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On September 1, 2005, Fluor Hanford completed a series of In-Place Leak tests on the PUREX Deep Bed filter #2 system per Work Package CP-05-05014. The testing was performed in support of ongoing PUREX stack 291-A-1 redesignation efforts. Specifically, testing was performed to address concerns regarding the validity of the Deep Bed #2 Filter efficiency assumption used in the PUREX stack Potential-to-Emit (PTE) calculations per report HNF-20611.

Report HNF-20611, Revision 0, *Unabated Emissions Estimate for the PUREX 291-A-1 Stack* provides a technical basis for redesignation of 291-A-1 stack from a major to a minor stack. Report calculations estimate a total (potential) unabated offsite dose for the PUREX stack of 0.031 mrem/yr. Though well below the 0.1 mrem/yr threshold for major stack status, given the PUREX facility inventory and concerns regarding the regarding the validity of using historical Deep Bed filter efficiency data for establishing an assumed Deep Bed Filter efficiency in the PTE calculations, it was determined additional testing was necessary to strengthen the technical bases for the proposed downgrade.

Using ASME N510-1989 as technical guidance, as is allowed by the standard per Section 1.2 for non-ASME N509 systems, a new procedure was developed to test the Deep Bed Filter system. Primary goals of this testing were to obtain current and accurate filter efficiency data, and to validate or invalidate the reported conservatism of PTE estimates per HNF-20611. To address uncertainties associated with the adequacy of aerosol mixing, a number of features not normally provided in a standard in-place leak test were incorporated into the test procedure. For example, where possible, both single-point and multipoint aerosol concentration readings were recorded at each aerosol sample location. Though not fully equivalent to an ASME N510 Section 9.0, *Air-Aerosol Mixing Uniformity Test*, the additional sample data provides added assurance that reported test results are in fact representative of the actual filter Deep Bed #2 filter system efficiency.

Test results per Work Package CP-05-05014 indicate a final Deep Bed #2 Filter aerosol penetration value of 0.033%. This translates into an overall efficiency of 99.967%. Per HNF-20611, PTE calculations using an assumed Deep Bed #2 Filter efficiency of 99.97% resulted in an estimated total (potential) unabated offsite dose

EDC (ENGINEERING DOCUMENT CHANGE) FORM (continued)

for the PUREX stack of 0.031 mrem/yr. Since the actual efficiency (99.967%) is less than the assumed HNF-20611 value (99.97%), the reported PTE estimate is conservative (i.e., PTE is slightly overstated). As such, In-Place Leak Test results validate acceptability of the efficiency assumption used in the HNF-20611 PTE calculation, and reinforce earlier technical bases conclusions regarding the proposed redesignation of the PUREX 291-A-1 Stack from a major to a minor stack.

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PUREX Deep Bed Filter #2 Aerosol Test and Efficiency Evaluation

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

Project Hanford Management Contractor for the
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PUREX Deep Bed Filter #2 Aerosol Test and Efficiency Evaluation

EXECUTIVE SUMMARY

On September 1, 2005, Fluor Hanford completed a series of In-Place Leak tests on the PUREX Deep Bed filter #2 system per Work Package CP-05-05014. The testing was performed in support of ongoing PUREX stack 291-A-1 redesignation efforts, based upon criteria for stack designation provided by EPA in the National Emission Standards for Hazardous Air Pollutants; Radionuclides in Title 40 Code of Federal Regulations Part 61, Subpart H, Section 61.93. The Section 61.93 requirements are also adopted by the State of Washington in the Washington Administrative Code (WAC) Chapter 246-247-035. Specifically, testing was performed to address concerns regarding the validity of the Deep Bed Filter #2 efficiency assumption used in the PUREX stack Potential-to-Emit (PTE) calculations per report HNF-20611.

Report HNF-20611, Revision 0, "*Unabated Emissions Estimate for the PUREX 291-A-1 Stack*" provides a technical basis for redesignation of 291-A-1 stack from a major to minor stack. Report calculations estimate a total (potential) unabated offsite dose for the PUREX stack of 0.031 mrem/yr. Though well below the 0.1 mrem/yr threshold for major stack status, given the PUREX facility inventory and concerns regarding the validity of using historical efficiency data for establishing an assumed Deep Bed Filter efficiency in the PTE calculations, it was determined additional testing was necessary to strengthen the technical bases for the proposed downgrade.

Using ASME N510-1989 as technical guidance, as is allowed by the standard per Section 1.2 for non-ASME N509 systems, a new procedure was developed to test the Deep Bed filter system. Primary goals of this testing were to obtain current and accurate filter efficiency data, and to validate or invalidate the reported conservatism of PTE estimates per HNF-20611. To address uncertainties associated with the adequacy of aerosol mixing, a number of features not normally provided in a standard in-place leak test were incorporated into the test procedure. For example, both single-point and multipoint aerosol concentration readings were recorded at each aerosol sample location. Though not equivalent to an ASME N510 Section 9.0, *Air-Aerosol Mixing Uniformity Test*, the additional sample data provides added assurance that reported test results are in fact representative of the actual Deep Bed #2 filter system efficiency.

Test results per Work Package CP-05-05014 indicate a final Deep Bed #2 Filter aerosol penetration value of 0.033% ± 0.0008% at 1 standard deviation. This translates into an overall filtration system efficiency of 99.967% ± 0.001% at 1 standard deviation. Per HNF-20611, PTE calculations using an assumed Deep Bed #2 Filter efficiency of 99.97% results in an estimated total (potential) unabated offsite dose for the PUREX stack of 0.031 mrem/yr. Since the actual efficiency (99.967%) is less than the assumed HNF-20611 value (99.97%), the reported PTE estimate is conservative (i.e., PTE is slightly overstated). As such, In-Place Leak Test results

validate acceptability of the efficiency assumption used in the HNF-20611 PTE calculation, and reinforce earlier technical bases conclusions regarding the proposed redesignation of the PUREX 291-A-1 Stack from a major to a minor stack.

1.0 INTRODUCTION

The PUREX facility is deactivated and has no future processing mission. The PUREX stack 291-A-1 is currently designated a major emission unit in the Federal Facility Compliance Agreement and Hanford Site Air Operating Permit. While evaluating the stack for required upgrades to meet the newly adopted NESHAPs maintenance and test policies, it was suggested that the current PUREX stack PTE may be less than 0.1 mrem/yr. If this PTE assumption was correct, and the PUREX stack qualified for a minor stack designation and appropriate periodic confirmatory monitoring. To further investigate the feasibility of revising the stack designation, Fluor Hanford (FH) prepared test procedures to collect current air sample data to support PTE calculations. Because there were no sample locations upstream of the Deep Bed filter system, it was decided to perform sampling at a location downstream of the Deep Bed system and back-calculate stack emissions using an assumed Deep Bed filter efficiency. The air sample tests were completed in late 2003 and early 2004.

Based on past aerosol test data, a conservative Deep Bed filter efficiency estimate of 99.97% was assigned to the PTE calculations. Considering available aerosol test data, an original designed efficiency of the system (99.9%), and age of the system (37 years), FH believed the assumed system efficiency of 99.97% was conservative. Using 99.97%, the potential to emit was estimated to be 0.031 mrem/yr, which is less than the 0.1 mrem/yr threshold for Major Stack designation.

On July 29, 2004, Fluor Hanford issued report HNF-20611, Revision 0, "*Unabated Emissions Estimate for the PUREX 291-A-1 Stack.* The report serves as the technical basis for the FH-proposed downgrade of the PUREX 291-A-1 stack. The HNF-20611 report describes the airflow and air sample tests performed, the test results, and includes a discussion on the laboratory analyses performed on the year 2003 and 2004 test data.

After reviewing HNF-20611, the Washington Department of Health (WDOH) believed a more cautious approach to the stack downgrade was warranted. Of primary concern was the reliability of the efficiency assumptions used to back calculate the PTE. Specific WDOH Data concerns included: past data may not reflect the actual conditions; past test data was not obtained using current industry standards (e.g., ASME N510), and report assumptions relating the older test data to current conditions could not be verified. In short, additional testing was necessary to show actual system performance and to assure report assumptions did not yield non-conservative estimates of the PUREX PTE.

To address these concerns, it was decided to perform an In-Place leak Test of the Deep Bed #2 filter system to determine its actual (current) efficiency. The remainder of this report describes the development and performance of the Deep Bed filter test procedure and the results of the test.

Note: *See HNF-20611, Revision 0, for a detailed description of the PTE calculation, a review of the air sample test data, and a more extensive discussion on the PUREX Deep Bed Filter design and its history.*

2.0 PURPOSE

The purpose of this Deep Bed #2 filter test is simply to establish an accurate determination of filtration efficiency to support PTE calculations for PUREX stack 291-A-1.

3.0 DESCRIPTION

3.1 System Design

In brief, PUREX Deep Bed Filter #2 (DBF#2) currently serves a pre-filter function for Stack 291-A-1 HEPA filters. The system was designed and installed per Project CAC-140 in 1965 and as such predates today's codes and standards for HEPA system design and testing. The filter system is comprised of two major parts (i.e., fore-filter and after-filter.) According to the design specifications, DBF#2 was designed to have a particulate removal efficiency of 99.9% with an installed airflow capacity of 125,000 scfm. The sampling system is deactivated and abandoned in-place. The DBF#2 filter system is located upstream of ten parallel banks of testable HEPA filters with two stages of filtration each. The PUREX building is currently unoccupied and deactivated. The exhaust system operates in a reduced once-through ventilation mode (typically about 35,000 scfm, relatively constant flow) with only three of the ten parallel Building 291-AE HEPA banks in service at any given time.

3.2 Historical Test Method Evaluation and New Test Method Development

The Deep Bed filter system presents some unique test challenges. For this reason, the FH HVAC engineering discipline manager (who is also the designated FH HEPA Subject Matter Expert (SME)) was asked to assist in the evaluation of the previous test method and with the development of a revised, more reliable, aerosol test procedure.

As previously noted, DBF#2 was not designed and installed in accordance with today's codes and standards (e.g., ASME N509, ASME AG-1, etc.) Although design efficiency of the PUREX Deep Bed filter (99.9%) may approach that of a standard

HEPA filter system (99.95%), the ability to demonstrate system performance using an ASME N510 fully compliant test is limited by configuration. This problem is not uncommon among many older nuclear air cleaning systems. Authors of the Standard recognized that older filter systems that were designed to other standards cannot always be tested in full accordance with ASME N510. As is shown in the following ASME N510 excerpt, allowances have been made to enable testing of Non-N509 systems using ASME N510 test practices:

> Per ASME N510-1989, Section 1 (1.2) "*Sections of this Standard may be used for technical guidance for testing air treatment systems designed according to other criteria*".

ASME-specified prerequisite tests are intended to verify the quality of aerosol mixing, flow uniformity, and other parameters to reduce uncertainties in data accuracy. Without the ability to perform the ASME-specified prerequisite tests, uncertainties in data accuracy can be of concern. Though not equivalent, system evaluations, special test procedures, and use of industry accepted rule-of-thumb design guidance can often be used to increase confidence in the accuracy of test data obtained from non-qualified system configurations. Regardless of installation date, most systems can be tested using a modified ASME N510 In-Place Leak Test approach. The Deep Bed filter system is no exception.

In order to ensure the best possible test configuration was selected for the Deep Bed filter test, the system configuration was evaluated for testability. Reviews were also performed on the former test procedures and resultant data. The Deep Bed filter system was last tested in 1994, using Site Generic test procedure 7-GN-055. Several observations regarding the former procedure and data suggest procedure improvements can be made to increase confidence in the reliability of the test data. Evaluation results and discussions of key test procedure improvements are discussed below.

(1) *100% Baseline Concentration:* ASME N510-1989 requires establishment of the 100% baseline concentration upstream of the tested filter. A valid baseline concentration is essential to the test process. Establishing the baseline concentration directly upstream of the filter removes all uncertainty in the challenge concentration due to potential aerosol dilution or diversion. This assures the photometer is adjusted to measure filter penetration based on the actual upstream challenge aerosol concentration. Filter efficiency is determined by the ratio between the downstream (penetration) and upstream (base percent) aerosol concentrations.

Review of the former PUREX test procedure shows 100% baseline concentrations were established downstream of the filter. One test shows aerosol was injected into two small access doors located on the inlet side of fans EF-1-1 and EF-1-2 and was measured downstream of the fans at test ports located just prior to entry into the main stack. Although the injection and sample locations are likely to have resulted in a well-mixed baseline concentration, establishing a downstream baseline is not in accordance with the ASME N510-1989. Establishing a downstream baseline concentration is also discouraged by the DOE Nuclear Air-cleaning Handbook [DOE-HDBK-1169-2003 (Section 8.6).]

During the evaluation, efforts were made to identify suitable test ports upstream of the filter. These efforts were not successful. The Deep Bed filter system and its associated concrete air tunnel duct are located below grade and are not readily accessible for inspection or modification. An abandoned air sample system provided some hope that an upstream measurement could be obtained; however, the location was not ideal and was considered unlikely to yield a representative upstream sample. After review of the system drawings and several field inspections, it was concluded that no test ports existed to support a valid upstream 100% baseline measurement. Since the Standard test practice for determining upstream baseline concentration was not possible, a modified test approach was required. By necessity, a downstream baseline concentration approach was chosen, as is the usual practice under such circumstances.

Review of the system configuration revealed an injection location on building 291-AE discharge duct that provided a more accessible and reliable aerosol injection location. The 291-AE location (Point E) was selected as the new baseline aerosol injection location. The original 100% concentration sample point F was viewed acceptable and was maintained as the baseline sample port for the new test. The required test deviation (upstream baseline) will have little or no impact on the reliability of test data collected: see Section 3.5 of this report for additional information.

(2) *Aerosol Equilibrium:* A weakness in the original test procedure was the absence of a specified time delay for establishing an equilibrium concentration upstream of the deep bed filters. Given the limited volume of the discharge duct, coupled with fan mixing effects, aerosol injected into the fan inlet plenum would easily achieve a stable (equilibrium) downstream aerosol concentration in a minute or less. In contrast, injecting aerosol into the large PUREX ventilation air tunnel over 450 feet upstream of DBF#2, could easily require 20 minutes or more of continuous aerosol injection to achieve an equilibrium upstream concentration. Because the original procedure was silent on injection duration, the validity of penetration data was entirely reliant on the experience of the Vent and Balance test personnel to recognize the significance of this important time delay effect.

Test personnel had no means for determining the actual upstream concentration during testing. Though trained to wait until photometer readings are stable prior to recording a final result, unless test personnel fully appreciated the time delay effect, it is possible final penetration readings were recorded before an equilibrium aerosol concentration was established. As such, DBF#2 may have been challenged with an aerosol concentration significantly less than the established 100% concentration. This time delay effect may explain the higher than expected efficiencies recorded during some of the previous tests (e.g., 1994 test, data point 99.994%.)

Today's flowrate is approximately one third of the typical flowrate prior to PUREX deactivation. Therefore, the required time delay associated with today's test will be even longer than the earlier tests. The new test procedure includes work steps to determine the minimum injection durations needed to establish equilibrium aerosol concentrations at both upstream and downstream test locations.

(3) *Aerosol Concentration:* ASME N510-1989 identifies an acceptable poly-disperse liquid aerosol droplet size distribution as follows: 99% less than 3.0 µm; 50% less than 0.7 µm; and 10% less than 0.4 µm. Aerosols produced from air (cold) generators using Laskin nozzle technology meet the ASME droplet size criteria.

Per DOE-HNBK-1169-2003 (Section 8.6.1), a desirable aerosol concentration is between 20 µg/L and 100 µg/L. Manufacturer's literature identifies a slightly broader range (10 µg/L and 100 µg/L) as being acceptable. Aerosol concentrations less than 10 µg/L require excessive instrument gain and should generally be avoided; concentrations greater than 100 µg/L should also be avoided due to potential instrument saturation affects.

One drawback of the cold generator is its ability to test large systems. For this reason, thermal generators are generally used for testing large volume filter systems. Thermal generators also produce an acceptable aerosol; however, the mean average particle size from a thermal generator is less than the average particle size produced with a Laskin nozzle style generator. With all other test parameters equal, test results using thermal generators are sometimes viewed as being conservative (penetration slightly overstated).

Review of past PUREX test data indicates as many as 10 thermal generators (operating in parallel) were used during a test. With a measured flow rate of approximately 105,000 cfm, and assuming all generators were operated at their full capacity, this would have resulted in an aerosol concentration of approximately 60 µg/L; an acceptable concentration for the test. However, one disadvantage of using multiple thermal generators is the potential variability in generator oil levels and its impact on stable generator performance.

To minimize concerns for maintaining constant aerosol generation rates, and given the reduced PUREX airflow rates, it was determined a single thermal generator should be used for the new test. A high-capacity thermal aerosol generator, ATI model TDA-5B was selected. To ensure generator output was maintained as constant as possible, the generator reservoir was filled prior to each baseline measurement and prior to injecting aerosol for each penetration measurement. At a flow rate of 37,000 cfm, a single thermal generator is expected to produce a mixed aerosol concentration of approximately 18 µg/L. Although towards the lower acceptable range, 18 µg/L is still considered a valid concentration for testing.

(4) *Air-Aerosol Mixing Uniformity*

ASME N510-1989 prerequisite testing per Section 9 (*Air-aerosol Mixing Uniformity Test"*) assures all sample locations yield representative measurements of aerosol concentration. Though no evidence of mixing uniformity testing could be found during a DBF#2 record search, assumptions regarding the adequacy of mixing can be made by reviewing the system design configuration and by applying an industry accepted rule-of-thumb (i.e., determination of mixing adequacy based on duct length.)

According to the Nuclear Air Cleaning Handbook, DOE-HDBK-1169-2003, Section 8.5.5 "*Adequate mixing upstream usually can be obtained by introducing the test aerosol at least 10 diameters upstream of the filters or absorbers, or by introducing it upstream of the baffles or turning vanes in the duct"* A similar acknowledgement regarding the acceptability of the 10-duct diameter rule-of-thumb is provided in ASME AG-1-2003, Section HA-5800 which states, "*Sampling manifolds shall be qualified to demonstrate they collect a representable sample equivalent to a single point sample taken at least ten duct diameters downstream of the filters.*" Injection and sampling locations were chosen as far apart as possible to optimize aerosol mixing and uniformity. In all cases, the selected aerosol injection and sampling locations for the DBF#2 test met the ten-duct diameter criterion.

DOE-HDBK-1169-2003, Section 8.6.1 states the following, "*For systems in which good mixing cannot be achieved, multipoint sampling and averaging may be used, in accordance with Section 11 of ASME N510.*" Though adequate aerosol mixing for DBF#2 can reasonably be assumed based on distance alone, the test procedure includes steps to measure baseline and penetration concentrations using both single and multipoint probes. Use of the multiple probes enables comparison of readings to demonstrate mixing adequacy at each sampling location, and provides additional data should averaging techniques be required to establish a final filter efficiency.

3.3 <u>Test Procedure Development</u>

Procedure development goals for this activity include:

1. Develop a technically defendable, repeatable, and reliable test process

2. Adhere to ASME N510-1989 test requirements to the maximum degree possible
3. Select injection and sampling point locations to maximize aerosol mixing and measurement reliability
4. Where possible, limit unnecessary test variables (e.g., limit control system interaction by placing control system in manual operation; use a single thermal generator rather than multiple air operated generators, etc.)
5. Ensure sufficient test data is recorded to demonstrate adequacy of final test results

The following list provides a brief summary of the DBF#2 procedure development activities:

- Performed a detailed record search to identify all available data from the previous test process
- Performed a system inspection to identify all potential test port locations, to assess system configuration, and to evaluate potential work hazards
- Interviewed the former PUREX HVAC engineer and Vent and Balance Test personnel who were previously involved with the PUREX test
- Met with DOE-RL, EPA and WDOH to discuss test strategy
- Reviewed former test procedures and system drawings
- Performed investigative/preparatory work packages, as required
- Submitted a proposed test plan to EPA and WDOH for review
- Issued a test procedure and work package
- Performed the DBF#2 In-Place Leak Test.

3.4 Final Test Configuration

As previously noted, the applicable Codes and Standards indicate adequate mixing can generally be assumed providing a minimum of ten duct diameters exists between the aerosol injection and sampling location. Selected test locations were chosen to optimize mixing and uniformity of the challenge aerosol and to assure valid measurements. In all cases, the selected aerosol injection and sampling points for the Deep Bed filter test met the ten- duct diameter criterion, and had 90° bends which are considered beneficial for mixing. See Figure 1 for a layout of the exhaust ventilation system identifying the injection and sampling test locations. The final DBF#2 test configuration is described below:

- The selected 100% baseline injection port was located just downstream of the 291-AE HEPA filters at test location E. Baseline sampling ports were located downstream of the exhaust fans at test location F. The distance between the injection and sampling locations is greater than 200 feet. This distance easily exceeds the assumed minimum acceptable value of 10 duct diameters. In addition, because the PUREX exhaust air passes through an operating exhaust fan prior to aerosol measurement, which is considered beneficial because of added assurance that full aerosol mixing is achieved for the base concentration measurement. According to the Nuclear Air Cleaning Handbook, DOE-HDBK-1169-2003, Section 8.5.5, "*Extraction of the downstream sample at a point several duct diameters downstream of the fan will usually provide a well-mixed sample.*" The downstream location provided the best mixing conditions for baseline testing. Test results have confirmed the effectiveness of aerosol mixing at location F.

- The selected aerosol injection port for challenging the deep bed filter was test location A. The injection Point A is located approximately 450 feet from the inlet to Deep Bed filter #2. However, additional exhaust air from the other half of the PUREX facility is joined with the aerosol mixed air approximately 200 feet from the DBF#2 inlet. Therefore, adequacy of mixing must be based on the 200 feet value rather than the total distance (450 feet.) Converting the 11' X 8' tunnel duct to a circular equivalent diameter resulted in an assumed duct diameter of 10.2 feet. Any distance greater than 102 feet should exceed the required ten duct diameters. The intersection of the two PUREX airstreams is approximately 200 feet from the filter. This distance represents nearly 20 duct diameters of available mixing. Consequently, injection at Point A can be assumed to result in a well-mixed aerosol concentration for challenging the filter.

- The selected aerosol sampling test ports for measuring filter penetration are located on the housing inlets immediately upstream of the 291-AE HEPA filters (See Location D on Figure 1). The duct from the DBF#2 includes multiple 90° turns and several transitions. Dimensions for the largest portion of the duct is 8' X 8'. Converting the 8' X 8' duct to a circular equivalent diameter resulted in an assumed duct diameter of 8.7 feet. Any distance greater than 87 feet exceeds the required ten duct diameters. The first sample point at filter housing FH-V11-4-5 is located approximately 90 feet from BDF#2. Because the penetration sample point is >10 duct diameters downstream of the deep bed filter, aerosol is expected to be adequately mixed for each of the Point D sample extraction locations.

  The penetration sample location is located directly upstream of the first stage HEPA filter bank. The duct is accessed through four existing 4" ports, as shown in Figure 2 (ventilation air flow is from left to right). This location is divided into 12 equal areas, the centroid of each area corresponding to the center of each HEPA filter. HEPA filter banks 5, 9 and 10 are currently in operation and are referred to as test locations D-5, D-9 and D-10 respectively. (Note: Test location D-5 is the same as the previous upstream air sampling location described in HNF-20611.)

- The fan control system was placed in a manual mode (i.e., modulating damper in a fixed position) during testing to eliminate any potential control system interaction. In addition, the stack air sampling system was shut down during testing to prevent high concentrations of aerosol from entering the sampling system.

3.5 Assumptions and Uncertainties

- **Baseline concentration cannot be established upstream of the filters as required per ASME N510-1989 (Step 10.5.6.)**

  Configuration of the Deep Bed filter system requires the baseline concentration to be established downstream of the filter. Though establishing a downstream baseline is discouraged by the DOE Nuclear Air-cleaning Handbook [DOE-HDBK-1169-2003 (Section 8.6)] and is undesirable from an ASME N510-1989 procedural standpoint, it is expected that this necessary test deviation will have little or no impact on the reliability of the test data.

  Downstream baseline aerosol concentration measurement is considered acceptable by FH engineering in this case because it is the same air stream both upstream and downstream, with no branched air entries or exits to cause uncertainties. The PUREX building has only one operational exhaust fan system and no operational supply fans; all air exhausted through the 291-A-1 stack is the result of infiltration into the PUREX building. The exhaust fan provides the only exit route for building exhaust. Because the PUREX air tunnel is far more negative than any surrounding area within the building, there is virtually no potential for diversion of the test aerosol once it is injected into the duct system at Point A.

- **Adequacy of airflow distribution upstream of the Deep Bed filter system is unknown and cannot be determined using ASME N510 Section 8 techniques.**

  Capacity and Airflow distribution tests per ASME N510 Section 8 are performed after construction is complete and are considered prerequisites to an ASME Section 10, In Place Leak Test. The ASME Section 8.0 tests are important for assuring an installed filter system meets the capacity requirements of the design specifications, and for verifying an acceptable level of flow uniformity exists across the face of the filter. Uniform flow promotes even dirt loading and assures uniform velocity through the filter media. While necessary for system acceptance, uniformity of dirt loading and velocity through the media are not critical test parameters. The purpose of the PUREX filter test is to determine an accurate measurement of system efficiency in its current configuration and flow rate. The lack of flow distribution data through the Deep Bed media has no impact on the validity of the data obtained.

- **Adequacy of air-aerosol mixing uniformity upstream of the Deep Bed filter system is unknown and cannot be determined using ASME N510 Section 9 techniques.**

  Performance of an ASME N510-1989, Section 9, *Air-Aerosol Mixing Uniformity Test* is a prerequisite for the ASME Section 10, *In Place Leak Test*. A review of PUREX records found no indication that equivalent testing had been performed on the Deep Bed filter system. A well-mixed aerosol is essential for achieving accurate test results. Therefore, an attempt was made to measure and validate adequacy of the upstream sample by using an abandoned air tunnel sample system (see Figure 1, Point B). Unfortunately, testing showed the in-duct sample system tubing was no longer in direct communication with the air tunnel. Procedure steps for determining an upstream concentration at Point B were deleted from the test procedure.

  Performance of an air-aerosol mixing uniformity test was not possible. Nevertheless, because the distance between the upstream aerosol injection location (Point A) and the inlet of the Deep Bed filter system is greater than 10 duct diameters, it is reasonable to assume the challenge aerosol had sufficient time to mix with the PUREX exhaust to achieve a stable, fully-mixed upstream aerosol challenge concentration.

- **The test required the thermal aerosol generator to operate for extended periods of time. After approximately one hour of operation, there was a significant decline in the aerosol output.**

  The Deep Bed filter test requires the displacement of large air volumes to achieve an equilibrium upstream aerosol concentration and downstream penetration sample result. In order to achieve a stable concentration, the aerosol generator had to be operated continuously for over 30 minutes, thus all penetration data was taken after at least 30 minutes had elapsed. A review of the test data revealed generator performance declined rapidly after one hour of operation. Additional testing showed the variation in aerosol output was due primarily to liquid levels in the aerosol generator. The manufacturer also suggested prolonged operation may have led to the development of a film inside the heated chamber that contributed to a decline in performance. To ensure only the most reliable data is used for determining system efficiency, all penetration data obtained after one hour of generator operation is considered suspect and will not be used.

3.6 Test Performance

Pre-job radiological surveys and other test preparations were performed per Work Package CP-05-05397. The Deep Bed aerosol test was performed on 3 consecutive days in accordance with procedure instructions contained in Work Package CP-05-0514. Actual testing began on August 30 and ended on September 1, 2005. Copies of the test procedure and its completed data sheets are included as Appendix A. The following is a summary of the aerosol test activities performed each day.

Note: *The dates on the datasheets are important for defining trial number. The trial numbers indicated on the datasheets do not correspond to the trial numbers as discussed in the remainder of this report. These have been redefined because the trial from Day 1 is validated by later testing. So for discussion in the remainder of this report, Trial 1 is the Day 1 measurements, Trial 2 is the Day 2 measurements, and Trial 3 is the Day 3 measurements.*

Day 1 (August 30):

The first day test activities included completion of the visual inspection checklist, establishing and documenting the test configuration, performing the stack flow measurements. Using the internal reference feature of the photometer, background particulate measurement was obtained. Aerosol was injected at Point E and was measured at Point F-3. A stable downstream concentration was achieved after approximately five minutes of aerosol injection. The sample probe was relocated to obtain data for the other Point F test ports. Aerosol mixing and sample stability was found to be excellent at each Point F test port location (see Appendix 1, Data Sheet 7.) A second photometer was then used to establish an "official" downstream concentration for test Trial 1 (see Data Sheet 9 dated 8/30/05). The recorded photometer gain value of 5.28 indicates an acceptable level of aerosol was established for the test.

After the two baseline concentrations were established, the aerosol generator was refilled and moved to the upstream test location (Point A), the Internal Reference (IR) photometer was relocated directly upstream of the Deep Bed filter system (Point B), and the remaining photometer was moved to the downstream sample location (Point E) in Building 291-AE. The original intent was to use the IR photometer at test location B to establish the minimum time delay for achieving a stable upstream aerosol concentration. After several minutes of testing, it became apparent that test location B was not connected to the air tunnel as originally believed (see Appendix 1, Data Sheet 8). Efforts to collect sample data at test location B were abandoned.

The Point B test problems consumed much of the afternoon. Because an entire test trial could not be completed in the remaining shift, a decision was made to perform a partial test trial at housing FH-V11-4-5. Aerosol penetration was measured at test location D-5. It was confirmed that the test equipment was performing properly and that mixing was acceptable at the penetration sampling location (see Appendix 1, Data Sheet 9 (dated 8/30/05)).

It was later determined that goals for establishing a minimum equilibrium time delay for the Point B could be effectively met by measuring the time delay needed to achieve a stable penetration concentration at test location D. The test procedure was revised to reflect this new strategy.

Day 2 (August 31):

After a new baseline was established between Points E and F, testing was performed between Points A and D to determine the minimum time needed to achieve a stable penetration aerosol concentration downstream of the Deep Bed filter system. Test equilibrium is established when increasing photometer values level off and stabilize (see Appendix 1, Data Sheet 8 (dated 8/31/05)). The test demonstrated that the time delay for establishing equilibrium was about 30 minutes, though 43 minutes was selected for the efficiency testing to be conservative. Penetration data was collected at each of the three 291-AE Point D locations. The D-5 data was consistent with the previous day's test data. Test Trial 2 was complete; however, it was noticed that the penetration readings at test locations D-9 and D10 dropped over time. This unexplained change in recorded penetration values strongly suggested a potential problem existed with the photometer, the generator, or both. This issue was evaluated and successfully resolved on Day 3 of the testing.

Day 3 (September 1):

Baseline and penetration tests were repeated again. Beginning at test location D-5, the results were again consistent with previous measurements. But as before, as sampling moved from port to port, bank to bank, the penetration result became progressively lower. The likely cause was a change in aerosol generator; however, additional testing was needed to determine the actual cause.

After completing Trial 3 testing at test locations D-5, D-9 and D-10 (HEPA filter banks 5, 9, and 10), the penetration test was partially repeated at test location D-5. Using the exact same photometer settings, the test revealed concentrations were down 12% from previous measurements at that same location (based on comparison of multipoint probe measurements from same port). This shows that the observed decline in penetration values were not due to the test location, but rather the amount of time which had elapsed between individual Point D measurements.

To confirm the aerosol generation rate was actually declining over time, the generator and photometer were relocated to their original baseline concentration positions. The generator reservoir was approximately 3/8 full. To test the potential impact of oil level on aerosol output, the generator was not refilled as was done in the earlier trials. With the photometer settings unchanged from the original base concentration measurement, a measurement was obtained using the partially filled generator. The new baseline measurement was reading only 60% of the original baseline 100%

measurement. The value declined to 48% after an additional 14 minutes of operation. This test clearly showed aerosol generator output is dependent on oil level and performance declines over time.

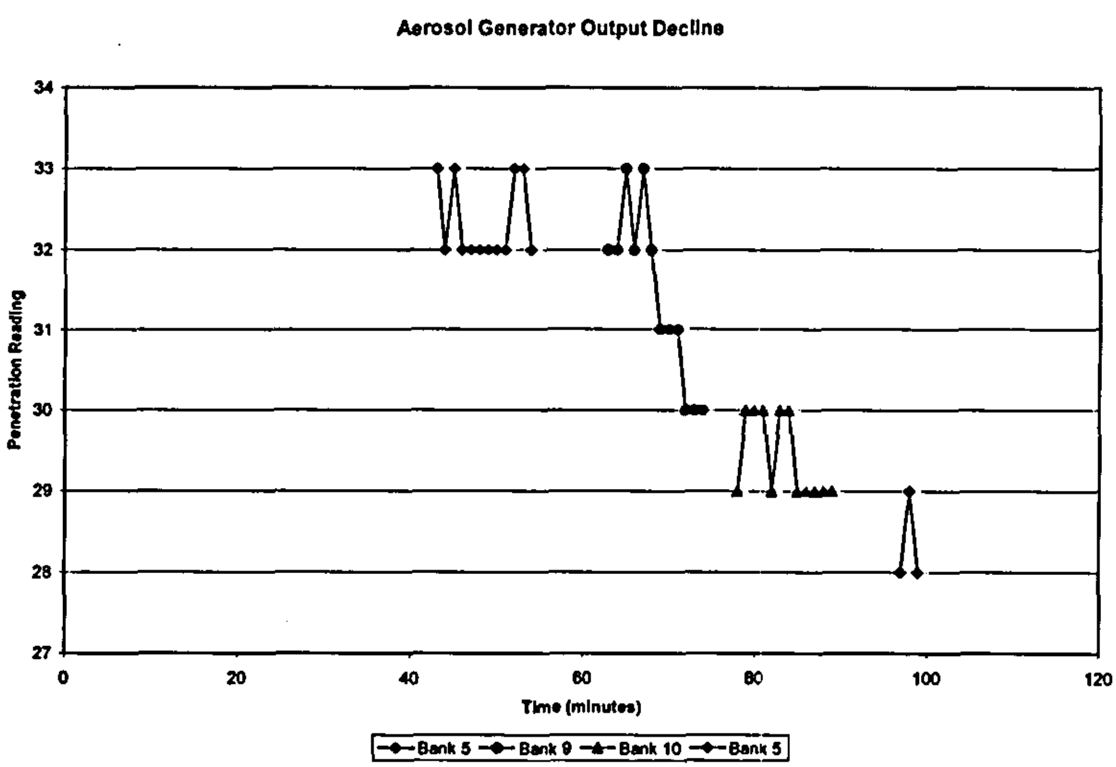
3.7 Data Evaluation

Final test results were selected to provide the most representative and reliable test result, the following items were considered during this selection process:

- Only readings taken within the first hour of generator operation are considered valid
- ASME N509 gives preference to multipoint sampling manifolds, so the multipoint probe readings were favored over single point readings
- ASME N510 directs users to repeat the test "until readings are repeatable within 5% of respective previous readings"
- ASME N510 directs users to "use the final set of readings to calculate penetration".

In order to determine the best data, the effects of aerosol generator output was evaluated by plotting the penetration data versus time for day-three measurements (see Graph 1).

Graph 1



Note: *It is apparent from Graph 1 that aerosol generation is relatively constant for the first hour of operation, but after that, generator output declines rapidly.*

Because data collected after one hour of generator operation is not representative with respect to the baseline measurement, all data obtained late in the test process must be considered unreliable and thus should not be used for determining a final filter efficiency value. Penetration measurements at all D locations were recorded using both single-point sampling traverses and multipoint probes. However, due to the decline in generator output after 1 hour of operation, only the test location D-5 data is considered fully valid, since only the D-5 measurements were all taken within the first hour of generator operation. Test location D-9 and D-10 measurements are considered less valid, and will not be used (though all data is available for review in the Appendix datasheets). A summary of the test data for location D-5 is provided in Table 1. A statistical analysis of this data is provided in Table 2.

Table 1

Test Location D-5		Penetration Readings (% Scale)			
		Single Point Probe			Multipoint Probe
	Port	Depth 1	Depth 2	Depth 3	
Trial 1 8-30-05	1	34	34	34	50
	2	32	32	32	32
	3	34	32	32	32
	4	34	34	34	34
Trial 2 8-31-05	1	34	34	35	38
	2	34	32	33	33
	3	33	33	33	34
	4	33	33	33	32
Trial 3 9-1-05	1	33	32	33	34
	2	32	32	32	33
	3	32	32	32	33
	4	33	33	32	32

Table 2

Summary Test Data for Location D-5						
	Single Point			Multipoint		
	Average	Std. Deviation	Repeatability %	Average	Std. Deviation	Repeatability %
Trial 1	33.2	±1.0	-	37	±8.7	-
Trial 2	33.3	±0.8	0.5%	34.25	±2.6	-7.4%
Trial 3	32.3	±0.5	-3.0%	33	±0.8	-3.6%
Trial (Avg.)	32.9	±0.5	-	34.75	±2.0	-

Notice the consistency between the various single point measurements. These values confirm very good mixing and uniformity at the penetration sampling location with a 3-trial average reading of 32.9 ± 0.5 at 1 sigma. This represents a scatter of only 1.5% at 1 standard deviation. Notice also that the standard deviation improved with each trial as the measurement technique was refined and became more consistent. It is important to note that test location D-5 is the same location where the HNF-20611 upstream air sample data was collected. As such, data obtained through these aerosol tests also tends to validate the adequacy of mixing and uniformity associated with the HNF-26011 air sample data.

Penetration test data is reported in terms of photometer meter reading (i.e., % scale). Deep bed filter efficiency is calculated by applying the scale factor of 0.1 to the reading to determine the measured value, then dividing by the baseline concentration value of 10,000 to determine penetration. This value is multiplied by 100 to obtain percent penetration. Subtracting percent penetration from 100% determines filter efficiency. A summary of the Deep Bed #2 filter efficiency test results is provided in Table 3.

Table 3

Penetration Sample Data at Location D-5					
Date	Port	Deep Bed Filter Efficiency (%)			
		Multipoint Probe Readings	Single Reading	Trial Average	Overall Average
Trial 1 8-30-05	1	50	99.95	99.963	99.965
	2	32	99.968		
	3	32	99.968		
	4	34	99.966		
Trial 2 8-31-05	1	38	99.962	99.966	
	2	33	99.967		
	3	34	99.966		
	4	32	99.968		
Trial 3 9-1-05	1	34	99.966	99.967	
	2	33	99.967		
	3	33	99.967		
	4	32	99.968		

Readings for all three trials at test location D-5 were each taken within the first hour of generator operation, used a multipoint probe, and were shown to be repeatable. Thus the average trial 3 test result is considered the most valid result, with a reading of 33 ±0.8 at 1 sigma. This trial 3 result meets the ASME 5% repeatability criteria, as it is only 3.6% less than the previous trial 2 average (see Table 2). Applying the scale factor of 0.1 to the reading to determine the measured value, then dividing by the baseline concentration value of 10,000, the penetration is calculated to be

0.00033, or 0.033%. Subtracting from 100%, this translates to a Deep Bed Filter #2 efficiency of 99.967 ± 0.001% at 1 sigma.

Locations D-5, D-9, and D-10 represent all the penetration sampling locations. Measurements at the three locations were originally planned to ensure an abundance of data. But since all three locations are considered equivalent with respect to aerosol mixing, any one of the locations can alone provide sufficient data to determine penetration. Location D-5 data is preferred because all 3 full test trials data was obtained within the first hour of generator operation, whereas much of the location D-9 and D-10 test results were obtained after one hour. However, even if all complete data sets from test location D-5, D9 & D10 were included in the calculations without regard for validity, the overall average multipoint data yields an average reading of 33.2 ± 3.9 at 1 sigma, which translates to an efficiency of 99.967% ± 0.004% at 1 sigma, which is the same result as the most valid data, only with more scatter.

The best and most reliable penetration data is considered to be the average of the final (trial 3) multipoint probe sampling data from test location D-5.

4.0 CONCLUSION AND RECOMMENDATIONS

The best and most reliable penetration data is considered to be the average of the final (trial 3) multipoint probe sampling data obtained from test location D-5. The basis for this determination is discussed in Section 3.7 of this report. The final recorded penetration result is 0.033%, which translates to a deep bed filter efficiency of 99.967% ± 0.001% at 1 sigma. Since the actual efficiency (99.967%) is less than the assumed HNF-20611 value (99.97%), the reported PTE estimate is conservative (i.e., PTE is slightly overstated). As such, In-Place Leak Test results validate acceptability of the efficiency assumption used in the (HNF-20611) PTE calculation, and reinforce earlier technical bases conclusions regarding the proposed redesignation of the PUREX 291-A-1 Stack from a major to a minor stack.

5.0 REFERENCES

HNF-20611, Revision 0, *Unabated Emissions Estimate for the PUREX 291-A-1 Stack*

ASME N509-1989, *Nuclear Power Plant Air-Cleaning Units and Components*

ASME N510-1989 (reaffirmed 1995), *Testing of Nuclear Air Treatment Systems*

ASME AG-1-2003, *Code on Nuclear Air and Gas Treatment*

DOE-HDBK-1169-2003, *Nuclear Air Cleaning Handbook*

HW-82117, *Replacement Exhaust Ventilation Filter PUREX Plant* (May, 4, 1964)

BNWL-B-125, *Filter Efficiency Test - - PUREX Plant Ventilation Exhaust Filters* (September 1, 1971)

Appendices

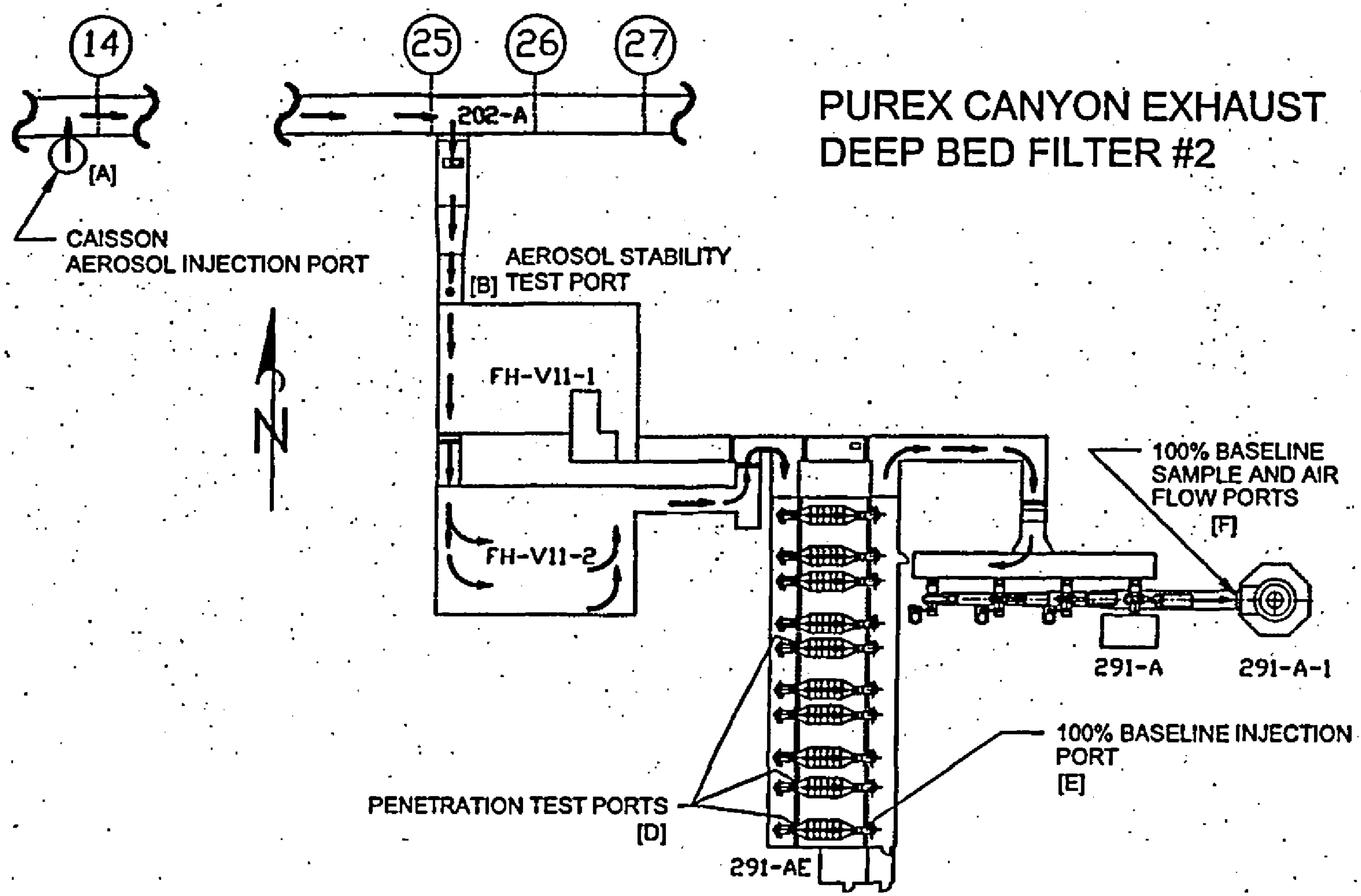
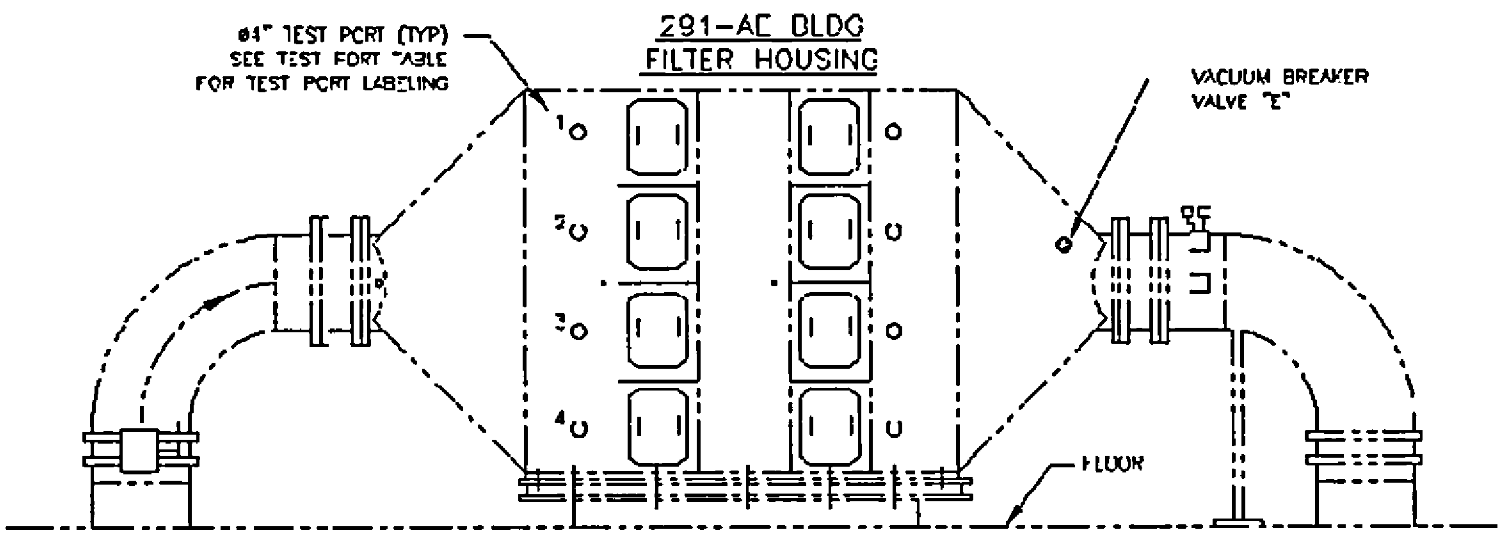


Figure 1: Deep Bed Filter #2 System Configuration



TEST PORT TABLE			
TEST PORT NO	FH-V11-4-5 LABEL	FH-V11-4-9 LABEL	FH-V11-4-10 LABEL
1	D-5-1	D-9-1	D-10-1
2	D-5-2	D-9-2	D-10-2
3	D-5-3	D-9-3	D-10-3
4	D-5-4	D-9-4	D-10-4

Figure 2: Building 291-AE Filter Bank Test Port Locations

APPENDIX 1

PUREX DEEP BED FILTER #2 EFFICIENCY MEASUREMENT PROCEDURE AND DATA

Work Change Notice CP-05-05014 * 1

08/31/2005 9:26 AM

Document Number	CP-05-05014 W GENERIC WORK ITEM	Record Status	ACT
Work Item Title	PUREX DEEP BED FILTER #2 AEROSOL TEST		
WCN Number	1	Record Copy Printed	Yes 2

Origination

Name	Date
Smith, Ronald R	08/30/2005

Non-ADP WCN Number

Incorporated By

Approval	Date
R Smith	8/31/05

Reason for Change

Measurements at point B were not possible due to system configuration. Steps relating to point B were removed. Steps to determine test time delays were revised to be determined at point D instead of point B.

Approvals

Code	Description	Approval	Date
DA	Design Authority	[signature]	8-31-05
E	Environmental	D Johnson	8-31-05
FWS	FIELD WORK SUPERVISOR	E. L. Suen	8-31-05
OPS	Operations	[signature]	8-31-05
R	Radiation Protection	[signature]	8-31-05
S	Safety & Health	John D. [signature]	8/31/05

Change Instructions

Page 1 Delete first bullet of section 1.2.

Page 5 In note prior to step 7.1.1, replace "7.1.5" with "7.1.6".

Page 6 Add the following substeps to step 7.1.3:

a. Ensure nitrogen purge continues with needle valve 100% closed until no visible aerosol is observed exiting the nozzle.

b. Allow the generator to cool down approximately one hour prior to refill.

c. Transport generator between test locations with care to prevent sloshing of aerosol liquid and development of air pockets.

d. Open reservoir fill port and tap sides of generator to dislodge any air pockets. that may be present.

Page 6 Add new step 7.1.6 as follows:

7.1.6 Ensure the following steps have been taken prior to test restarts:
a) Ensure sampling system is terminated
b) Locate generator at location E
c) Ensure generator reservoir is full but below neck of fill port

Facility Group CPF

LOCKOUT REQUIRED Y____ N ✓ 8-31-05

Cat. Exclusion # GCX-3
Scrn/Eval # NA
RS 8-31-05 NA
Initials/Date

Work Change Notice CP-05-05014 * 1

08/31/2005 9:26 AM

Document Number	CP-05-05014 W GENERIC WORK ITEM	Record Status	ACT
Work Item Title	PUREX DEEP BED FILTER #2 AEROSOL TEST		
WCN Number	1	Record Copy Printed	Yes 2

d) Go to step 7.8.

Page 15 In the note prior to step 7.7.22, replace "50" with "20" in both locations

Page 15 Add "Allow generator to operate for a minimum of 10 minutes (14) and" at the beginning of step 7.8.3.

Page 16 Section 7.9 title, replace "upstream" with "downstream".

Page 16 In note prior to caution, replace "upstream" with "downstream" and delete "7.9.1, 7.9.2, and"

Page 16 Delete steps 7.9.1 and 7.9.2.

Page 16 Add new step 7.9.5a after 7.9.5 as follows:

7.9.5a Insert multiport probe into port D-5-3.

Page 17 Delete second sentence of note prior to step 7.9.8.

Page 17 In step 7.9.8, replace "air tunnel sampler (location B)" with "port D-5-3".

Page 18 Delete first bullet of note, and delete "plus 30 minutes" from second bullet of note.

Page 19 In step 7.10.13, replace "replace" with "Cover" and delete "cover" at end of sentence.

Page 19 In note prior to step 7.10.14, replace "30" with "60".

Page 19 Add following note prior to step 7.10.14.2:

Note: Minimize development of air pockets through careful handling of generator.

Page 19 Delete step 7.10.14.5.

Pages 37 - 38, Add new data sheets 8 and 9.

Page 37 On new Data sheet 8, replace "Upstream" with "Port D-5-3".

Facility Group CPF

Work Document CP-05-05014

08/24/2005 12:43 PM

Document Number CP-05-05014 W GENERIC WORK ITEM
Work Item Title PUREX DEEP BED FILTER #2 AEROSOL TEST
Record Status ACT
Record Copy Printed Yes 1

Documents

Component Number	Component Name
N/A	

Temporary Component Number	Temporary Component Name
DBF #2	DEEP BED FILTER #2

Symptom, Problem, or Condition

RL HAS DECIDED TO ACCEPT THE REGULATORS PROPOSAL TO PERFORM A CURRENT TEST TO ELIMINATE ANY QUESTION OF CONFIGURATION, FLOW RATES, OR CHANGES IN EFFICIENCY SINCE 1994 (THE LAST TEST RESULTS AVAILABLE); THEREFORE, AN AEROSOL TEST ON THE PUREX DEEP BED FILTER #2 WILL BE PERFORMED AND THE PTE WILL BE RECALCULATED BASED ON THESE TEST RESULTS TO CONCLUSIVELY DETERMINE THE STACK DESIGNATION.

THIS AEROSOL TEST OF THE DEEP BED FILTER CANNOT FULLY COMPLY WITH ANSI N510 BECAUSE THE FILTRATION SYSTEM WAS NOT DESIGNED TO ANSI N509 SINCE IT'S CONSTRUCTION PREDATED THE STANDARD. HOWEVER, THE TEST WILL MEET THE SUBSTANTIVE REQUIREMENTS AND INTENT OF ANSI N510. AS ALLOWED BY N510, CERTAIN SECTIONS OF N510 CAN BE USED AS TECHNICAL QUIDANCE FOR NON-N509 SYSTEMS. THE WORK INSTRUCTIONS WILL PROVIDE THE DIRECTION TO ACCOMPLISH THIS.

Location

Facility CP **System** 41D
Building / Room 291-A
Other

Charge Code

CACN	COA
119165	

Origination

Name Smith, Ronald R **Date** 07/12/2005
Need Date **Phone** 376-1981

Validation

Name Showman, Jodie **Date** 07/13/2005
Request Number 199220

Phase Designator

Priority 2 Priority Two

Mode

Personnel Safety Rel. No
Correct. Maint, Assesment No
Plant Forces Work Review Required No
Plant Forces Work Review Number

Resources Required

Code	Description	No	Est Hr	Act Hr
NCO	NUCLEAR CHEMICAL OPERA'	1	24.0	
RCT	RADIATION CONTROL TECH	1	24.0	
V&B	VENT AND BALANCE	4	24.0	

Cognizant Engineer Condron, Jim D **Phone** 376-0863

Cognizant Manager Giamberardini, Steven J **Phone** 376-2680

LOCKOUT REQUIRED Y N ✓ [signature] 8/25/05

Reference Documents

Type	Document
AJHA	FS-353
RWP	RC-05-001
	RC-05-003

USQ Review: Cat. Exclusion # CE-Y-05; Screening # ; Initials/Date [signature] 7/11/05

Facility Group CPF

Work Document CP-05-05014

08/24/2005 12:43 PM

Document Number	CP-05-05014 W GENERIC WORK ITEM	**Record Status**	ACT
Work Item Title	PUREX DEEP BED FILTER #2 AEROSOL TEST	**Record Copy Printed**	Yes 1

Tech. Spec. / OSR Requirements Reference

Essential Systems

Code	Descrption

Resolution / Retest

Perform PUREX deep bed filter aerosol test in accordance with the attached instructions.

Planning Codes

Planning Required Yes

Code	Description

Resolution By

Approval	Date
Condron, Jim D [Transcribed]	08/23/2005

Screener / Operations Review

Approval	Date
~~N/A~~ WARP Chairman [signature]	8/25/05

Approvals

Code	Description	Approval	Date
DA	Design Authority	[signature]	8-24-05
E	Environmental	Johnson, Dan L [Approved]	08/23/2005
FWS	FIELD WORK SUPERVISOR	[signature]	8-24-05
IH	INDUSTRIAL HYGIENIST	N/A per D.A.	N/A
OPS	Operations	[signature]	8-25-05
QA	QUALITY ASSURANCE	[signature]	8-25-05
R	Radiation Protection	[signature]	8/24/05
S	Safety & Health	[signature]	8/23/05
TA	Technical Authority	[signature] P.M. O'Brien	8/24/05

Pre-Work Review

Approval	Date
[signature]	8/24/05

Lock and Tag

Number	Location

Facility Group CPF

 *** RECORD COPY *** *** RECORD COPY ***

Work Document CP-05-05014

08/24/2005 12:43 PM

Document Number CP-05-05014 W GENERIC WORK ITEM
Work Item Title PUREX DEEP BED FILTER #2 AEROSOL TEST

Record Status ACT
Record Copy Printed Yes 1

Person In Charge
Name
Organization

Calibration Standards

Standard	Exp Date	Tolerance

Work Release
Release Type F

Approval [signature] Date 8/30/05

Work Suspension (See Work Suspension Sheet)

PIC Date

Field Work Complete

Approval Eugene L. Green Date 9/7/05

Reactor Containment Integrity

Operations Acceptance

Approval [signature] Date 9-7-05

Post Work Review

Approval [signature] Date 9-13-05

Failure Information

Component Number	Failure Class	Failure Code	Ident. Method	As Found	Action Taken

Failure Comments

Facility Group CPF

J-4	RESOLUTION/RETEST	CP-05-5014/W
	PUREX DEEP BED FILTER AEROSOL TEST	PAGE 1 OF 48

1.0 PURPOSE AND SCOPE

1.1 Purpose

Purpose of this procedure is to verify aerosol mixing effectiveness at various test port locations in the PUREX exhaust system and to collect aerosol test efficiency data for PUREX Deep Bed Filter #2. The data will be evaluated by Engineering and be used to determine overall efficiency of the Deep Bed filter system. This test is being performed in support of ongoing PUREX stack assessment efforts.

1.2 Scope

A Department of Energy (DOE) approved challenge aerosol is used in accordance with the test requirements of ASME-N510-1989, Section 10, *"HEPA Filter In-Place Leak Test"* to determine aerosol penetration as a result of leakage through or around Deep Bed Filter #2.

The designed efficiency of PUREX Deep Bed Filter #2 approaches that of a standard HEPA filter system. However, since the system design predates the ASME N509 and ASME N510 standards, not all of the ASME N510 test requirements can be satisfied. Therefore, this procedure was developed using the ASME N510 test requirements as guidance.

The test will verify the effectiveness of aerosol mixing at various duct locations. Although the system does not allow an ASME N510 compliant air-mixing uniformity test, testing can be performed to estimate the effectiveness of aerosol mixing. Two locations will be considered (see Figure 1 for locations A-F):

per ucn #1 RBSmith 8/31/05

- ~~Mixing between Caisson #14 upstream injection port (Location A) and Air tunnel sampling probe (Location B);~~ R R
- Mixing between Filter Building #4 Injection port (Location E) and sample port (Location F) downstream of the exhaust fans.

The test will also provide data for determining aerosol efficiency of the Deep Bed #2 filter system. Ports located downstream of the exhaust fans (Location F) represent the best mixing conditions for testing. For this reason, and because sample port configuration does not accommodate reliable measurement of a 100% upstream baseline concentration, the test will be performed based on a 100% downstream baseline concentration.

Filter Efficiency:

Requirement: Not Applicable.

Note: *The PUREX Deep Bed Filter #2 is not required per Documented Safety Analysis (DSA). All air discharged through Stack 291-A is routed through Deep Bed filter #2. The Deep Bed filter system performs a pre-filter function, as it is located upstream of the Filter Building #4 HEPAs.*

Filter Differential Pressure (DP):

Requirement: Filter DP for Deep Bed Filter #2 should not exceed 8" wg.

Source: Procedure 2CP-SOP-AU-05010, Section 5.5.6 "Off Normal DP in No. 2 Deep Bed Filter"

Filter System Flowrate (cfm):

Requirement: Not applicable.

2.0 REFERENCES

- H-2-63449 – Sheet 1, 291-A Filter Inlet Particulate Sampler
- H-2-66130 – Sheet 1 -3, Surveillance Caisson for Air Tunnel and Hot Pipe Trench
- H-2-825908 - Sheet 1, 3 & 6, Instrumentation Consolidation I & E Flow Diagram
- H-2-825908 - Sheet 2, Instrumentation Consolidation Filter House No. 4
- Work Package CP-05-5397, Inspect Radiological Conditions of Caisson

3.0 PERSONNEL REQUIREMENTS

3.1 Vent and Balance Stationary Operating Engineers (SOE) trained in accordance with TFC-BSM-TQ-STD-14, REV A-2.

3.2 Radiological Control Technician (RCT).

3.3 Operations Personnel (OPS) & Stationary Operating Engineer (SOE) support.

3.4 Industrial Hygiene (IH).

4.0 PRECAUTIONS AND LIMITATIONS

4.1 If during performance of this procedure, any of the following conditions are found, stop work, place equipment in a safe condition, and notify the Field Work Supervisor (FWS).

- Facility equipment malfunction that adversely impacts the performance of this procedure.
- Personnel error or procedural inadequacy that prevents fulfillment of procedural requirements.
- Limiting conditions of applicable RWP(s) are exceeded.

4.2 Contact Supervision for additional instructions if changing plant conditions affect work, or work delays are anticipated to extend completion of projected work scope beyond the planned test duration.

4.3 This is a step-by-step compliance procedure, unless indicated otherwise within the body of this procedure.

4.4 Though developed using ASME N510 In-Place Leak Test requirements as guidance, it is important to note the Deep Bed filter system was not designed as an ASME N509 filtration system. Therefore, by necessity, aspects of this test are not consistent with the ASME N510-1989 acceptance test process.

4.5 Performance of this procedure will require shutdown of the 291-A stack sampling system to prevent concentrated aerosol from being drawn into the stack sampling probe and transport lines.

4.6 The Model TDA-5B aerosol generator poses a significant fire risk if not operated properly. Generator must be operated in accordance with the Manufacturer's instructions at all times. A fire extinguisher is to be staged in the vicinity of the aerosol generator when it is operating.

4.7 Visible aerosol may be observed exiting the PUREX stack during the test. This condition is both anticipated and acceptable.

4.8 If emergency/abnormal conditions are encountered, personnel are to respond to the situation as trained, and as discussed in the AJHA and pre-job safety meeting.

4.9 Stack sampling system downtime is limited to 48 hours during this activity unless additional notification of longer downtime is provided to EPA and WDOH regulatory agencies. Contact the ECO as soon as it is apparent that sampling system downtime will exceed 48 hours.

5.0 SPECIAL TOOLS, EQUIPMENT, AND MATERIALS

NOTE

Measuring and Test Equipment (M&TE) used to collect quantitative data during performance of this procedure shall meet the following requirements:

- Be within its current calibration cycle as evidenced by an affixed calibration label.
- Be capable of required range (i.e., equipment range capability shall exceed measured value).
- Have accuracy equal to or greater than tolerance(s) specified.

5.1 ATI (Model TDA-5B) Aerosol generator capable of producing a poly-dispersed challenge aerosol concentration consistent with ASME-N510-1989 requirements.

5.2 Two linear - readout forward - light scattering photometers or "percent penetration meter" with a minimum linear range of 10^5.

NOTE

Accuracy requirements for pressure measurement devices are as follows:

- Pressure range > 1.0 "wg to 1.0 psig. → ±0.1 in. wg
- Pressure range 0.1 "wg to 1.0 "wg. → ±0.01 in. wg

5.3 Differential pressure measuring device (manometer, micro-manometer, etc.) capable of measuring required test pressures.

5.4 Optional: Flow rate measuring device (hot-wire anemometer) capable of measuring velocity between 0 – 3000 fpm with accuracy of at least ±3% of reading.

5.5 Temperature measurement device (accuracy ±2.0°F).

5.6 Test Aerosol: Emery 3004 (Poly- Alphaolefin) MSDS # 24335.

5.7 Aerosol Injection Flex Duct for locations A and E, as required.

5.8 Single Port and Multi-port Aerosol Sampling Probe(s)

5.9 Platform Ladder (for filter housing test port access)

5.10 Two-way radios

5.11 Industrial Hygiene Sampling Equipment, as required

5.12 Plastic Sheeting & tape, as required

5.13 nitrogen bottles, pressure regulators, and carts

5.14 fire extinguisher near aerosol generator

6.0 PREREQUISITES

√ 6.1 Notify the Environmental Compliance Officer (373-1792) that the test will begin.

√ 6.2 Confirm aerosol injection and sampling locations are labeled (note: Figure 1, Location A is excluded from labeling requirement.)

√ 6.3 Notify the Occurrence Notification Center (376-2900) that there will be visible aerosol coming from the PUREX stack due to the aerosol testing of the deep bed filter.

√ 6.4 Confirm that recent work efforts to blow down the 3/8" sample line in Building 291-AB (Figure 1, Location B) with compressed air or nitrogen was accomplished.

7.0 INSTRUCTIONS

NOTE

- Procedure steps shall be performed in the sequence provided, unless otherwise allowed in the procedure text.
- Figure 1 provides injection and sampling test port location information.
- Figure 2 provides specific filter bank test port location information.
- Additional copies of Data Sheets may be added, as needed.

7.1 Non-Sequential / Repetitive Test Instructions

NOTE

Non-Sequential / Repetitive Test Instruction Steps 7.1.1 through 7.1~~8~~ 6 are not order dependent. For increased procedure flexibility, these steps may be worked independently, at any time, and repeated, whenever necessary, to support the test.

per WCE#1 RCSmith 8/31/05

√ 7.1.1 PERFORM non-intrusive test equipment setup activities, as desired.

√ 7.1.2 INSTALL/REINSTALL caps, plugs, etc. as required.

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NOTE
When liquid reservoir is full, the TDA-5B aerosol generator is capable of running continuously at full capacity for approximately 4 hours.

per wcc# RRSmith 8/31/05 7.1.3 **CHECK AND REFILL** aerosol generator with liquid test agent during the test process as necessary.
See Substeps a-d on wcc# 1

NOTE
Sampling system operation will be affected during the performance of this procedure. System may be terminated and/or restored to normal operations whenever requested by the FWS, based on input from the effluent engineer or ECO.

7.1.4 If requested by FWS, **CONFIGURE** stack sampling system as shown below.

System Restoration

7.1.4.1 If Sampling System restoration is requested,

a. **CONFIRM** aerosol injection has ceased.

b. **RESTORE** sampling system to normal operation in accordance with procedure 2CP-SOP-ENV-54001.

c. **ENSURE** the date/time that the system is restored to normal service is recorded in Data Sheet 6.

System Termination

7.1.4.2 If Sampling System termination is requested

a. **TERMINATE** sampling system operation in accordance with procedure 2CP-SOP-ENV-54001.

b. **ENSURE** the date/time that the system was removed from service is recorded in Data Sheet 6.

7.1.5 RCT and IH personnel will **MONITOR** work and perform surveys as necessary.
7.1.6 - See wcc# 1
per wcc#1 RRSmith 8/31/05

7.2 M&TE Calibration Information

√ 7.2.1 **ENSURE** M&TE calibration data for all Vent and Balance instrumentation to be used in test is recorded in Data Sheet 1.

NOTE
Photometers and/or aerosol generators should not be exchanged until completion of a test trial.

7.2.2 IF during performance of test additional or replacement instrumentation is required to complete test, THEN PERFORM the following:

√ 7.2.2.1 RECORD calibration data for additional instrument(s) in Data Sheet 1.

7.2.2.2 NOTE AND DESCRIBE in Data Sheet 1:

- "Why" additional instrumentation was needed.
- "When" (filter and test trial number) additional instrumentation was added.
- "Where" (procedure step number) instrumentation was added.
- "Who" entered additional data into Data Sheet 1 (sign/Date).

7.2.2.3 IF photometer or generator failure occurs during the mixing verification process or performance of a test trial, THEN REPEAT those portions of the test impacted by the equipment failure.

√ 7.2.3 ENTER V&B signature (Vent and Balance Lead) on Date Data Sheet 1.

√7.3 Caisson Preparation

Caisson preparations have been completed during performance of Work Package CP-05-5397/W.

√7.4 Visual Inspection of Filter System:

NOTE
PUREX Deep Bed Filter system is located below grade and is not accessible for visual inspection. Visual Inspection criteria for this test are primarily limited to documenting system test configuration.

√7.4.1 PERFORM visual inspection of filter system AND CHECK (YES/NO column) as appropriate for each question listed on Data Sheet 2A.

√7.4.2 IF any response is different from the Expected Response, THEN NOTE observed discrepancies, deficiencies, or potential problems in Data Sheet 2A.

7.4.3 **SIGN AND DATE** (Vent and Balance Lead) Data Sheet 2A when inspection is complete.

7.5 System Test Configuration:

7.5.1 **PLACE** exhaust fan EF-1 in operation per procedure 2CP-SOP-AU-05010, as required.

7.5.2 **PLACE** exhaust fan damper controller in MANUAL mode per procedure 2CP-SOP-AU-05010.

7.5.3 **VERIFY** acceptability of Canyon Pressure.

7.5.4 **COMPLETE** Data Sheet 2B to record As-Tested system data as follows:

7.5.4.1 **REQUEST** Facility SOE assistance in collecting Data Sheet 2B As-Tested data and system configuration information.

7.5.4.2 **REQUEST** Facility SOE to **SIGN AND DATE** completed Data Sheet 2B.

NOTE:
Step 7.5.5 may be performed separately for each housing at any time prior to testing of the specific housing (Section 7.10).

7.5.5 **PREPARE** filter housing test ports by removing 4" caps and taping over the four test port holes on filter housings FH-V11-4-5, FH-V11-4-9, and FH-V11-4-10.

7.6 Deep Bed Filter Bank Air Flow (cfm) Determination

7.6.1 Obtaining Barometric Pressure

7.6.1.1 **CONTACT** Hanford Weather Forecaster by telephone (373-2716).

7.6.1.2 **REQUEST** absolute barometric pressure (P_b) for closest weather station.

7.6.1.3 **VERIFY** location, station number, time and elevation.

7.6.1.4 **RECORD** data on Data Sheet 3.

7.6.2 **IDENTIFY** operating exhaust fan(s) data on Data Sheet 3.

7.6.3 Pre-Test Leak Check

7.6.3.1 IF MP20 manometer is used, THEN ENSURE Density Program is set to 0.000.

7.6.3.2 BLOW clean, dry air into pitot tube impact hole until manometer reads at least 3.00" w.g.

7.6.3.3 CLOSE off hole opening AND HOLD for minimum of 15 seconds.

NOTE:
Leak check PASSES if manometer reading remains stable (± 0.2" w.g.) for at least 15 seconds; otherwise, leak check FAILS.

7.6.3.4 OBSERVE manometer reading AND RECORD results (PASS or FAIL) on Data Sheet 3.

7.6.3.5 APPLY suction to pitot tube static pressure hole until manometer reads at least 3.00" w.g., AND HOLD for minimum of 15 seconds.

7.6.3.6 OBSERVE manometer reading AND RECORD results (PASS or FAIL) on Data Sheet 3.

7.6.3.7 IF leak check fails, THEN:

7.6.3.7.1 REPAIR OR REPLACE equipment as required.

7.6.3.7.2 REPEAT Steps 7.6.3.1 through 7.6.3.6

7.6.4 Identifying Velocity Traverse Site

NOTE:
- The velocity traverse site is located on the exhaust duct, west of main stack. The ports are labeled A, B, C, D, E & F from North to South and correspond to F-1, F-2, F-3, F-4, F-5, & F-6 in this procedure, respectively.
- Traverse point intervals on Data Sheet 4 are measured relative to port opening surface.
- The stack duct is 66" x 83", 38.04 square ft. The dimension from top of port to bottom of duct is 96¾". The 83" duct depth begins 13¾" below the port (there is a dead-air duct entry.)

7.6.4.1 IF port labels are missing, THEN NOTIFY FWS.

7.6.5 Deep Bed #2 Pitot Traverse Measurements at 291-A-1

7.6.5.1 MARK pitot tube and temperature probe insertion positions to allow accurate probe positioning during testing using distances indicated on Data Sheet 4 (thickness of port/duct entrance is included in these values).

7.6.5.2 MEASURE relative humidity (RH) in (DB2) air stream, AND RECORD on Data Sheet 4. F-3

7.6.5.3 MEASURE static air pressure (P_g) in DB2 air stream, AND RECORD on Data Sheet 4. F-3

7.6.5.4 DB2 Air Velocity Pressure and Temperature

7.6.5.4.1 MEASURE velocity pressure (VP) at each traverse point in order shown on Data Sheet 4.

7.6.5.4.2 MEASURE DB2 air temperature (t_a) at each traverse point in order shown on Data Sheet 4.

7.6.5.4.3 WIPE pitot tube as it is removed, AND REQUEST RCT to perform removable contamination survey after withdrawing pitot tube from port.

A 7.6.5.5 REPEAT step 7.6.5.4 for remaining test port(s).

7.6.5.6 ENTER time test completed and sign/date Data Sheet 4.

7.6.6 Pitot Tube Performance verification

NOTE:
If velocity pressure at last traverse point is unsuitably low (less than 0.04" w.g.), then the traverse point with the highest value velocity pressure should be used to verify pitot tube performance.

7.6.6.1 COPY last traverse point measurement from Data Sheet 4 AND ENTER reading as VP_1 on Data Sheet 5.

7.6.6.2 PURGE pitot tube impact and static pressure holes with clean, dry, pressurized air.

7.6.6.3 REPEAT last traverse point measurement AND ENTER reading as VP_2 on Data Sheet 5.

7.6.6.4 **DETERMINE** percent difference (P) between measurements:

$$P = 100 \frac{(VP_1 - VP_2)}{VP_1}$$

7.6.6.5 **RECORD** results, including PASS/FAIL conclusions, on Data Sheet 5.

> **NOTE:**
> If percent difference is greater than ± 5% but velocity pressure at VP_1 is less than 0.04" w.g., repeating Steps 7.6.5.3 through 7.6.6.5 is NOT required. The Design Authority determines acceptability of VP measurements.

7.6.6.6 IF percent difference is greater than ± 5% AND VP_1 is equal to or greater than 0.04" w.g., THEN **REPEAT** Steps 7.6.5.3 through 7.6.6.5.

7.6.7 Post-test Leak Check

7.6.7.1 IF MP20 manometer is used, THEN **ENSURE** Density Program is set to 0.000.

7.6.7.2 **BLOW** clean, dry air into pitot tube impact hole until manometer reads at least 3.00" w.g.

7.6.7.3 **CLOSE** off hole opening AND **HOLD** for minimum of 15 seconds.

> **NOTE:**
> Leak check PASSES if manometer reading remains stable (± 0.2" w.g.) for at least 15 seconds; otherwise, leak check FAILS.

7.6.7.4 **OBSERVE** manometer reading AND **RECORD** results (PASS or FAIL) on Data Sheet 5.

7.6.7.5 **APPLY** suction to pitot tube static pressure hole until manometer reads at least 3.00" w.g., AND **HOLD** for minimum of 15 seconds.

7.6.7.6 **OBSERVE** manometer reading AND **RECORD** results (PASS or FAIL) on Data Sheet 5.

7.6.7.7 IF either leak check fails, THEN REPAIR OR REPLACE equipment as required AND:

7.6.7.7.1 REPEAT Steps 7.6.3.1 through 7.6.3.7.

7.6.7.7.2 REPEAT Steps 7.6.5.1 through 7.6.7.7.

7.6.8 COMPLETE the following DB2 Flow Test calculations, AND RECORD results on Data Sheet 5:

7.6.8.1 DETERMINE Total t_s by adding t_s entries for each port on Data Sheet 4.

7.6.8.2 DETERMINE Average t_s by dividing Total t_s by 66.

7.6.8.3 CALCULATE Velocity FPM for each traverse point listed on Data Sheet 4:

$$FPM = 4005 \times \sqrt{VP}$$

7.6.8.4 DETERMINE Total FPM for each port and RECORD on data sheets 4 and 5.

7.6.8.5 DETERMINE Total FPM by adding port total FPM entries on Data Sheet 5.

7.6.8.6 DETERMINE Average FPM by dividing Total FPM by 66.

7.6.8.7 CALCULATE Total CFM to determine stack air flow on Data Sheet 5:

TOTAL CFM = AVERAGE FPM x DUCT AREA SQ FT x CORRECTION FACTOR

7.6.8.8 Vent & Balance Lead sign and date Data Sheet 5.

7.7 Establishing Internal Reference (IR) Concentration

7.7.1 SHUTDOWN sample system as follows:

- REQUEST RCT to exchange stack sample in accordance with procedure 2CP-SOP-ENV-54001, with exception that the replacement shutdown filter need not be labeled.
- ENSURE that the time the sample filter is removed is recorded in Data Sheet 6.
- REQUEST SOE to shut off the sampling system vacuum pumps in accordance with procedure 2CP-SOP-AU-05010.

7.7.2 ENSURE reservoir of aerosol generator is full.

NOTE:
Two photometers will be used during the test. One photometer will be used to verify aerosol mixing, establish a background concentration and to estimate actual aerosol concentration. All measurements from this photometer will be based on the photometer's Internal Reference (IR). The second photometer will be used to establish penetration based on a downstream 100% base percent (BP) concentration. For the remainder of the procedure the two photometers will be referred to as the IR photometer and BP photometer, respectively.

7.7.3 SET UP (IR) photometer and (BP) photometer at Location F-3 (label photometers as "IR" and "BP"), and aerosol generator at Location E (downstream side of Filter Housing FH-V11-4-10 in Bldg 291-AE). See Figures 1 and 2.

7.7.4 ALLOW IR & BP photometers electronics to warm up for a minimum of 15 minutes before use.

7.7.5 INSTALL flex hose at Location E, as required.

7.7.6 OPEN (fully) filter housing vacuum breaker valve located on the downstream side of Filter Housing FH-V11-4-10 (Figure 2).

7.7.7 SET IR photometer valve to *CLEAR* position to provide clean air for the scattering chamber.

7.7.8 SET selector switch to 10% position.

7.7.9 ADJUST *STRAYLIGHT* control fully clockwise.

7.7.10 DEPRESS *INTERNAL REFERENCE* switch to the ON position.

7.7.11 ADJUST *GAIN* Control until a meter reading of 100% is obtained on the 10% scale.

7.7.12 SET *INTERNAL REFERENCE* switch to the OFF position.

7.7.13 SET selector switch to the 0.1% position.

7.7.14 ADJUST *STRAYLIGHT* control until a reading of 0 is obtained on the meter.

7.7.15 RECORD final *GAIN* number (from dial) in Data Sheet 7.

NOTE:
Photometer probe(s) must be configured so as to prevent sampling in the dead air space associated with the sampling port access.

7.7.16 **OPEN** pitot tube port plug AND **INSERT** multi-port photometer probe fully into test port "F-3" (C), downstream of exhaust fan.

7.7.17 **MEASURE** Background Concentration at test port F-3 (C) AND **RECORD** Range switch setting (scale), meter reading, and value for IR in Data Sheet 7.

NOTE:
ATI Model TDA-5B aerosol generator shall be used in the test.

7.7.18 **INJECT** aerosol into duct system as follows:

7.7.18.1 **ENSURE** aerosol generator is operated in accordance with the manufacturer's instructions at all times.

7.7.18.2 **START** aerosol generator, as required.

7.7.18.3 **ENSURE** metering valve on aerosol generator is 100% open.

7.7.18.4 **INJECT** challenge aerosol into test Location E, upstream of the sample probe.

7.7.18.5 **RECORD** nitrogen regulated supply pressure on Data Sheet 7.

7.7.19 **RECORD** time, range switch setting (scale), meter reading, and value (i.e. scale X reading) for INTERNAL REFERENCE concentration (IRC) on Data Sheet 7.

7.7.20 **DOCUMENT** observed stability of aerosol concentration at measurement location (e.g., excellent, Good, Fair, Poor) by checking the appropriate box on Data Sheet 7.

7.7.21 **REPEAT** steps 7.7.19 and 7.7.20 at 2 to 5 minute intervals until an equilibrium state has been achieved, but not less than 15 minutes.

NOTE:
With a DB2 flow rate of 30,000 cfm, full output of the TDA-5B generator should result in an aerosol concentration of approximately ~~50~~ 20 µg/l (i.e., ~~50%~~ 20% on 10% scale).

7.7.22 IF final meter reading per Step 7.7.21 is less than 10% on the 10% scale, (i.e., the measured concentration is less than 10 µg/l), THEN CONTACT FWS for direction to proceed.

NOTE:
Photometer probe(s) must be configured so as to prevent sampling in the dead air space associated with the sampling port access.

7.7.23 MEASURE aerosol concentration at the remaining 5 ports (F-1, F-2, F-4, F-5 and F-6) with the multiport probe AND RECORD values(s) in Data Sheet 7. WIPE off and survey the sample tube each time it is removed from a port.

7.7.24 RECORD minimum allowable mixing duration needed to establish a stable base percent concentration in Data Sheet 7.

7.7.25 V&B Lead sign and date Data Sheet 7.

7.8 Establishing Base Percent (BP) Concentration

7.8.1 SET UP base percent concentration (BP) photometer, as required. 7-8-1

NOTE:
Photometer probe(s) must be configured so as to prevent sampling in the dead air space associated with the sampling port access.

7.8.2 INSERT multi-port photometer probe in test port "F3", downstream of exhaust fans, as required.

7.8.3 Allow generator to operate a minimum of 10 minutes and ESTABLISH downstream 100% baseline sample

7.8.4 RECORD the following values in Data Sheet 9:

- Range switch setting (scale), meter reading, and value for baseline percent (BP).
- Final *GAIN* number (from dial)
- Nitrogen supply regulated pressure.

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X 7.8.5 **TURN OFF** Aerosol generator.

X 7.8.6 **REMOVE** BP photometer probe and **CLOSE** test port plug F-3. 14 MIN. to Baseline

X 7.8.7 **CLOSE** (fully) vacuum breaker valve located on the downstream side of Filter Housing FH-V11-4-10 (Location E on Figure 2.)

per UCN #1 RBmill 8/31/05

7.9 Aerosol Mixing ~~Upstream~~ Downstream of Deep Bed Filters

> **NOTE:** Downstream
> Determination of aerosol mixing ~~upstream~~ of deep bed filters (steps ~~7.9.1, 7.9.2, and~~ 7.9.8 through 7.9.12) only needs to be performed during the first trial. The minimum allowable time delay established in trial 1 may be used for trials 2 and 3.

> **CAUTION:**
> Inadvertent adjustments or sudden jarring of equipment during relocation can alter test results. Do Not make any equipment adjustments.

per UCN #1 RBmill 8/31/05

X ~~7.9.1 RELOCATE (carefully) and SET-UP the internal reference IR photometer at the air tunnel sampler (Location B) located in the Bldg 291-AB.~~

~~7.9.2 ATTACH the IR photometer to the air tunnel sample line (3/8" pipe) located in Building 291-AB.~~

X 7.9.3 **REMOVE** the caisson 16" access port cover. Start

X 7.9.4 **SET UP** the aerosol generator at Location A, as required. 9:10 AM

X 7.9.5 **SET-UP** the BP photometer in the 291-AE Bldg near filter housing FH-V11-4-5.

7.9.5a Insert multiport probe into port D-5-3.

per UCN #1 RBmill 8/31/05

7.9.6 **ALLOW** photometer(s) electronics to warm up for a minimum of 15 minutes before use.

7.9.7 **INJECT** aerosol into Location A (flex hose) as follows:

7.9.7.1 **ENSURE** aerosol generator is operated in accordance with the manufacturer's instructions at all times.

7.9.7.2 **START** aerosol generator, as required.

7.9.7.3 **ENSURE** metering valve on aerosol generator is 100% open.

7.9.7.4 **INJECT** challenge aerosol into test Location A, (caisson upstream of Deep Bed Filter #2).

7.9.7.5 **RECORD** nitrogen supply regulated pressure on Data Sheet 8 (first trial only).

NOTE:
The primary purpose of the following measurement is to determine the time delay necessary to establish equilibrium in the sample concentration. ~~Concentration measured may or may not be representative of actual aerosol concentration.~~

per UCN# KDonnell 8/31/05

7.9.8 **MEASURE** aerosol concentration at ~~air tunnel sampler (Location B)~~ Port D-5-3 AND **RECORD** time, range switch setting (scale), meter reading, and value on Data Sheet 8.

7.9.9 **DOCUMENT** observed stability of aerosol concentration at measurement location (e.g., excellent, Good, Fair, Poor) by checking the appropriate box on Data Sheet 8.

NOTE:
Additional copies of Data Sheet 8 may be added, as necessary.

7.9.10 **REPEAT** steps 7.9.8 and 7.9.9 at 2 to 5 minute intervals (approximate) until all of the following criteria are satisfied: (Notify FWS if stability is questionable.)

- Sample results are stable
- Concentration trend is not increasing
- Injection time period exceeds 30 minutes.

7.9.11 **RECORD** minimum allowable time delay (minutes) on Data Sheet 8.

7.9.12 Vent & Balance Lead **SIGN** and **DATE** Data Sheet 8.

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7.10 Deep Bed Filter #2 Downstream (Penetration) Concentration

NOTES:

- ~~An additional minimum delay time of 30 minutes must occur between establishing equilibrium (step 7.9.10) and measuring the downstream concentration (step 7.10.2).~~
- The minimum time delay established during trial 1 (injection duration per step 7.9.11 ~~plus 30 minutes)~~ will also be used for test trials 2 and 3.
- Photometer probe(s) must be configured so as to prevent sampling in the dead air space associated with the sampling port access.

per UCO#1 R Smith 8/31/05

7.10.1 Fully INSERT the Multi-port probe through the tape and into the filter housing test port specified on Data Sheet 9 (beginning with FH-V11-4-5) and RECORD starting time. 10:08

7.10.2 MEASURE aerosol concentration at the specified test port AND RECORD range switch setting (scale), meter reading, and value in Data Sheet 9.

7.10.3 DOCUMENT observed stability of aerosol concentration at measurement location (e.g., Excellent, Good, Fair, Poor) by checking the appropriate box in Data Sheet 9.

7.10.4 REMOVE multi-port probe, wiping off and surveying probe as it is pulled out

7.10.5 INSERT single port probe into filter housing test port specified on Data Sheet 9. Measurements are taken from the inside surface of the housing.

7.10.6 MEASURE aerosol concentration at three probe depths across the sampling plane as specified on Data Sheet 9, AND RECORD range switch setting (scale), meter reading, and value for each in Data Sheet 9.

7.10.7 DOCUMENT observed stability of aerosol concentration at measurement location (e.g., Excellent, Good, Fair, Poor) by checking the appropriate box in Data Sheet 9.

7.10.8 RECORD primary and secondary filter DP readings (from local instruments) on Data Sheet 9.

7.10.9 REMOVE probe from test port, wiping it off and surveying it as it is pulled out, then tape ~~over the hole in~~ the tape covering the test port.

7.10.10 REPEAT Steps 7.10.1 through 7.10.9 for each remaining test port on the filter housing. SIGN data sheet 9 at completion of each filter housing.

7.10.11 REPEAT Steps 7.10.1 through 7.10.10 for each remaining filter housing (FH-V11-4-9 and FH-V11-4-10).

7.10.12 TURN OFF Aerosol generator and DISCONNECT line from caisson.

NOTE:
Step 7.10.13 does not need to be performed if immediately proceeding to section 8.0, Restoration.

per ucn#1 RRSmith 8/31/05

7.10.13 ~~REPLACE~~ Cover caisson 16" access port ~~cover.~~

NOTES:

- Wait ~~30~~ 60 minutes (minimum) between trials to allow system purging.
- The third trial may be waived at the discretion of the FWS based on measured value variation of results between trial 1 and trial 2. If third trial is waived, skip to Section 8.0.

7.10.14 PERFORM a second and third trial as follows: STOP

per ucn#1 RRSmith 8/31/05

7.10.14.1 MOVE BP photometer to Location F.

Note: See ucn#1

7.10.14.2 MOVE aerosol generator to Location E.

7.10.14.3 OPEN (fully) filter housing vacuum breaker valve located on the downstream side of Filter Housing FH-V11-4-10 Location E (Figure 2).

7.10.14.4 START aerosol generator.

~~7.10.14.5 WAIT minimum time determined in Step 7.7.24.~~

per ucn#1 RRSmith 8/31/05

7.10.14.6 REPEAT steps 7.8.1 through 7.10.14.

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8.0 RESTORATION

> **NOTE:**
> Sections 8.1 through 8.8 may be performed in any order or concurrently.

8.1 291-A Stack Sampler

> **NOTE:**
> Step 8.1.1 may actually be performed at any time after the completion of final baseline aerosol injection (7.10.12), as determined by FWS, but preferably within 48 hours of shutdown.

8.1.1 **RESTART** sample system as follows:

- **REQUEST** SOE to restart the sampling system vacuum pumps in accordance with procedure 2CP-SOP-AU-05010.
- **REQUEST** RCT to ensure stack sample exchange in accordance with procedure 2CP-SOP-ENV-54001, with exception that the shutdown filter needs no documentation and may be discarded.
- **ENSURE** that the time the sample filter is inserted is recorded in Data Sheet 6.

8.2 Location A: Surveillance Caisson & Ductwork

> **NOTE:**
> The inside of PUREX column 14 caisson will be left in the configuration established in work package CP-05-5397/W.

8.2.1 **CLOSE** caisson access port cover and seal with metal tape.

8.2.2 **SEAL** around the perimeter of the 10' caisson cover (under vertical skirt) with metal tape.

8.3 Location B: Air Tunnel Sample Tubing

8.3.1 **REMOVE** (IR) photometer, as required.

8.3.2 **INSPECT** 3/8" pipe sample line and verify cap has been restored (Location B).

8.3.3 **DECONTAMINATE** sampler line connection, as necessary, to non-smearable.

8.3.4 **BAG** job related waste generated during the work.

8.4 Location D: Filter Building # 4 Filter Housing Inlet Test Ports

8.4.1 REINSTALL permanent test port caps on filter building #4 filter housings, as required.

8.4.2 INSPECT Location D test port caps re-installation to verify absence of gross leakage.

8.4.3 DECONTAMINATE test port caps and adjacent housing surfaces, as necessary, to non-smearable.

8.4.4 BAG job related waste generated during the work.

8.5 Location E: Vacuum Breaker Valve

8.5.1 REMOVE flex hose, as applicable.

8.5.2 ENSURE Vacuum Breaker Valve on Filter Housing FH-V11-4-10 is fully closed.

8.6 Location F: Pitot Tube Sample Ports

8.6.1 RESTORE (Location F) pitot tube sample ports to there original configuration as follows:

8.6.1.1 ENSURE Pitot tube isolation plugs are installed (six places).

8.6.1.2 DECONTAMINATE test port Location F surfaces as necessary, to non-smearable.

8.6.1.3 BAG job related waste generated during the work.

NOTE:
In service Fan to be determined by Operations at time of restoration.

8.7 Vortex Damper Control and Filter Building #4.

8.7.1 REQUEST Facility SOE to restore HVAC system to normal operation as follows:

- Place selected exhaust fan in operation per procedure 2CP-SOP-AU-05010, as required.
- Verify acceptability of Canyon Pressure.

8.8 Final Restoration and As-Left Configuration

8.8.1 **ENSURE** waste generated per these work instructions is disposed in accordance with the Waste Packaging/Labeling Instruction Sheet.

> **NOTE:**
> The following step is consistent with normal facility radiological control practices and has been provided to support immediate test equipment removal from contamination areas. If immediate equipment removal is not required, then release of the test equipment may be deferred until a later date.

8.8.2 IF immediate removal of the test equipment from contamination area is required, THEN **PERFORM** the following:

8.8.2.1 **REQUEST** RCT to perform a contamination survey of test equipment.

8.8.2.2 **DECONTAMINATE** test equipment, as required.

8.8.3 **ALLOW** ventilation system to operate a minimum of 30 minutes (after ventilation system has been fully restored to normal operation) AND PERFORM the following:

8.8.3.1 **RECORD** As-left System Configuration Data in Data Sheet 10 and sign/date the data sheet.

8.8.3.2 **ENSURE** operational data is within specifications per procedure 2CP-SOP-AU-05010.

8.8.3.3 **REQUEST** Design Authority (or delegate) support in addressing all out-of- specification requirements, as applicable.

9.0 CALCULATIONS

Aerosol test data will be evaluated by Engineering. Penetration calculations will be documented in an Engineering Test Report.

10.0 ACCEPTANCE

Purpose of this procedure was to collect filtration efficiency information for Deep Bed Filter # 2, not to determine compliance to Documented Safety Analysis or Environmental Permit requirements. Therefore, no acceptance criteria are to be applied to the test data (i.e., no pass/fail criteria are assigned).

11.0 DISPOSITION

11.1 **DOCUMENT** any deficiencies, test exceptions, or component failures observed during the performance of this procedure in Craft Resource Log (J-5).

> **NOTE:**
> All documented test exceptions must be evaluated by the Design Authority and dispositioned (if necessary) prior to package closeout.

11.2 **ENSURE** all test exceptions are dispositioned prior to package closeout.

11.3 **FORWARD** data collected to the Design Authority for further evaluation and performance of calculations.

11.4 **OBTAIN** copy of test results and **ADD** to this work package.

12.0 BIBLIOGRAPHY

- ASME-N510-1989, American Society of Mechanical Engineers (ASME), "Testing of Nuclear Air Treatment Systems."
- ERDA 76-21, Nuclear Air Cleaning Handbook, "Design, Construction, and Testing of High Efficiency Air Filtered Systems For Nuclear Application."
- ACGIH Industrial Ventilation, Section 9.
- Drawing H-2-75975, HVAC Plan Section & Detail
- Drawing H-2-75976, HVAC Sections & Detail
- Drawing H-2-58543, Structural Concrete Filter Building
- Drawing H-2-58543, Structural Concrete Filter Building
- Drawing H-2-58544, Structural Concrete Filter Building Roof Plan
- Drawing H-255018, Heat & Vent- Plan & Section Ductwork Process Exhaust System Sheet No. 1
- Drawing H-2-55021, Heat & Vent Plan & Sections Fan Layout & Piping
- Material Safety Data Sheet (MSDS) 24335, SYNTHETIC ALIPHATIC HYDROCARBON
- Vendor Information File # CVI-21619, Supp 06-14
- HNF-PRO-8323, "Management of HEPA Filter Systems."

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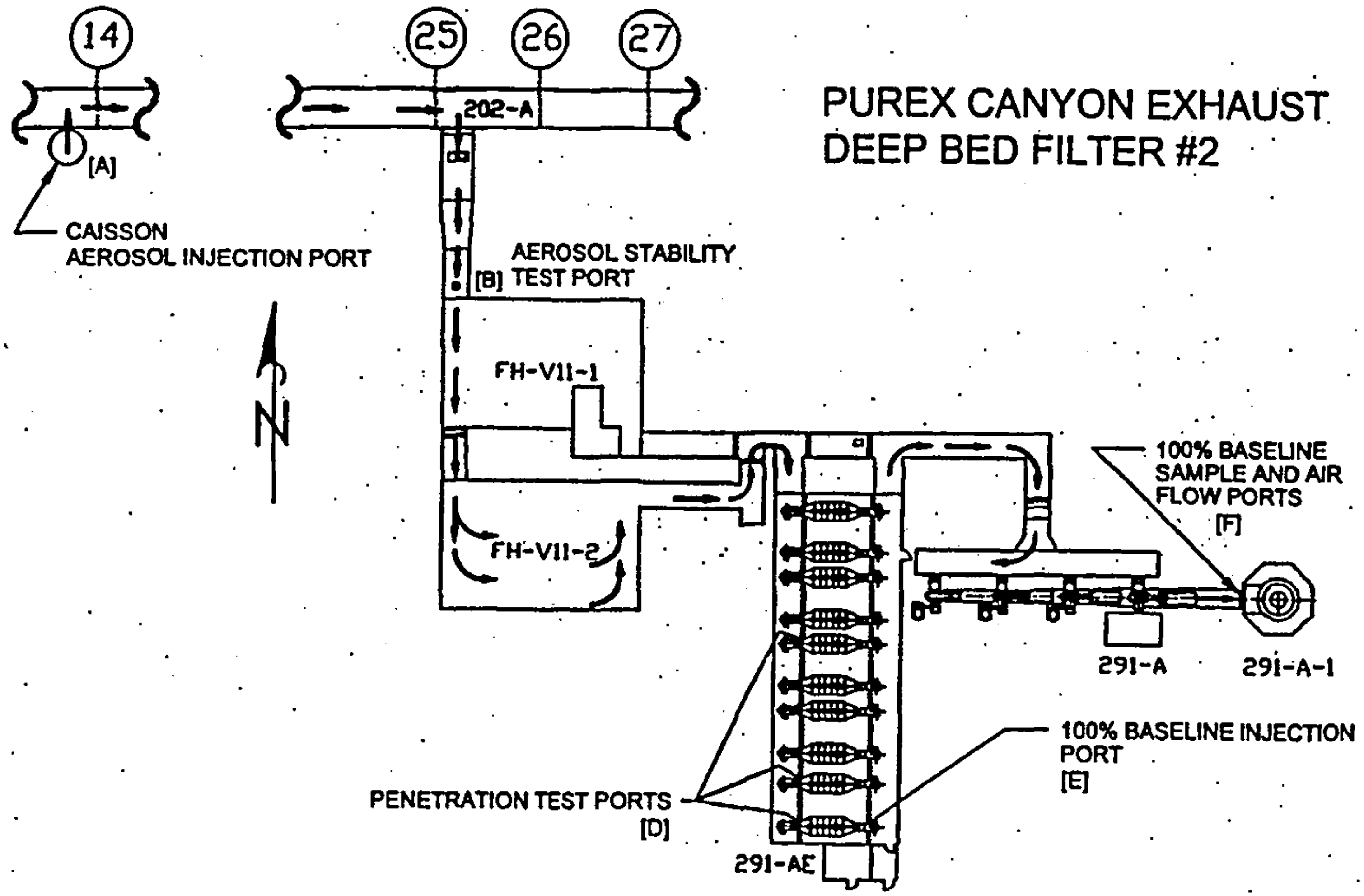

Figure 1: Deep Bed Filter #2 System Configuration

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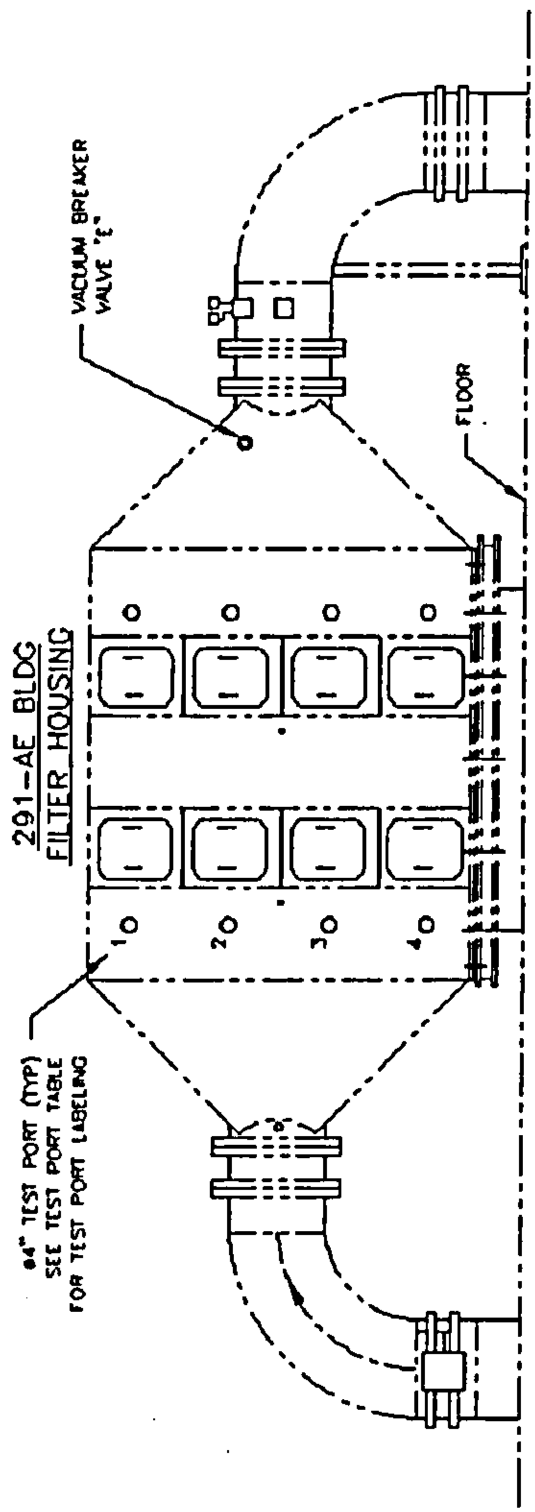
Figure 2 – Filter Bank Test Port Locations



TEST PORT TABLE

TEST PORT NO	FH-V11-4-5 LABEL	FH-V11-4-9 LABEL	FH-V11-4-10 LABEL
1	D-5-1	D-9-1	D-10-1
2	D-5-2	D-9-2	D-10-2
3	D-5-3	D-9-3	D-10-3
4	D-5-4	D-9-4	D-10-4

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DATA SHEET 1 – Filter Testing Instrumentation Log

7.2.1	INSTRUMENT CALIBRATION DATA
Differential Pressure Instrument	Aerosol Generator
Instrument Type: MICRO	*(1.) Model Number:* TDA-5B
Code Number: 817-28-09-117	*Equipment Number:* 15952
Calibration Due Date: 7-25-06	*Functional Verification Due Date:* N/A
Range: 0-30" w.c. *Accuracy:* ± 1%	*(2.) Model Number:*
(IR) Photometer	*Equipment Number:*
Equipment Number: 10186 (*)	*Functional Verification Due Date:*
Code Number: 799-23-10-003	Air Flow (Velocity) Instrument
Calibration Due Date: 5-19-06	*Instrument Type:* MICRO
(BP) Photometer	*Code Number:* 817-28-09-117
Equipment Number: 9067	*Calibration Due Date:* 7-25-06
Code Number: 702-23-10-010	*Range:* 0-30" w.c.
Calibration Due Date: 5-16-06	*Accuracy:* ± 1%

7.2.2	ADDITIONAL INSTRUMENT CALIBRATION DATA Calibration Data should be entered into this portion of Data Sheet in the same format as shown above.
FLUKE 52 (THERMOMETER)	ALNOR (R.H.)
799-76-06-003	817-28-01-005
Due @ 12-17-05 ± 2°F	Due @ 4-25-06 ± 3%

(COMMENTS): (*) 799-23-10-003 Used for internal reference.

7.2.3 V&B Signature/Date: [signature] 12-30-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 28 OF 48

DATA SHEET 2A– Deep Bed Filter #2 System Inspection Checklist

VISUAL INSPECTION CHECKLIST	7.4.1 YES	7.4.1 NO	Expected Response
Is there adequate access to filter test ports?	✓		YES
Is the housekeeping in and around the housing adequate for testing?	✓		YES
Is lighting adequate to perform the test? (If response is "No", request PIC to provide supplemental lighting.)	✓		YES
Is there any evidence of physical damage to the housing or connected piping adjacent to the housing?		✓	NO
Are the sample ports identified in the sketch available for use?	✓		YES
Are installed gauges labeled?	✓		YES
Are sample port locations properly labeled?	✓		YES

(COMMENTS):

7.4.3 Vent and Balance Lead (Signature/Date): [signature] / 8-30-05

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Data Sheet 2B- Deep Bed Filter #2 As-Tested Configuration Data (Sheet 1 of 2)

STEP 7.5.4

Date/Time data taken: 8-30-05 9:07

Date Time

Parameter	SAMCONS Display Component Number	Value
Outside Ambient Temp	N/A	69 °F
Tunnel Air Temperature	TIT-V11-TUN-1	75.7 °F
Tunnel /Atmosphere DP	PDIT-V11-TUN-1	-0.58 in. wg.
Tunnel /Atmosphere DP	PDIT-V11-TUN-2	-0.57 in. wg.
Canyon/Atmosphere DP	PDIT-V11-CAN-1	-0.493 in. wg.
Canyon/Atmosphere DP	PDIT-V11-CAN-2	-0.491 in. wg.
Deep Bed #2 DP	PDIT-V11-DBF2-1	1.04 in. wg.
DB2 Flow Rate	FIY-V18-9-1	37,703 cfm.
291-AE Total HEPA DP	PDIT-V11-4-~~7~~ 13 *	2.77 in. wg.

JDC 8-30-05 * TYPOGRAPHICAL ERROR. SHOULD BE PDIT-V11-4-13

ELS 8-30-05 code shown per telecon ELS 8-30-05

Fan Number	Fan in Service? (Yes/No)	Auto Control? (Yes/No)	Vortex Damper % Open
EF-V11-1	Yes	NO	42
EF-V11-2	NO	NO	23
EF-V11-3	NO	NO	27

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Data Sheet 2B- Deep Bed Filter #2 As-Tested Configuration Data (Sheet 2 of 2)

Filter Bank No.	FB In Service? (Yes/No)	Damper I.D.	Damper Position (Check One)	
			Open	Closed
FH-V11-4-1	No	MV-V11-1	~~✓~~ RK 8-30-05	✓
		MV-V11-2		✓
FH-V11-4-2	No	MV-V11-3	~~✓~~ RK 8-30-05	✓
		MV-V11-4		✓
FH-V11-4-3	No	MV-V11-5		✓
		MV-V11-6		✓
FH-V11-4-4	No	MV-V11-7		✓
		MV-V11-8		✓
FH-V11-4-5		MV-V11-9	✓	
		MV-V11-10	✓	
FH-V11-4-6	No	MV-V11-11		✓
		MV-V11-12		✓
FH-V11-4-7	No	MV-V11-13		✓
		MV-V11-14		✓
FH-V11-4-8	No	MV-V11-15		✓
		MV-V11-16		✓
FH-V11-4-9		MV-V11-17	✓	
		MV-V11-18	✓	
FH-V11-4-10		MV-V11-19	✓	
		MV-V11-20	✓	
FH-V11-4-11	No	MV-V11-21		✓

7.5.4.2 SOE [signature] 8-30-05
Signature date

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 31 OF 48

DATA SHEET 3 - BACKGROUND DATA FOR 291-A-1

STEP #					
7.6.1.1	Hanford Weather Forecaster (373-2716)				
7.6.1.4	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200E	#6	680ft above MSL	9:43 AM	(P_b) 29.422
	COMMENTS:				
7.6.2	Operating exhaust fan(s):			EF-1	
7.6.3.4 7.6.3.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure: PASS/FAIL (PASS circled) 3.26" w.g. Static Pressure: PASS/FAIL (PASS circled) 3.49" w.g.				
	COMMENTS:				

[signature] 10-30-05
Signature / Date

DATA SHEET 4 - FLOW MEASUREMENTS FOR 291-A-1

7.6.5.2 7.6.5.3 Relative Humidity 23.70 %(RH) Static Pressure: .015 "w.g. (Pg)

	Traverse Point No.	Distance from port entrance (inches)	Port A (F-1)			Port B (F-2)			Port C (F-3)			Port D (F-4)			Port E (F-5)			Port F (F-6)		
			ts (°F)	VP ("w.g.)	FPM ** (ft/min)	ts (°F)	VP ("w.g.)	FPM ** (ft/min)	ts (°F)	VP ("w.g.)	FPM ** (ft/min)	ts (°F)	VP ("w.g.)	FPM ** (ft/min)	ts (°F)	VP ("w.g.)	FPM ** (ft/min)	ts (°F)	VP ("w.g.)	FPM ** (ft/min)
7.6.5.4.1	1	17½	84°	.045	850	84°	.063	1005	85°	.063	1005	85°	.064	1013	85°	.055	939	85°	.045	850
7.6.5.4.	2	25	84°	.050	896	84°	.069	1052	85°	.071	1067	85°	.063	1005	85°	.060	981	85°	.060	981
7.6.8.1	3	32½	84°	.061	989	84°	.070	1060	85°	.069	1052	85°	.070	1060	85°	.071	1067	85°	.067	1037
7.6.8.3	4	40	84°	.067	1037	84°	.076	1104	85°	.077	1111	85°	.085	1168	85°	.076	1104	85°	.068	1044
	5	47½	84°	.072	1075	84°	.076	1104	85°	.083	1154	85°	.090	1202	85°	.089	1195	85°	.074	1089
	6	55	84°	.063	1005	84°	.083	1154	85°	.080	1133	85°	.076	1104	85°	.073	1082	85°	.085	1168
	7	62½	84°	.069	1052	84°	.072	1075	85°	.089	1195	85°	.072	1075	85°	.071	1067	85°	.079	1126
	8	70	84°	.062	997	84°	.064	1013	85°	.093	1221	85°	.079	1126	85°	.070	1060	85°	.076	1104
	9	77½	84°	.071	1067	84°	.079	1126	85°	.066	1029	85°	.080	1133	85°	.093	1221	85°	.073	1082
	10	85	84°	.067	1037	84°	.060	981	85°	.065	1021	85°	.081	1140	85°	.087	1181	85°	.077	1111
	11	92½	84°	.071	1067	84°	.063	1005	85°	.058	965	85°	.075	1097	85°	.065	1021	85°	.065	1021
7.6.8.4			924	TOTAL 11,072 FPM		924	TOTAL 11,679 FPM		935	TOTAL 11,953 FPM		935	TOTAL 12,123 FPM		935	TOTAL 11,918 FPM		935	TOTAL 11,613 FPM	

* Traverse points are measured relative to the outside of port and includes port duct wall thickness and dead-air space.

** *FPM = 4005 √VP*

7.6.5.6 Time test completed: 10:15 Am Signature: [signature] Date: 8-30-05

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DATA SHEET 5 - DATA COMPLETION FOR 291-A-1 (Sheet 1of 2)

STEP #	PITOT TUBE PERFORMANCE CHECK	
7.6.6.1 7.6.6.3 7.6.6.5	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(VP₁ - VP₂) ÷ VP₁] x 100 = 1.50 % P = [(.065 - .064) ÷ .065] x 100 = 1.50 % If P > ± 5% AND VP₁ < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS) FAIL
	COMMENTS:	
	POST-TEST PRESSURE LEAK CHECK	
7.6.7.4 7.6.7.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure: (PASS)/FAIL 6.82 "w.g. Static Pressure: (PASS)/FAIL 4.45 "w.g.	
	COMMENTS:	
	DEEP BED #2 AIR FLOW CALCULATIONS	
7.6.8.1		Total Port A (F-1): 924
		Total Port B (F-2): 924
		Total Port C (F-3): 935
		Total Port D (F-4): 935
		Total Port E (F-5): 935
		Total Port F (F-6): 935
	Total t_s = t_{sA} + t_{sB} +...+ t_{sF}	Total t_s (A, B, C, D, E, F): 5588
7.6.8.2	Average t_s = Total t_s ÷ 66	t_s (avg): 84.6

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 34 OF 48

DATA SHEET 5 - DATA COMPLETION FOR 291-A-1 (Sheet 2of 2)

	DEEP BED #2 AIR FLOW CALCULATIONS		
7.6.8.4 7.6.8.5		Total Port A (F-1)	11,072
		Total Port B (F-2)	11,679
		Total Port C (F-3)	11,953
		Total Port D (F-4)	12,123
		Total Port E (F-5)	11,918
		Total Port F (F-6)	11,613
	Total FPM = $FPM_A + FPM_B + \ldots + FPM_F$	Total FPM (A, B, C, D, E, F)	70,358
7.6.8.6	Average FPM = Total FPM ÷ 66	FPM (avg)	1,066
7.6.8.7	Total CFM = Average FPM x 38.04 sq ft x 0.92*	CFM (total)	37,307

* This is an EPA approved correction factor for this variant pitot traverse, per EPA letter dated April 11, 1994.

7.6.8.8 V&B [signature] / 8-30-05
Signature / Date

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 35 OF 48

Data Sheet 6 – Stack Sampling System Operations Log

Record stack sampling system shutdown and startup dates and times below.

System shutdown date/time	System startup date/time
8-30-05 / 0820	8-30-05 / Ø1540
8-31-05 / 0905	8-31-05 / 1430
9/1/05 / 0730	9/1/05 / 1430
/	/
/	/
/	/
/	/
/	/
/	/

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 36 OF 48

Data Sheet 7 – (IR) Photometer Aerosol Mixing Data at Location F

7.7.15 IR Photometer gain number 3.8

7.7.17 IR Background concentration Scale .1 X Reading 7 = Value .7

7.7.18.5 Nitrogen supply regulated pressure 50

7.7.19 – 7.7.21 Internal Reference (IR) Aerosol Concentration Stability (Port F-3)

Test Port	Time	Measured Value			Aerosol Measurement Stability (Check one)
		Scale	Reading	Value	
F-3	12:42	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	12:45	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	12:47	100	12.5	1250	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	12:47 PM	100	14	1400	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	1249 PM	100	14	1400	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	1251 PM	100	14	1400	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	1253 PM	100	14	1400	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	1255 PM	100	13	1300	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3	1257 PM	100	13	1300	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
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F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐
F-3					Excellent ☐ Good ☐ Fair ☐ Poor ☐

7.7.23 Internal Reference (IR) Aerosol Concentration Stability (F-1,F-2,F-4,F-5 &F-6)

Test Port	Time	Measured Value			Aerosol Measurement Stability (Check one)
		Scale	Reading	Value	
F-1	1:00 PM	100	13	1300	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-2	1:02 PM	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-4	1:03 PM	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-5	1:04 PM	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐
F-6	1:05 PM	100	12	1200	Excellent ☑ Good ☐ Fair ☐ Poor ☐

7.7.24 Minimum allowable mixing duration 5 minutes

7.7.25 V&B sign/ date [signature] / 8-30-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 37 OF 48

Data Sheet 8:

7.9.7.5 Nitrogen supply regulated pressure 50

Steps 7.9.8/7.9.9 Upstream Aerosol Equilibrium Concentration &Time Delay

Test Port B	Time	Measured Value			Aerosol Measurement Stability (Check one)
		Scale X	Reading	= Value	
1	2:20 PM	100	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
2	2:25 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
3	2:30 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
4	2:35 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
5	2:40 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
6	2:45 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
7	2:50 PM	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
8					Excellent ☐ Good ☐ Fair ☐ Poor ☐
9					Excellent ☐ Good ☐ Fair ☐ Poor ☐
10					Excellent ☐ Good ☐ Fair ☐ Poor ☐
11					Excellent ☐ Good ☐ Fair ☐ Poor ☐
12					Excellent ☐ Good ☐ Fair ☐ Poor ☐
13					Excellent ☐ Good ☐ Fair ☐ Poor ☐
14					Excellent ☐ Good ☐ Fair ☐ Poor ☐
15					Excellent ☐ Good ☐ Fair ☐ Poor ☐
16					Excellent ☐ Good ☐ Fair ☐ Poor ☐
17					Excellent ☐ Good ☐ Fair ☐ Poor ☐
18					Excellent ☐ Good ☐ Fair ☐ Poor ☐
19					Excellent ☐ Good ☐ Fair ☐ Poor ☐
20					Excellent ☐ Good ☐ Fair ☐ Poor ☐

7.9.11 Minimum Allowable Time Delay SEE J-5 N/A minutes

7.9.12 V&B sign/ date [signature] 8-30-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W WCN #1 PAGE 37 OF 48

Data Sheet 8:

7.9.7.5 Nitrogen supply regulated pressure 50

Steps 7.9.8/7.9.9 ~~Upstream~~ Port D-5-3 Aerosol Equilibrium Concentration &Time Delay

D-5-3 ~~Test Port B~~ JOC 8/31/05	Time	Measured Value Scale X	Reading	= Value	Aerosol Measurement Stability (Check one)
1	12:44 pm	.1	0	0	Excellent ☐ Good ☐ Fair ☐ Poor ☐
2	12:47 pm	.1	20	2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
3	12:52 pm	.1	24	2.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
4	12:57	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
5	1:02 pm	.1	34	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
6	1:07 pm	.1	36 ~~30~~	3.6 ~~3.0~~	Excellent ☐ Good ☐ Fair ☑ Poor ☐
7	1:12 pm	.1	38	3.8	Excellent ☐ Good ☐ Fair ☑ Poor ☐
8	1:17 pm	.1	39	3.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
9	1:22 pm	.1	39	3.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
10	1:27 pm	.1	3.9	3.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
11					Excellent ☐ Good ☐ Fair ☐ Poor ☐
12					Excellent ☐ Good ☐ Fair ☐ Poor ☐
13					Excellent ☐ Good ☐ Fair ☐ Poor ☐
14					Excellent ☐ Good ☐ Fair ☐ Poor ☐
15					Excellent ☐ Good ☐ Fair ☐ Poor ☐
16					Excellent ☐ Good ☐ Fair ☐ Poor ☐
17					Excellent ☐ Good ☐ Fair ☐ Poor ☐
18					Excellent ☐ Good ☐ Fair ☐ Poor ☐
19					Excellent ☐ Good ☐ Fair ☐ Poor ☐
20					Excellent ☐ Good ☐ Fair ☐ Poor ☐

7.9.11 Minimum Allowable Time Delay 43 minutes

7.9.12 V&B sign/ date [signature] 8-31-05

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Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 1)

7.8.4 Base Percent (BP) Concentration

Scale Setting 100 X Meter Reading 100 = Value 10,000

Gain Setting 5.28 Nitrogen supply regulated Pressure 50

7.10.1 Start time 3:05 pm

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value: Scale X	Reading	= Value	Aerosol Measurement Stability (Check one)
D-5-1	Multi-Port	Full	.1	1250	125	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1	Single-Port	15"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1	Single-Port	39"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1	Single-Port	63"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Multi-Port	Full	.1	~~60~~ 32	~~6.0~~ 3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Single-Port	39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Single-Port	63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Multi-Port	Full	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	15"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Multi-Port	Full	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Single-Port	15"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Single-Port	39"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Single-Port	63"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐

8-30-05 8-31-05

Primary Filter DP	PDIT-V11-4-5-A	Value .76 ("wg)
Secondary Filter DP	PDIT-V11-4-5-B	Value .95 ("wg)
Comments	This data sheet information only - see J-5	

7.10.10 V&B sign/ date [signature] 8-30-05 @ 3:27 pm

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W WCN #1 PAGE 38 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 1)

7.8.4 Base Percent (BP) Concentration

Scale Setting 100 X Meter Reading 100 = Value 10000

Gain Setting 5.39 Nitrogen supply regulated Pressure 50

7.10.1 Start time 1:30 pm

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale X	Reading	= Value	Aerosol Measurement Stability (Check one)
D-5-1	Multi-Port	Full	.1	~~47~~ 38	~~4.7~~ 3.8	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1	Single-Port	15"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1		39"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1		63"	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Multi-Port	Full	.1	~~46~~ 33	~~4.6~~ 3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Single-Port	15"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2		63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Multi-Port	Full	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	15"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3		39"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3		63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Multi-Port	Full	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Single-Port	15"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4		39"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4		63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐

(Corrections initialed and dated 8-31-05)

Primary Filter DP	PDIT-V11-4-5-A	Value .76 ("wg)
Secondary Filter DP	PDIT-V11-4-5-B	Value .97 ("wg)

Comments: @ Ports # D-5-1 & D-5-2 - these two readings were retaken after the six outer probe holes were covered with tape to prevent any inleakage from outside filter housing.

7.10.10 V&B sign/ date [signature] 8-31-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 39 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 1)

7.10.1 Start time 1:53 pm

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale	X Reading	= Value	Aerosol Measurement Stability (Check one)
D-9-1	Multi-Port	Full	.1	37	3.7	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1	Single-Port	15"	.1	36	3.6	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1	Single-Port	39"	.1	36	3.6	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1	Single-Port	63"	.1	36	3.6	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Multi-Port	Full	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Single-Port	15"	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Single-Port	39"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Single-Port	63"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Multi-Port	Full	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Single-Port	15"	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Single-Port	39"	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Single-Port	63"	.1	35	3.5	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Single-Port	15"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Single-Port	39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Single-Port	63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐

Primary Filter DP	PDIT-V11-4-9-A	Value .90 ("wg)
Secondary Filter DP	PDIT-V11-4-9-B	Value .88 ("wg)

Comments

7.10.10 V&B sign/ date [signature] / 8-31-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 40 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 1)

7.10.1 Start time 2107 pm

7.10.2 – 7.10.9

Port Location	Probe Type	Probe Depth	Measured Value: Scale	X Reading	= Value	Aerosol Measurement Stability (Check one)
D-10-1	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1		63"	.1 RS 8-31-05	~~32~~ 32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2	Multi-Port	Full	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2	Single-Port	15"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2		63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3	Multi-Port	Full	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3		63"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4	Multi-Port	Full	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4	Single-Port	15"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4		39"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4		63"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐

Primary Filter DP	PDIT-V11-4-10-A	Value .86 ("wg)
Secondary Filter DP	PDIT-V11-4-10-B	Value .84 ("wg)

Comments:

7.10.10 V&B sign/ date [illegible] 8-31-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 41 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 2)

7.8.4 Base Percent (BP) Concentration

Scale Setting 100 X Meter Reading 100 = Value 10,000

Gain Setting 5.21 Nitrogen supply regulated Pressure 50

7.10.1 Start time ~~8'~~ 10:08 AM (initialed 9-1-05)

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale X	Reading	= Value	Aerosol Measurement Stability (Check one)
D-5-1	Multi-Port	Full	.1	34	3.4	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1	Single-Port	15"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-1		63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-2		63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3		63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Multi-Port	Full	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Single-Port	15"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-4		39"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-4		63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☐ Poor ☐

Primary Filter DP	PDIT-V11-4-5-A	Value .74 ("wg)
Secondary Filter DP	PDIT-V11-4-5-B	Value .93 ("wg)

Comments

7.10.10 V&B sign/ date [signature] 9-1-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 42 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 2)

7.10.1 Start time 10:28 AM

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale	X Reading	= Value	Aerosol Measurement Stability (Check one)
D-9-1	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1		39"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-1		63"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Multi-Port	Full	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2	Single-Port	15"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2		39"	.1	33	3.3	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-2		63"	.1	32	3.2	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Multi-Port	Full	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3	Single-Port	15"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3		39"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-3		63"	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Multi-Port	Full	.1	31	3.1	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4	Single-Port	15"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4		39"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-9-4		63"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐

Primary Filter DP	PDIT-V11-4-9-A	Value .87 ("wg)
Secondary Filter DP	PDIT-V11-4-9-B	Value .85 ("wg)
Comments		

7.10.10 V&B sign/ date [signature] 9-1-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 43 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 2)

7.10.1 Start time 10:43 AM

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale	X Reading	= Value	Aerosol Measurement Stability (Check one)
D-10-1	Multi-Port	Full	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1	Single-Port	15"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1		39"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-1		63"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2	Multi-Port	Full	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2	Single-Port	15"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2		39"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-2		63"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3	Multi-Port	Full	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3	Single-Port	15"	.1	30	3.0	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3		39"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-3		63"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4	Multi-Port	Full	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4	Single-Port	15"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4		39"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-10-4		63"	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐

Primary Filter DP	PDIT-V11-4-10-A	Value ("wg) .83" w.g.
Secondary Filter DP	PDIT-V11-4-10-B	Value ("wg) .82" w.g.

Comments:

7.10.10 V&B sign/ date [signature] 9-1-05

J-4	RESOLUTION/RETEST PURЕX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 44 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 3)

7.8.4 Base Percent (BP) Concentration

Scale Setting 100 X Meter Reading 48 = Value 4800

Gain Setting 5.21 Nitrogen supply regulated pressure 50

7.10.1 Start time 11:02 am

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale X	Reading	= Value	Aerosol Measurement Stability (Check one)
D-5-1	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-1	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-1	Single-Port	39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-1	Single-Port	63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-2	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-2	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-2	Single-Port	39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-2	Single-Port	63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-3	Multi-Port	Full	.1	29	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	15"	.1	28	2.8	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	39"	.1	2.9	2.9	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-3	Single-Port	63"	.1	28	2.8	Excellent ☐ Good ☐ Fair ☑ Poor ☐
D-5-4	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-4	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-4	Single-Port	39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-5-4	Single-Port	63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐

Primary Filter DP	PDIT-V11-4-5-A	Value .74 ("wg)
Secondary Filter DP	PDIT-V11-4-5-B	Value .93 ("wg)

Comments: Gain setting adjustment to 6.12 needed to attain BP of 10,000 ON Scale setting of 100.

7.10.10 V&B sign/ date [signature] 9-1-05

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 45 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 3)

7.10.1 Start time ____________________

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value Scale	X Reading	= Value	Aerosol Measurement Stability (Check one)
D-9-1	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-1	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-1		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-1		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-2	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-2	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-2		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-2		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-3	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-3	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-3		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-3		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-4	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-4	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-4		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-9-4		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐

Primary Filter DP	PDIT-V11-4-9-A	Value ________ ("wg)
Secondary Filter DP	PDIT-V11-4-9-B	Value ________ ("wg)
Comments		

7.10.10 V&B sign/ date ____________/______

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 46 OF 48

Data Sheet 9: AEROSOL MIXING DOWNSTREAM OF DEEP BED FILTER #2 (Trial 3)

7.10.1 Start time ____________________

7.10.2 – 7.10.8

Port Location	Probe Type	Probe Depth	Measured Value			Aerosol Measurement Stability (Check one)
			Scale	X Reading	= Value	
D-10-1	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-1	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-1		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-1		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-2	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-2	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-2		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-2		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-3	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-3	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-3		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-3		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-4	Multi-Port	Full				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-4	Single-Port	15"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-4		39"				Excellent ☐ Good ☐ Fair ☐ Poor ☐
D-10-4		63"				Excellent ☐ Good ☐ Fair ☐ Poor ☐

Primary Filter DP	PDIT-V11-4-10-A	Value ("wg)
Secondary Filter DP	PDIT-V11-4-10-B	Value ("wg)
Comments:		

7.10.10 V&B sign/ date ________________/______

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 47 OF 48

Data Sheet 10 – PUREX HVAC Exhaust As-Left System Configuration (Sheet 1 of 2)

8.8.3.1

Parameter	SAMCONS Display Component Number	Value
Outside Ambient Temp	N/A	68 °F
Tunnel Air Temperature	TIT-V11-TUN-1	75 °F
Tunnel /Atmosphere DP	PDIT-V11-TUN-1	-0.59 in. wg.
Tunnel /Atmosphere DP	PDIT-V11-TUN-2	-0.57 in. wg.
Canyon/Atmosphere DP	PDIT-V11-CAN-1	-0.489 in. wg.
Canyon/Atmosphere DP	PDIT-V11-CAN-2	-0.489 in. wg.
Deep Bed #2 DP	PDIT-V11-DBF2-1	1.06 in. wg.
DB2 Flow Rate	FIY-V18-9-1	37,406 cfm.
291-AE Total HEPA DP	PDIT-V11-4-~~3~~ 13**	2.80 in. wg.

PMC 9/1/05 ** Typographical error. Should be PDIT-V11-4-13 ERB 9/1/05

Fan Number	Fan in Service? (Yes/No)	Auto Control? (Yes/No)	Vortex Damper % Open
EF-V11-1	Yes	~~NO~~ Yes RIC 9-1-05	43
EF-V11-2	~~Y~~ NO EE 9-1-05	NO	23
EF-V11-3	NO	Yes	27

J-4	RESOLUTION/RETEST PUREX DEEP BED FILTER AEROSOL TEST	CP-05-5014/W PAGE 48 OF 48

Data Sheet 10 – PUREX HVAC Exhaust As-Left System Configuration (Sheet 2 of 2)

Filter Bank No.	FB In Service? (Yes/No)	Damper I.D.	Damper Position (Check One)	
			Open	Closed
FH-V11-4-1	No	MV-V11-1		✓
		MV-V11-2		✓
FH-V11-4-2	No	MV-V11-3		✓
		MV-V11-4		✓
FH-V11-4-3	No	MV-V11-5		✓
		MV-V11-6		✓
FH-V11-4-4	No	MV-V11-7		✓
		MV-V11-8		✓
FH-V11-4-5		MV-V11-9	✓	
		MV-V11-10	✓	
FH-V11-4-6	No	MV-V11-11		✓
		MV-V11-12		✓
FH-V11-4-7	No	MV-V11-13		✓
		MV-V11-14		✓
FH-V11-4-8	No	MV-V11-15		✓
		MV-V11-16		✓
FH-V11-4-9		MV-V11-17	✓	
		MV-V11-18	✓	
FH-V11-4-10		MV-V11-19	✓	
		MV-V11-20	✓	
FH-V11-4-11	No	MV-V11-21		✓

SOE Signature/ Date RKnight, 9-2-05

J-5	CRAFT/RESOURCE USAGE LOG AND MAINTENANCE RECORD	1. Document Number CP-05-5014/W

Date	Turnover, Problem Description, Action Taken	Name	Craft/ Resource Type	Hours
8/30	Held Prejob 7:00AM EJS			
8/30	Corrected typographical error on Page 29 PDIT-VII-4-13 is the correct nomenclature for 291-AE total HEPA DP	[signature]	DA	
8/30	NOTE: Both Photometers were Calibrated using PAO EJS			
8/30/3:00pm	Measurements at location B did not reveal presense of Aerosol. J-7 will be issued to establish new sample. Test will proceed to Section 7.10 for information purposes only. See Service Ticket WIN-05-412 for site preparation description.	[signature]	DA	
8/30	A Problem was Discovered with the Aerosol Generator during filling. As stated in the package combustion may occur if not filled properly or aerosol is splashed out of container. Ensure Nitrogen Purge is on during filling and chamber is cool. Also do not overfill.	EJS		
8/30	Held Prejob after Eng meeting 8:20 EJS went over plan for today AND PRECAUTIONS for Aerosol Generator			
~~8/31~~ 9/1/05	0645 Held Prejob.			

Summary by Craft/Resource Type

Craft/Resource Type	Total Hours	Craft/Resource Type	Total Hours

J-5	CRAFT/RESOURCE USAGE LOG AND MAINTENANCE RECORD	1. Document Number ___-___-_______/__

Date	Turnover, Problem Description, Action Taken	Name	Craft/ Resource Type	Hours
9-1-05	Aerosol generator reservoir was filled then baseline measurments were taken after 14 minutes operation (based on yesterday's stability time information) Then generator was shut off and allowed to cool, then the reservior was refilled for the filter challenge. Aerosol generator was run 43 minutes (based on stability times determined), then penetration tested at filter housing #5. Data looked good - consistent with previous. [Note: It was emphasized in the pre-job meeting to be very careful with holding the multipoint sample probe level. Care was taken, and multipoint readings were more consistent with single-point than yesterday.]			
	Penetrometer was moved to test @ banks 9 & 10. Bank 9 results seemed to drop off half-way through, and continued to decline through bank 10 penetration measurements. Cause of the reduction was unknown, so another trial was done on bank 5, position 3. Values had indeed dropped by 15%. ~~So another~~ It was suspected that the generator output had reduced, so another baseline measurement was taken. Within a few minutes, it was just below 60%, and had dropped to 48% after 14 minutes. Reservoir level dropped from 3/8 to 1/4.	Dan Johnson D Johnson		

Summary by Craft/Resource Type

Craft/Resource Type	Total Hours	Craft/Resource Type	Total Hours

J-5	CRAFT/RESOURCE USAGE LOG AND MAINTENANCE RECORD	1. Document Number ___-___-________/__

Date	Turnover, Problem Description, Action Taken	Name	Craft/ Resource Type	Hours
9-7	Corrected typographical error on page 47	J.D. CONDRON	DA	
JC	PDIT-V11-4-93 is the correct			
	nomenclature for 241-AE TOTAL HEPA DP			
	9-7-05 ELS			
9-8-05	COMPLETED POST JOB REVIEW ELS			
	need to Schedule Pipefitter to			
	tighten 4" CAPS ON filter Banks,			
	AND REMOVE Temporary labels placed			
	for Job instructions. ELS			

Summary by Craft/Resource Type

Craft/Resource Type	Total Hours	Craft/Resource Type	Total Hours

BD-6000-351 (03/98)

HANFORD RADIOLOGICAL WORK PERMIT

Contractor: FLUOR HANFORD			
General [X] Job Specific [ ]	Tech. Document No. N/A	Location Code All	RWP Number RC-05-001
Start Date 12/01/04	End Date 11/30/05	Responsible Organization 200 Area Central Plateau Surveillance and Maintenance	

Job Location
200 East and West Area(s)

Job Description and Type of Area: Entry into Radiation Areas (RA) and/or Contamination Areas (CA) to perform radiological surveys, surveillances, inspections, and minor work activities. To include housekeeping, decontamination activities and air balance stack flows and aerosol testing.

Primary Isotope(s): [X] MFP [ ] MAP [X] Cs [X] Sr [ ] H-3 [X] U [X] Pu [X] Other; Am

Radiation Emitted	Estimated Dose Rates	Contamination Levels	Radiological Worker Training Req.
[x] Alpha [x] Beta [x] Photons [ ] Neutrons	General Area: <5 mrem/h Maximum Contact: 65 mrem/h	Beta-gamma: 6,000 dpm/100 cm^2 Alpha: 140 dpm/100 cm^2	I [ ] II [X]

Internal Dosimetry Requirements (for routine work under this RWP, except those entering for observation only)
[ ] Annual Whole Body Count: [ ] Lung Count [ ] Urinalysis - Isotopes to Test for (if any):

MINIMUM RADIOLOGICAL PROTECTION REQUIREMENTS

HPT Coverage		Dosimetry	
X	Continuous	X	HSD – TLD
	Intermittent		HCND – TLD
	Start of Job		Pocket Dosimeter
	End of Job		Electronic Dosimeter
	Self Survey (if qualified)		Finger Rings
X	HPT Survey Required		Time Keeping
	Auto. Survey Device	X	Entry Control System
	See SI#		PNAD

MINIMUM PROTECTIVE EQUIPMENT

X	Coveralls		Shoe Covers
	Lab Coat	X	Canvas Boots
	Waterproof Suit	X	Rubber Overshoes
	Gortex Suit		Rubber Boots
	Cap		Full Face Respirator
SI 3	Hood		PAPR
SI 2	Surgeon's Gloves		Supplied Air Respirator
SI 2	Leather Gloves		SCBA
SI 2	Canvas & Surgeon's Gloves		Undressing Assistance
	Waterproof Gloves		Air Sampling Required
	No Personal Outer		ARM Required
	Modesty Clothing		Lapel Air Monitoring
X	See SI #4		See SI #

SPECIAL INSTRUCTIONS (SI)

1. VOID LEVELS:
   - CA Removable Contamination: ≥100,000 dpm/100 cm^2 βγ; ≥2,000 dpm/100 cm^2 α
   - Whole Body Dose Rate: ≥5 mrem/hr @ 30 cm
   - RA Removable Contamination: ≥1,000 dpm/100 cm^2 βγ; ≥20 dpm/100 cm^2 α
   - Whole Body Dose Rate: ≥100 mrem/hr @ 30 cm

   ACTIONS IF LEVELS EXCEEDED:
   a. Stop work and place work area into a safe condition.
   b. Notify Radiological Control Supervisor.
2. Two pairs of gloves are required. Inner gloves shall be surgeons/latex. Outer pair may be determined by the RCT.
3. A hood is required for any overhead work activities.
4. Reaching across the CA boundary is permitted without a full set of PPE, provided that a single pair of gloves is worn and the RCT is present to perform a contamination survey upon exiting or completion of task.
5. PPE is not required for work that is in a RA.

ALARA Review: YES [ ] NO [X]	Pre-Job Briefing: YES [ ] NO [X]	Post-Job ALARA Review Required: YES [ ] NO [ ]
RWP Prepared By: C. R. Meinecke	Phone: 376-9271	RCT Phone: 372-3123
Line Mgt. Print: B. L. Osborne Sign: *B. L. Osborne*	Phone 373-3663	Date 11/30/04
RC Mgt. Print: D. R. Ekstrom Sign: *D. R. Ekstrom*	Phone 376-1135	Date 11/30/04
	Phone	Date
Acknowledged By:		Date:
RWP Change Approvals:		Date:

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