DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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January 19, 1995

Mr. Mark Whitaker, EH-6
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Mr. Whitaker:

Enclosed for your information and distribution are 13 Defense Nuclear Facilities Safety Board staff reports. The reports have been placed in our Public Reading Room.

Sincerely,

George W. Cunningham
Technical Director

Enclosures (13)

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

October 4, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: J. W. Troan

SUBJECT: Report on the Radioactive Air Monitoring Programs at the Savannah River Site F Canyon and FB-Line

1. **Purpose:** This memorandum documents the Defense Nuclear Facilities Safety Board (DNFSB) technical staff and outside expert assessment of the radioactive air monitoring programs at the Savannah River Site (SRS) F Canyon and FB-Line. This assessment is based on an on-site review at the SRS conducted on July 6-8, 1994, and subsequent document reviews.

2. **Summary:** The SRS radioactive air monitoring programs at F Canyon and FB-Line are evaluated by the DNFSB Staff as marginally adequate. Although the SRS radioactive air monitoring programs at F Canyon and FB-Line meet some Radiological Control Manual requirements, the programs sometimes lack further or clear definition of the requirements, engineering methodology to achieve objectives, and a sound technical basis. It is the DNFSB Staff's opinion that the SRS approach to engineering may lead to a misconception that the radioactive airborne monitoring systems are more capable than they are. This situation may result in a false sense of security.

   The DNFSB Staff found that the Westinghouse Savannah River Company (WSRC) has not clearly shown that the programs meet all requirements of the Radiological Control Manual, and has not strictly followed the DOE guidance for engineering of systems to provide for the prompt detection of airborne plutonium within the workplace. Thus, the DNFSB Staff believes that continuous air monitoring equipment may not be properly designed, installed, operated, and maintained with sufficient sensitivity to alert potentially exposed workers to unexpected increases in airborne radioactivity.

   WSRC considers that they meet the airborne radioactivity requirements, but have established some compensatory measures to deal with situations where the detection of airborne radioactivity may not be prompt. The DNFSB Staff is uncertain if these measures: 1) are applied to achieve protection equivalent to the protection that would be provided by properly positioned continuous air monitoring equipment, and 2) achieve radiation dose as low as reasonably achievable (ALARA).

3. **Background:** Air sampling and monitoring are used to verify the confinement of radioactive materials, determine posting requirements, control area access, establish requirements for protective equipment and measures, and warn of significant changes in airborne radioactive concentrations. Both real-time and retrospective assessments of radioactive material confinement and of the ambient air to which workers are exposed is accomplished by air sampling and monitoring.

   The U.S. DOE *Radiological Control Manual,* DOE/EH-256T, establishes the requirements for personnel protection from airborne radioactivity. In addition, DOE provides additional guidance in the *Health Physics Manual of Good Practices for the Prompt Detection of Airborne Plutonium in the Workplace,* PNL-6612. These requirements and guidance, together with various American National Standard Institute (ANSI) standards and U.S. Nuclear Regulatory Commission (NRC) guides and reports were used by the DNFSB staff as a basis for assessing the radioactive air monitoring program at the SRS F Canyon and FB-Line.

4. **Discussion/Observations:**

   a. Equipment - The placement of air sampling and monitoring equipment at SRS is based solely on qualitative airflow pattern studies. Such studies do not determine potential dilution factors for various locations within a monitored area. An August 1993 report issued by DOE Defense Programs, Office of Self-Assessment, Safety Diagnostics Division, titled, *Augmented Evaluation Team Report on Alpha Continuous Air Monitors* (AET Report) presented a complex-wide evaluation of alpha Continuous Air Monitors (CAMs) performance. One of the findings in the report was that CAM response (detects and alarms when elevated airborne radioactivity is present in room monitored) of 15 to 30% was significantly lower than expected, and was attributed to placement and not availability. WSRC's resolution to this conclusion was a description of their defense-in-depth system which included examples of engineering controls (e.g., use of glove boxes) and administrative controls (e.g., mandatory use of respiratory protection equipment for plutonium glove box work). It is the DNFSB staff's opinion that the WSRC solution is not comprehensive, since it does not address all situations where there is a need to alert potentially exposed workers to unexpected increases in the airborne radioactivity.

   Furthermore, the AET Report concluded that traditional means of determining CAM placement may be inadequate. WSRC agreed that more definitive guidance is needed to properly locate CAM sample points. However, WSRC described and defended their current qualitative method as serving its purpose on the basis of cost effectiveness, ease of use, and source term characterization. From the DNFSB staff's review of correspondence, it appeared that DOE Savannah River (DOE-SR) personnel found the initial WSRC response for this item incomplete, and requested additional information. The DNFSB staff has an unsigned letter from DOE-SR accepting the subsequent WSRC response. The DNFSB staff believes that the subsequent WSRC response was inadequate, since it did not completely describe how the air monitoring systems were determined to be

positioned adequately to have sufficient sensitivity to alert personnel to unexpected increases in the airborne radioactivity levels.

b. Procedures - A sample of procedures that define the installation, operation, operability checks, and calibration of air sampling and air monitoring were reviewed. In some cases, the procedures did not provide sufficient guidance. Review highlights include:

Procedure 5Q1.2-458, *Review of Sampling and Monitoring Systems,* does not provide detailed criteria for evaluating adequacy. The procedure purports to satisfy the intent of the Radiological Control Manual (Manual) Articles 551.4, 555.2 and 555.3, however, it is the DNFSB staff's opinion that the language and terminology employed in the procedure are vague at best. For example, in paragraph 5.4.2(2), the procedure requires the reviewer to " ...verify by observation that the retrospective air samplers are placed in strategic locations, based on the airflow study, operating history, and type of process ..." The procedure, in its current form, does not adequately address the Manual Article 555.4 requirement, which states that air sampling equipment should be positioned to measure air concentrations to which persons are exposed. It is the DNFSB staff's opinion that the procedural requirement, which is limited to an airflow study, does not provide quantitative data to support any assumption of the equivalency between the air sampled by the CAM and the air breathed by worker(s) located in the monitored areas.

Furthermore, the procedure does not indicate whether a mechanism exists to alert the responsible group of " ... facility or operational changes ..." It was not apparent to the DNFSB staff that configuration management includes the involvement of radiological controls personnel prior to changes that may impact the performance of air sampling and monitoring equipment.

Procedures 5Q1.7.220, *Source Checking Fixed High Volume Air Monitors (Alpha)* and 5Q1.7-217, *Operation and Weekly Source Check of Eberline Beta CAM, Model AMS-3A* do not meet the daily operability checks for CAMs required by Manual Article 551.5 and 555.7.

Procedure 5Q1.2-132, *Particulate Airborne Radioactivity Sampling and Monitoring*, Section 5.3.3, allows personnel wearing respiratory protection to be exposed up to the Derived Air Concentration (DAC) values equal to the Protection Factor for the respiratory device. The DNFSB staff believes that this may not be keeping with the principles of ALARA.

WSRC personnel explained that it is a practice at the FB-Line to shut down installed High Volume Air Monitors (HVAMs) for work activities that are likely to create high airborne conditions. The intent is to prevent the probable contamination of the HVAMs. Worker protection for these conditions include respiratory protection, Radiological Control Inspector (RCI) job coverage, and frequent assessments using high volume grab samples.

While this practice does not violate existing Manual requirements, it is the DNFSB staff's opinion that this hiatus in monitoring by HVAMs could lead to significant worker exposure under the condition of a large puff release in which the DAC value greatly exceeds the respiratory protection factor.

c. Technical Basis - Various documents that describe the technical basis and configuration of the existing system were reviewed. In general, documentation does not demonstrate compliance with the Manual's requirements and the technical approach to design and implementation does not completely follow the guidance given in the *DOE Health Physics Manual of Good Practices for Prompt Detection of Airborne Plutonium in the Workplace.* The DNFSB staff noted that assumptions made in some of WSRC's assessment of the bounds of performance did not represent the extreme case. The following highlights DNFSB staff's observations and assessments:

General Air Sampling Plan(s) (GASP) for F Canyon and FB-Line were reviewed and the following observations were noted: 1) It was not apparent that the assessment of the facility was comprehensive. There was no inventory of rooms or a plan that appeared complete. 2) The historic perspective of changes only addresses the ventilation system. Other changes that may influence the air sampling and monitoring system were not noted. 3) The procedure used did not require that every Radiological Control Area be tested because rooms may be similar in construction. It was not clear to the DNFSB staff where these equivalent situations were justified. 4) Rationale for positioning various types of detectors was not apparent. 5) Source terms and location of workers were not identified, and 6) Survey maps were not filled out completely, and did not identity such items as who conducted the survey, time when the survey was done, conditions of the facility (e.g., ventilation configuration, etc.), and source and personnel location. A report on a FB-Line air sampling and monitoring placement evaluation was made on July 5, 1994. It contained some information that was found missing from the facility's GASP, but did not provide comprehensive information. A similar evaluation did not exist for the F Canyon.

The alarm sensitivity and performance of alpha CAMs employed at SRS is linked to a particle size distribution. The DNFSB staff believes there is a performance issue since it remains uncertain to the staff whether sufficient data exist to comprehensively characterize the potential source terms and confirm the equipment's collection efficiency and overall performance. The DNFSB staff reviewed the draft SRS Workplace Air Sampling and Monitoring Technical Basis Manual, and did not find that it adequately described the radioactive source term (i.e., particle size distribution, chemical nature, quantity, location, etc.) relative to the F Canyon and FB-Line process.

The WSRC resolution for some of the conclusions reached in the AET Report sometimes lacked sound technical justification. For example, WSRC described their

current use (October 1993) of a smoke generator for air migration studies by stating that, "[a]lthough this is a qualitative method, we believe that it serves its purpose on the basis of cost effectiveness, ease of use, and source term characterization." WSRC argued to continue to use the qualitative method instead of the quantitative methods because "tracer equipment are cost prohibitive." In their response, WSRC did not provide detailed justification, impact, or compensatory measures for this position.

The DNFSB staff understanding is that the SRS alpha CAMs are not capable of measuring one DAC when averaged over eight hours (8 DAC-hours) as required by the Manual, Article 555.5. This 8 DAC-hour requirement is consistent with the minimum detection level recommended in ANSI N317, *Performance Criteria for Instrumentation Used for Inplant Plutonium Monitoring*, of one Maximum Permissible Concentration (MPC) of ^{239}Pu in 8 hours (8 MPC hours). In contrast, the WSRC Procedure 5Q1.7-204A, *Portable Alpha Constant Air Monitors Daily and Monthly Responsibilities*, Section 5.3.2, Section 5.3.2, Monitor Sensitivity and Alarm Setting, states, "[t]he monitor sensitivity exceeds the capability to detect 1 DAC/8 hours and will alarm when the airborne alpha activity exceeds 1 DAC/8 hours." The DNFSB staff believes this statement is misleading. Additionally, the determination of achieving this requirement is further confounded by Manual's requirement that CAMs should be capable of measuring eight DAC-hours "under laboratory conditions." The term "laboratory condition" is not further defined by the Manual, so it must be interpreted. The WSRC interpretation of CAM capabilities "under laboratory conditions" varied. For example, WSRC personnel describe that "under laboratory conditions" may be defined to mean the level at which an observable or measurable increase in count rate occurs. It is the DNFSB staff's opinion that this vague and variable interpretation may lead to uncertain performance.

WSRC has tasked the Inhalation Toxicology Research Institute (ITRI) Laboratory to evaluate the performance of a SRS high volume mobile CAM. The study is expected to provide documentation on particle collection efficiency, transport line loss, detection capability, and radon/thoron progeny discrimination. The assessment is behind schedule, and it was not apparent to the DNFSB staff that the results of this assessment could be completely extended to other SRS equipment or systems (e.g., installed HVAMs).

d. Training - The F Canyon and FB-Line RCIs training and qualification documentation for air sampling and monitoring were reviewed, and the DNFSB staff found no administrative deficiencies. The DNFSB staff assessed the level of knowledge in this area in March 1994, and observations and discussion were noted in a DNFSB staff trip report dated April 20, 1994.

5. **Future Staff Actions:** The DNFSB staff intends to follow issues associated with the air monitoring program at SRS F Canyon and FB-Line. The staff plans to:

a. Evaluate aspects of the work planning process that address protection against airborne radioactivity.

b. Assess measures taken to compensate for air monitoring system deficiencies that have been identified by the WSRC self-assessment and assess their adequacy.

c. Monitor results from the ITRI evaluation of the SRS high volume mobile CAM, and review the SRS plan to resolve findings.

d. Visit the calibration facility used for calibrating air sampling and monitoring equipment and assess the calibration program's compliance with the Radiological Control Manual requirements.

e. Review the WSRC operational readiness certification of the FB-Line air monitoring and sampling program.