification due to gravity settling.

A.3 Sample Location(s) in the Cross Section of the Duct Evaluation

Evaluation-Meets guidance. Velocity distribution at the sampling location is not documented, however, the Re number is >1.0E+05, which is well within the turbulent region for a well mixed stream. The multipoint sample probe has 3 nozzles (Figure 2) as recommended with nozzle length to diameter ratio and nozzle bend to diameter being greater than the recommended minimum of 5. Thus the ratios are in compliance. However, the nozzle inlets are not tapered.

Use of this procedure will result in a very conservative volume release flow rate. Additionally, the over reporting of release flow rate would compensate for any sampling error associated with the existing sample extraction design and equipment location.

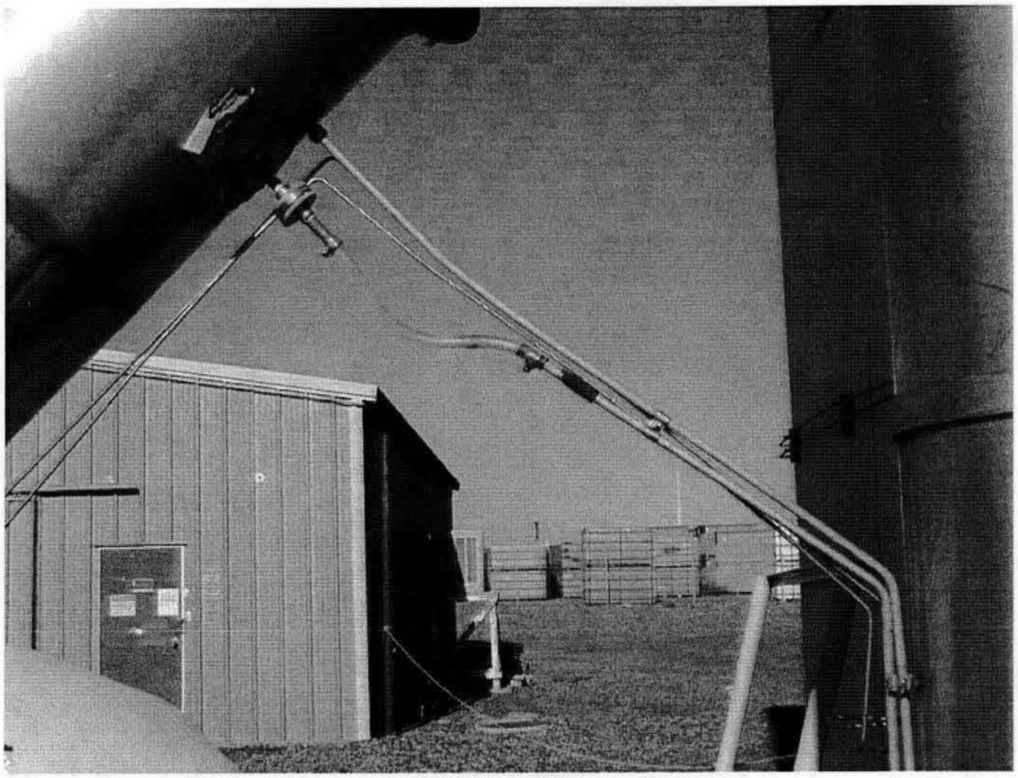

Figure 1. 296-P-31 Sample Holder

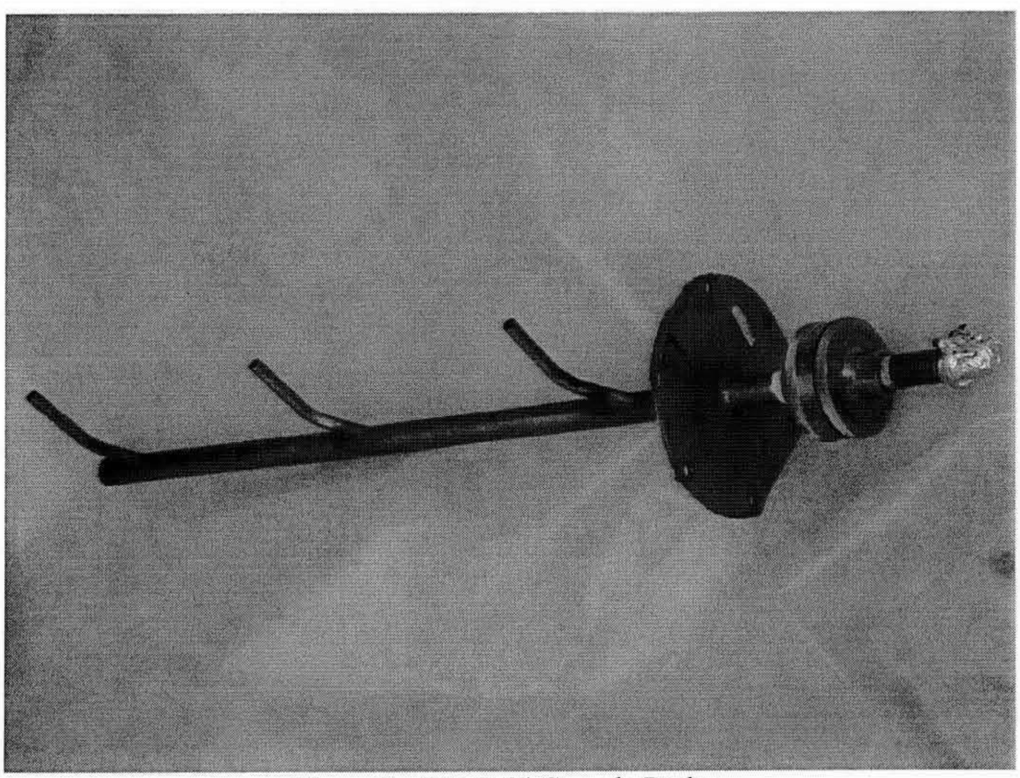

Figure 2. 296-P-31 Sample Probe.

## F. Request for Approval of Alternative Sample Extraction System

1. Use of this procedure (described in Section D) will result in a very conservative volume release flow rate. Additionally, the over reporting of release flow rate would compensate for any sampling error associated with the existing sample extraction design and equipment location.
2. The proposed use of the current sample extraction equipment, if operated continuously, will not significantly underestimate actual emissions since the sample flow is near isokinetic (.5 cfm).
3. For other than those particulars described above or in the referenced material, representative samples of the effluent stream will be withdrawn continuously from the sampling site following the guidance presented in ANSI N13.1-1969 as discussed in Section E1.
4. Effluent samples collected by the system will be retrieved on a monthly frequency, with those samples composited for calendar quarterly analysis

## G. Quality Assurance Requirements Related to Sample System Inspections, Sample Handling, and Sample Analysis

1. The sample extraction, sample handling, and sample analyses will comply with the Hanford Site's NESHAP Quality Assurance Project Plan for Radioactive Air Emissions Data (HNF-EP-0528-7). [note: this will include laboratory analysis/identification of radioisotopes which contribute 10% or more of the potential emissions]
2. The 296-P-31 sampling system was inspected per 40 CFR 61, Appendix B, Method 114, Table 2 annual requirements (see inspection package attached). Because this is the first inspection in more than 10 years of stack operation, and a clean system was found to be in place, it is recommended that rather than an annual inspection a 5 year frequency for inspection is adequate. Approval of this recommendation is requested, based on the S&M status of the facility and the recent inspection which found the system to be acceptable without cleaning.

## H. References


AIR 04-1201, Letter to Keith A. Klein, RL, from Allen W. Conklin, Washington State Department of Health, regarding ALARACT Demonstration for the 296-P-31 Stack, dated December 7, 2004.

ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, American National Standards Institute, New York, New York, Feb. 19, 1969.

40 CFR 60, Method 2 or 2A of Appendix A, *Test Methods.*

40 CFR 61.93, *Emission Monitoring and Test Procedures.*

CP-25132, "Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, for the 296-P-31 Stack," March 2005.

Ecology, 2006, *Hanford Site Air Operating Permit 2006 Renewal*, Number 00-05-006 Renewal 1, Washington State Department of Ecology, Washington State Department of Health, Benton Clean Air Authority, effective 01/01/2007.

EPA, 1999, Letter to RL from EPA Region 10, OAQ-107 dated 08/16/1999 "approval to use an alternative flow measurement method as proposed for the 296-B-10 stack."

EPA, 2003, Letter to J. Hebdon, RL, from B. Wiese, EPA Region 10, OAQ-107 dated 03/26/2003, "approval to use an alternative flow measurement method as proposed for the 291-T-1 stack."

EPA, 2004, Letter to K. A. Klein, RL, from J. KenKnight, EPA Region 10, OAQ-107 dated 07/19/2004, "Request for Alternative Flow Measurement Procedure and the Sample Extraction System of stack 296-Z-14 of the 232-Z Contaminated Waste Recovery Process Facility at the Plutonium Finishing Plant."

HNF-26241, *Unabated Radionuclide Emissions Estimate for the 209E 296-P-31 Stack*, June 2005, Fluor Hanford, Richland, Washington.

WAC 246-247, *Radiation Protection – Air Emissions.*

ATTACHMENT 1 TO ALTERNATE MONITORING PLAN

**Engineering Change Form,**
***Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, for the 296-P-31 Stack***

consisting of 10 pages, including this coversheet

S

# EDC (ENGINEERING DOCUMENT CHANGE) FORM

## Document Identification

**1. Change Title:**
Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, for the 296-P-31 Stack

**Key Words:**
209E, Critical Mass Laboratory, ANSI N13.1-1969, 296-P-31, comparison, stack, sampling, probe

**8. Release:** Release CACN 119162

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**2. Project No./Work Package No.:**
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**3. Review Designators:**
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Additional Reviewers: ☐ ☐ ☐ ☐ ☐ ☐

| 4. Area | 5. Building | 6. Facility | 7. System No. |
|---|---|---|---|
| 200 E | 209E | Critical Mass Laboratory | 296-P-31 |

**9. USQ Required?** ☐ USQ ☐ CX ☒ NA No.:

| 10. Distribution - Name | MSIN | Distribution - Name | MSIN |
|---|---|---|---|
| DL Johnson | L1-08 | SJ Giamberardini | S4-49 |
| GJ LeBaron | S4-49 | | |

**11. Change Description (description and reason for requested change):**
The 209E Critical Mass Laboratory stack sampling system is compared with the ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, in response to WDOH letter AIR 04-1201, item B.3. This ANSI standard would be applicable if the stack was designated major.

## Approvals

| 12. Change Originator | TA/DA | Engineering Management/TA Manager |
|---|---|---|
| DL Johnson 3-7-05 | Daniel L Johnson 3-7-05 | SG Giamberardini 7MAR05 |
| Print/Signature/Date | Print/Signature/Date | Print/Signature/Date |
| Title Environmental | Title | Title |
| Dale L Dyekman 3-8-05 | | |
| Print/Signature/Date | Print/Signature/Date | Print/Signature/Date |

## 13. Document Index

| Action | Number | Title | Rev (being issued) | Change Page(s) | Config Baseline |
|---|---|---|---|---|---|
| N | CP-25132 | Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, for the 296-P-31 Stack | 0 | | ☐ |

**14. Potentially Affected Documents Not Modified By This EDC:**

| Document Type | Document Number/Revision | Document Owner (Organization) | Technical Authority Notified | Date Notified |
|---|---|---|---|---|
| NA | | | | |

CP-25132
Revision 0

# Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, for the 296-P-31 Stack


Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

**Fluor Hanford**
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Further Dissemination Unlimited

CP-25132
Revision 0
EDC #: HNF-EDC-05-25133

# Critical Mass Laboratory 209E Comparison with ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities,* for the 296-P-31 Stack

Document Type: ES    Program/Project: CP

D. L. Johnson
Fluor Hanford

Date Published
March 2005

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Printed in the United States of America

Total Pages: 8

# CRITICAL MASS LABORATORY 209E COMPARISON WITH ANSI N13.1-1969, *GUIDE TO SAMPLING AIRBORNE RADIOACTIVE MATERIALS IN NUCLEAR FACILITIES*, FOR THE 296-P-31 STACK

A comparison with the applicable sections is provided as follows:

4.2.1.2 Sampling point should be a minimum of five diameters (or 5 times the major dimension for rectangular ducts) downstream from abrupt changes in flow direction or prominent transitions.

The sample probe is located approximately 44" downstream of the fan outlet in a round duct approximately 20" in diameter, based on field measurements. Therefore, it is only about 2 diameters downstream from the last major flow disturbance, which is less than the minimum 5 diameters.

4.2.2 Samples should be representative with respect to physical and chemical composition of airstream.

The effluent stream would be expected to be well mixed at the sampling point due to the mixing effects of the fan, and the fact that the probe is located several diameters downstream from the last contributor. The multipoint sample probe has 3 nozzles as recommended in section A3.2, though they do not appear to be located exactly in the centers of equal area annuli. Although the record sampler was probably designed to be isokinetic, it has typically operated at approximately 4 times this value. (The sampler was probably built based on a design flow matching the 4 HEPA filter design flow of 4000 cfm.) At a typical stack flow rate of 1200 scfm, the isokinetic sample flow rate would be 0.5 cfm. The sampler has been normally operated at 2 cfm (this sample flow rate may be reduced in the future to more closely match the isokinetic design). The isokinetic flow rate is calculated by multiplying the stack flow by the area ratio of the sum of the probe nozzle areas (3 nozzles, 0.237" ID) divided by duct area (20" duct diameter) at the sampling location as follows:

Isokinetic Sample Flow = (1200 scfm)(0.13 $in^2$)/(310 $in^2$) = 0.5 scfm

4.3.1 Sensitivity and accuracy of the analytical or counting method will determine the minimum volume of air which must be sampled to obtain the requisite accuracy and precision of results.

Samples are normally obtained over a one-month period at a rate of 2 cfm, providing more than the minimum volume for the WSCF Laboratory to meet the contractual Minimum Detectable Concentrations, as outlined in HNF-EP-0835-10 "Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Effluent and Environmental Monitoring Program During Calendar Year 2004", which are based on 40 CFR 61, Appendix E, Table II.

4.3.2 If possible, the sample should be large enough to permit 1/10 the permissible level to be determined with reliability.

As stated above, samples are normally obtained over a one-month period at a rate of 2 cfm, providing more than the minimum volume for the WSCF Laboratory to meet the contractual Minimum Detectable Concentrations, as outlined in HNF-EP-0835-10 "Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Effluent and Environmental Monitoring Program During Calendar Year 2004", which are based on 40 CFR 61, Appendix E, Table II.

5.2.2 Airborne particulate matter should be evaluated and characterized at regular intervals and before any anticipated process change.

Particulate matter has been sampled for one 4-week period annually to provide periodic confirmatory monitoring, consistent with requirements for minor stacks and the relatively static condition of the facility. There is no anticipated process change. It is temporarily being sampled continuously as discussed above.

5.2.2.1 Appropriate filtration should be chosen for sampling.

Particulates are collected on Versapor 3000 filters, as approved and characterized in ANSI N13.1-1999, Annex D, Table D.1.

5.2.2.1.7 Filter holders and support should be chosen for proper chemical compatibility, mechanical strength, sealing, and ease of operation in changing filters. Sample air movers should have the capability of delivering the necessary air flow against the resistance of the sampling system.

Standard commercially available sample holders have been used for the sampling system. The sample holders are easily screwed apart and have a sealing ring to ensure that all the air flows through the filter. The vacuum system is standard, and provides adequate air flow through the sampler.

5.3 Airborne radioactive gases or volatile materials should be sampled by an appropriate method if present.

Not applicable. Radioactive gases are not present in sufficient quantity for measurement.

A1. Minimization of the length and bends of sample delivery lines will contribute to representative sampling.

The sample holder is fastened directly to the sampling probe, which practically eliminates line length and bends, very similar to the first example design shown in ANSI N13.1-1969, Appendix A, Figure A2.

A2. Selection of sampling position along a stack: The distance from the last upstream disturbance to the point of sample extraction should be a minimum of five and preferably ten or more duct diameters downstream. Sampling from a vertical run avoids stratification due to gravity settling. Sampling as far downstream as possible avoids most transient variation in airstream quality.

As previously discussed, the sample probe is located approximately 44" downstream of the fan in a round duct approximately 20" in diameter. Therefore, it is less than the minimum 5 diameters from the last major flow disturbance.

Sampling is from a semi-vertical run (approximately a 45° angle). Typical average air velocity is approximately 600 fpm, and the airflow has a Reynolds number of approximately 100,000. This is sufficient velocity and turbulence to prevent stratification due to gravity settling. [Settling calculations from a spreadsheet by John Glissmeyer, PNNL, based on EPA Air Pollution Training Course 413, "Control of Particulate Emissions, Student Manual", by David S. Beachler and James A. Jahnke, document # EPA 450/2-80-066, demonstrate insignificant stratification at these higher velocities (e.g. only 0.1% settling per foot of 10 micron particles would be expected in a horizontal 20" duct at 600 fpm, and 1% at a hypothetical 70 fpm).]

A3.1 Velocity and flow distribution should be known for the sampling point, and particle and gaseous composition should be representative.

Measurement of the velocity distribution at the sampling location is not documented. However the Reynold's number at the duct sampling location is approximately 100,000, which is solidly in the turbulent regime, well over the 2100 threshold. According to A3.3.2, "As the flow becomes more turbulent, the velocity becomes more nearly uniform across the duct". Being near the fan, the velocity profile might be skewed. The effluent stream would be expected to be well mixed at the sampling point due to the mixing effects of the fan, and the fact that the probe is located several diameters downstream from the last contributor.

A3.2 A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable.

The multipoint sample probe has 3 nozzles as recommended in section A3.2. They are distributed over the cross-section of the duct, but they do not appear to be located exactly in the centers of equal area annuli.

A3.3 The velocity distribution across the duct or stack should be known in order to establish isokinetic flow and representative sample points.

Measurement of the velocity distribution at the sampling location is not documented; however the stack flow is measured in accordance with 40 CFR 60, Appendix A, Method 2. Therefore the average velocity is known and may be used to establish an approximate average isokinetic flow rate at this duct location. The Reynolds number at the duct sampling location is approximately 100,000, which is solidly in the turbulent regime, well over the 2100 threshold. According to A3.3.2, "As the flow becomes more turbulent, the velocity becomes more nearly uniform across the duct". Being near the fan, the velocity profile might be skewed.

A3.4 Sampling probe configuration is recommended by figures in this standard, with bend radius meeting criteria and precisely tapered probe end edges.

The 296-P-31 sampler uses a multipoint probe, similar to that as described in Figure A5 of ANSI N13.1-1969. Figure A5 specifies the nozzle length as approximately five times the diameter, and the radius of the bend as five or more times the diameter. The nozzle OD is 0.317" and ID is 0.237". Lengths are approximately 1-3/4", and bend radii are approximately 2". The length to diameter ratio (based on the inside diameter, because the inside would seem to be the important dimension) is ~7.4, and the radius to diameter ratio is ~ 8.4. Thus the ratios are in compliance. The nozzle inlets are not tapered.

B1. Sampling line length should be kept to a minimum length. An estimate of the fraction of particles deposited in sampling lines under various conditions should be made using the experimental data presented in this appendix.

The sampling line length is kept to a minimum length. The sample holder is coupled directly onto the probe, essentially eliminating the sample line, similar to the first example design shown in ANSI N13.1-1969, Appendix A, Figure A2.

B2. Particles carried by an airstream moving in a horizontal tube will tend to settle to the bottom of the tube due to the influences of gravity. The equations apply to laminar flow only.

Not applicable. The probe is not horizontal, nor is the flow laminar, so gravity settling would not be expected to be appreciable.

B3 Velocities must be kept high enough to avoid appreciable losses by Brownian diffusion.

The sample flow has a Reynold's number of approximately 4500 at the nozzles, and from 2200 to 6600 in the manifold. All are in the turbulent regime (>2100), therefore it is reasonable to expect that velocities are high enough to avoid appreciable losses by Brownian diffusion.

B5 Elbows in sampling lines should be avoided if at all possible. When required, the bend radius of the elbow should be as long as practical, and design flow rates through any line containing an elbow should be kept low. When possible, the sampler installation should allow for probe removal in order to evaluate the losses in the probe entry elbow and to permit cleaning.

There are no unnecessary bends. The sample holder is fastened directly to the sampling probe, which eliminates sample line bends, very similar to the first example design shown in ANSI N13.1-1969, Appendix A, Figure A2. The probe is accessible for removal.

ATTACHMENT 2 TO ALTERNATE MONITORING PLAN

**Stake Probe Inspection Instructions**

consisting of 7 pages, including this coversheet

## 1.0 SCOPE:

These instructions provide direction for inspecting the 209E stack sample probe in accordance with 40CFR61 NESHAP Amendment, as would be performed on major stacks. In addition, the probe will be taken to the laboratory for rinsing to provide a sample to be used in a line loss study, assuming there are deposits. As-built measurements will be taken to provide information to be used in a comparison to the ANSI standard. The work scope is divided into four main areas:

- **PROBE REMOVAL FOR INSPECTION AND CHARACTERIZATION**
- **PREPARATION OF PROBE FOR CLEANING AT LABORATORY**
- **PROBE FINAL INSPECTION AND REINSTALLATION**
- **RESTORATION AND SAMPLE LINE LEAK TEST**

The 209E exhaust system and stack sample pump will be shut down during this activity, except during leak test.

## 2.0 SPECIAL TOOLS, EQUIPMENT, AND MATERIALS:

- Ladder or elevated work platform,
- Site Bore Scope (Stack Probe & Sample Line Inspection Equipment),
- Ultrasonic Leak Test Equipment,
- Digital Camera,
- Decon supplies,
- Metal Tape,
- Calibrated Calipers (for measuring up to ½" dimension) and tape measure for up to 24"
- RTV sealant, or equivalent.

## 3.0 REFERENCES

3.1 FSP-3647, Section OP-5, *Access Control for CP S&M Facilities.*

3.2 Drawings:

- H-2-96072 Sht 1, *P&ID HVAC Supply and Process Exhaust*

3.3 40CFR61 NESHAP Amendment.

3.4 Standard Operating Procedure 2CP-SOP-ENV-54006, *209E Stack Sampling.*

3.5 Standard Operating Procedure 2CP-SOP-0-05002, Start-up & Shutdown of *209E Building Exhauster*

3.6 Vendor Operating Procedure/Guidance for the Site Video Scope.

**4.0 PRECAUTIONS/LIMITATIONS:**

4.1 If during the performance of this instruction, any equipment malfunctions, personnel error, procedural inadequacy, environmental, or physical hazards exist that may pose a risk to personnel and/or equipment, work shall immediately be stopped. Equipment shall be placed in a safe condition, and the Field Work Supervisor, and/or Facility Administrator shall be notified immediately.

4.2 Do not use the bore scope for the probe inspection if contamination is found in or on the probe, because this could disturb material that needs to be quantified by the laboratory as part of the line-loss study.

4.3 The WSCF Laboratory will not accept the probe for analysis if a survey level exceeds 3000 cpm by the PAM measurement. Sending the probe may be delayed if radon is suspected, to allow radon decay, or the probe may be sent to the 222-S Laboratory. The WSCF Laboratory is preferred.

4.4 Shipment of the probe to the laboratory for analysis may not be required if probe is found uncontaminated.

**5.0 PREREQUISITES:**

5.1 All personnel entering the 209E area must be in compliance with access controls requirements per FSP-3647, Section OP-5, *Access Control for CP S&M Facilities*.

5.2 Arrangements for survey coverage support by a Radiological Control Technician (RCT) shall be completed.

5.3 Electrician shall inspect cords and test GFCI receptacles.

5.4 Notify ECO of pending exhaust fan shutdown.

5.5 Remove sample filter and send to lab per Standard Operating Procedure 2CP-SOP-ENV-54006, *209E Stack Sampling*.

5.6 Insert a non-record filter paper and shut down the sample pump.

5.7 Shut down the exhaust fans, using Operating Procedure 2CP-SOP-0-05002, Start-up & Shutdown of *209E Building Exhauster*, as early as two days prior to scheduled work to allow probe radon contamination to decay.

5.8 Document on the Data Sheet the time and date that the exhaust fans and stack sample pump are shut down.

5.9 Stage Site Bore Scope, ladder/platform.

5.10 Lock and tag power supply to the 209-E exhaust fan using Controlling Organization L&T in accordance with attached TAF.

## 6.0 INSTRUCTIONS:

### 6.1 PROBE REMOVAL FOR INSPECTION

**NOTES:**

- RCT shall provide continuous coverage during probe removal/ inspection activities.
- For general operating guidance of the bore scope, refer to *Sample Line Video Inspection Procedure – Template, included in the work package.*

6.1.1 Scribe a mark on the sample holder to ensure correct orientation when replacing.

6.1.2 Access stack sample holder, remove flexible tubing from sample holder, and tape openings.

6.1.3 Disassemble.probe flange and carefully remove the probe from the stack, taking care to minimize contact between the nozzle and the inner duct or port surfaces. Pull the probe through a cloth as it is removed to minimize spread of potential contamination.

6.1.4 Engineer and QC confirm nozzle orientation (i.e. axial, into air stream) and record on Data Sheet.

6.1.5 Place tape over the duct hole.

6.1.6 RCT measure alpha smear activity (obtained from probe exterior during probe removal) with a PAM instrument.

6.1.7 Take photos of probe showing exterior and interior condition as visible from openings.

6.1.8 Engineer and QC inspect probe nozzle(s) for visible deposits and general condition, and record results on Data Sheet.

6.1.9 Remove sample holder and have Engineer and QC inspect probe manifold for visible deposits and general condition, and record results on Data Sheet.

6.1.10 Insert bore scope into the stack sample probe and inspect the tubing and nozzle(s) for visible deposits, and record results on Data Sheet, if required by the FWS.

## 6.2 PREPARATION OF PROBE FOR CLEANING AT LABORATORY

**NOTE:**

The FWS shall determine if this section will be required to be performed.

6.2.1 Package probe for shipping to the laboratory per shipper instructions.

6.2.2 Bag sample holder and store in sample cabinet.

6.2.3 Fill out COC form (Attachment 1) to prepare for sending the probe to the laboratory for rinsing/analysis.

6.2.4 Perform survey of probe container for shipment.

6.2.5 Transport probe to laboratory as directed by the FWS.

## 6.3 PROBE FINAL INSPECTION AND REINSTALLATION

6.3.1 Repair/clean probe as necessary, and Re-inspect probe nozzle(s) and manifold for visible deposits, and record results on Data Sheet.

~~6.3.2 Take photos of probe showing clean probe exterior and interior openings.~~ CJS 2-17-05 Dan Johnson PER TELECON 2-17-05

6.3.3 QC measure probe dimensions, including nozzle ID and OD, nozzle length, approximate centerline bend radius, and probe ID, OD and length to flange, and record on Data Sheet.

6.3.4 Re-attach sample holder to probe.

6.3.5 Access stack sample flange and carefully insert the probe into the stack, ensuring proper nozzle orientation (i.e. axial, into air stream) and taking care to minimize contact between the nozzle and the inner duct or port surfaces, and re-attach and seal flange.

6.3.6 Re-attach flexible tubing to sample holder.

## 6.4 RESTORATION AND SAMPLE LINE LEAK TEST

6.4.1 Ensure a non-record sample filter is inserted into sample holder.

6.4.2 Switch sample pump ON.

6.4.3 QC perform an ultrasonic in-service leak test at the stack sample probe to sample holder connection. If leakage is detected contact the FWS. Correct and repeat test, as directed by the FWS.

6.4.4 QC record final ultrasonic in-service leak test results on Data Sheet.

6.4.5 Remove Controlling Organization L&T from 209-E exhaust fan power supply.

6.4.6 Remove non-record filter paper, install new record filter paper, and reset sample flow rate per Standard Operating Procedure 2CP-SOP-ENV-54006, *209E Stack Sampling*.

6.4.7 Start/Run the exhaust fans using Standard Operating Procedure 2CP-SOP-0-05002, Start-up & Shutdown of *209E Building Exhauster.*

6.4.8 Document on Data Sheet the time and date the exhaust fan and sample pump are placed in operation.

6.4.9 Notify ECO of the date and time the exhaust fans were restarted.

## 7.0 RETEST

Verify that the 209-E exhaust system and stack sampling system are operating properly.

# Data Sheet

5.8 Shutdown time/date for exhaust fans and sample pumps 1-24-05 8:35 AM / 1-24-05 8:35 AM

**Initial Inspection**

| Step | Location | Visible Deposits (YES/NO) | Orientation | Condition | Printed Name/ Signature | Date |
|---|---|---|---|---|---|---|
| 6.1.4<br>6.1.8 | Nozzle(s) | Yes (1) | OK - axial | Good | Eng D.L. Johnson [signature]<br>QC [stamp FH 017] | 1-25-05<br>1-25-05 |
| 6.1.9 | Manifold | Not sure (2) | | Good *(2) | Eng D.L. Johnson [signature]<br>QC [stamp FH 017] | 1-25-05<br>1-25-05 |

Comments/Observations:
(1) Only a dusting of residue (2) Saw 3 bumps. May be welds. Will determine later if it is a deposit or welds

John Markell : 727-0646

6.1.10 Results of bore scope inspection (if required by FWS): Determined that the bumps were welds/metal. Only minimal deposits at opposite nozzle.

D.L. Johnson [signature] / 2-17-05
Print name/signature Date

**Final Inspection**

| Step | Location | Visible Deposits (YES/NO) | Printed Name/Signature | Date |
|---|---|---|---|---|
| 6.3.1 | Nozzle(s) | No | D.L. Johnson [signature] | 2-17-05 |
| | Manifold | No* | D.L. Johnson [signature] | 2-17-05 |

Comments/Observations * Only Isolated - generally clean

**Probe Dimensions**

| Step | Nozzle(s) ID | Nozzle(s) OD | Nozzle(s) Length | Approx. Bend Radius | Probe ID | Probe OD | Probe Length |
|---|---|---|---|---|---|---|---|
| 6.3.3 | 0.237 | 0.317 | 2 3/4" | 2" | 0.495" | 0.670" | 17 3/4" |

[stamp FH 017] / 2-17-05
QC Date

**Leak Test**

6.4.4 Ultrasonic leak test results: (Pass) Fail

[stamp FH 017] / 2-17-05
QC Date

6.4.7 Startup time/date for exhaust fans and sample pumps: 12:35 PM / 2-17-05