DEFENSE NUCLEAR FACILITIES SAFETY BOARD

September 21, 1993

MEMORANDUM FOR: G.W. Cunningham, Technical Director
Joyce Davis
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FROM: Lester Clemons
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SUBJECT: **SRS ALARA Assessment, June 28-July 2, 1993**

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Purpose: The purpose of this report is to summarize the observations of DNFSB Staff members, L. Clemons and R. Zavadoski, who reviewed radiological conduct-of-operations at the Savannah River Site (SRS) to assess the program for maintaining radiation exposures as low as is reasonably achievable (ALARA).

Summary: The ALARA program at SRS is organizationally sound and reflects significant improvement in management compared to what was observed in previous technical staff assessments of radiological conduct-of-operations at SRS. The establishment of the site-wide ALARA advisory committees with the facility radiological/ALARA representatives as committee members provide the opportunity for continuous dialogue among the facilities. The ALARA awareness program is intended to encourage workers to implement ALARA principles on a routine basis. However, recent problems with plastic suit air hose disconnections may reflect inadequate worker training as well as faulty connectors. In addition, the presentation of unnormalized data on worker exposure trends could be misleading to those trying to assess program success. As a consequence of these outstanding concerns, the success of the program could not be determined.

Background: The changing of missions at the Savannah River Site has resulted in the cessation of operations at several facilities and the modification of operations at others. K-Reactor was the last of five production reactors at SRS where operations have terminated. The ongoing decontamination and removal of highly-contaminated gloveboxes from the "old"

HB-Line facility and installation of new equipment is typical of a mission change. (The "old" HB-Line is a separate facility from the "new" HB-Line, also referred to as the JB-Line, which resumed operations in early 1993.) The preparations for decontamination and decommissioning (D&D) of the Separations Equipment Development (SED) facility and reactor facilities are currently under review by the DOE. The commonality among all of these operations is the increased potential for workers to be exposed to high radiation and contamination levels during operations to shut down and prepare facilities for long-term storage. As facilities are shut down and their contaminated systems and components are breached, it is imperative that the workforce be trained in the principles of ALARA to ensure that worker and public health and safety are not compromised during these non-routine operations.

The DNFSB Technical Staff performed an assessment of ALARA programs at the Savannah River Site including a site visit from June 28, 1993 to July 2, 1993. The objective was to determine the extent to which good ALARA practices are being implemented at SRS. Prior health physics/ALARA assessments at the Department of Energy (DOE) Hanford and Rocky Flats sites have indicated that ALARA principles are not always understood and implemented at the worker level where it is most needed and beneficial.

The SRS ALARA teams provided information on the site-wide ALARA program and discussions on facility-specific ALARA programs for the SED facility, the Defense Waste Processing Facility (DWPF), the high-level waste tank farms, the separations facilities, and the reactors and spent fuel basin facilities. While much of the ALARA philosophy is common to all facilities, the differing operations in each require differences in practical application of ALARA principles.

ALARA Organization: The organizational structure of the SRS site-wide ALARA program is governed by the Radiological Advisory Committee (RAC) chaired by the Westinghouse Savannah River Company (WSRC) Executive Vice-President. The RAC membership consists of division/department vice presidents/managers who are responsible for ALARA issues in their facilities. The Health Protection Department manager is vice-chairperson of the RAC. The "top down" approach indicates that upper management is committed to implementing the ALARA philosophy at SRS and was the central theme of the presentations. This emphasis is quite different from that observed in November 1991 when the DNFSB technical staff performed the health physics assessment of non-reactor facilities that led to Recommendation 91-6. Reorganization of the WSRC Health Physics/ALARA department may be a contributing factor to an improved ALARA organization; most of the presenters are probably new to the organization since they did not participate in the 1991 briefings of the DNFSB staff.

ALARA program implementation across the site is articulated in the various WSRC, Health Protection Department and operating division/department program and procedure manuals.

Among the key documents are the WSRC 5Q Manual," Radiological Control," WSRC-IM-90-140, "SRS ALARA Guide," DOE Order 5480.11, "Radiation Protection for Occupational Workers," and DOE N 5480.6, "Radiological Control Manual." The ALARA program at SRS appears to be appropriately structured and focussed to achieve ALARA goals and objectives. This represents a significant organizational improvement over the situation observed in previous technical staff health physics/radiological assessments of non-reactor facilities at SRS.

ALARA Training/Awareness: The training of workers in the principles of ALARA is initially integrated into the general employee training (GET) and radiation worker training (RWT) for work performed in radiation controlled areas. This general training is supplemented by facility-specific ALARA training to address the radiological hazards unique to the various facilities. In a classroom demonstration that emphasizes to workers how easy contamination can spread, tools are dusted with invisible chalk powder that becomes visible under an ultraviolet (black) light. After the tools are used to complete the training task, the instructor directs the "black" light at the workers' hands where the "contamination" is clearly visible. This training has been very effective in developing worker appreciation and understanding of how easy it is to spread contamination and the need to control the spreading of contamination in the workplace.

The ALARA requirements for the "old" HB line, where there are extremely high contamination levels associated with the D&D work (up to 100 million dpm alpha) differ from those for potentially high exposure tasks in the separations facilities (FB-line, HB-line, etc.). The D&D workers in the "old" HB-line are required to wear double plastic suits for protection against high contamination levels. The back of the outer suit is sprayed with a contamination fixative paint before the worker is cut out of the suit to minimize the spreading of contamination. This procedure has resulted in a low frequency of skin contaminations (one in 1992, none through May 1993) for the "old" HB-line D&D operations. It was stressed that workers are trained to be responsible for keeping their individual exposures ALARA. However, assistance is required for the donning and doffing of the plastic suits for the "old" HB-Line D&D operations and other highly contaminated workstation areas.

The level of ALARA awareness is heightened by the use of suggestion boxes, internal memoranda, and special ALARA Awareness Days. Awards are given to workers who submit the best ALARA suggestions. The "ALARA Flash" and "ALARA Goalpost" newsletters are published and distributed by the Separations Area, where high exposure can result from prolonged hands-on operations. Awareness Days are held annually; this year they were held during the week of June 7. Senior management made presentations on ALARA concerns and awareness to personnel in reactors (K-Area), H-Area, F-Area, and 700-Area. The ALARA suggestion winners were acknowledged, and ALARA awareness buttons were given to the workers. However, the DNFSB staff did not observe anyone other than management wearing the buttons. A brief interview was conducted with three

technicians as they were exiting the "old" HB-Line workstation area. They appeared to be aware of ALARA principles and responded appropriately to the questions asked.

Radiation Exposure Trends: The annual accumulated worker exposure at SRS has been on a downward trend since 1980. The total whole body exposures at SRS decreased from 1,204 person-rem in 1980 to 316 person-rem in 1992. These data are usually presented in "raw" form implying that workers are reducing their exposures through the use of ALARA techniques. When asked to distinguish between less exposure due to reduced work assignments and less exposures due to ALARA efficiencies, the presenters were unable to respond. The importance of being able to identify exposure reductions attributed to ALARA techniques was illustrated during the presentations. A tool that enables the gaskets on "Hanford connectors" to be changed in 5-10 seconds has recently been developed by a SRS technician. These connectors, used in the tank farms to transfer waste to the tanks, are highly contaminated and manual replacement of the gaskets requires several minutes, resulting in high worker exposures. It is not clear whether the SRS ALARA program has a procedure for quantitatively assessing the effectiveness of the gasket replacement tool in reducing worker exposures.

The failure to present meaningful exposure data that can be easily understood appears to be a DOE-wide problem. The normalization of personnel exposures to a meaningful baseline (e.g., person-rem/workers with recorded exposures; person-rem/person-hour in the radiation field; person-rem/radiation work permit [RWP] entry, etc.) is necessary to effectively measure and evaluate the significance of worker exposure reductions attributed to ALARA processes. Unless the DOE develops a method for normalizing personnel exposures to a meaningful, realistic baseline, it will continue to present information that can be misleading and open for misinterpretation.

Plastic Suit Hose Disconnect Problems: Air-supplied plastic suits are used at SRS for respiratory and skin protection of workers in highly-contaminated work areas. From January 20 to February 11, 1993, five different incidents occurred in which the male fitting on the plastic suit pigtail inadvertently disengaged from the female fitting on the air supply hose. The workers left the workstations immediately and sustained no detectable injury or radionuclide uptake as a result of the disconnections. The plastic suits are equipped with a Delrin acetal thermoplastic male connector that fits into a brass quick-disconnect female locking ring fitting on the hoses. The two types of female quick-disconnectors were Parker brand and Foster brand couplings.

The SRS presenters provided sample fittings for demonstration to the DNFSB review team. In a test of engaging and disengaging the fittings, it was observed that the spring-loaded, brass metal female locking ring required a positive force to lock onto the plastic male pigtail fitting. This was observed in 80-90% of the connect-disconnect tests performed. A WSRC

explanation for the hose disconnects during operations was that the knurled locking ring rubbed against an obstruction and inadvertently became disengaged. The review team noted that the force required to disengage the secured (seated) female quick-disconnector would most likely rip the suit. This observation was later supported in a discussion with SRS industrial hygiene personnel. On the other hand, if the quick-disconnect was not fully engaged at the donning station, an accidental rubbing against a structure could possibly disengage the coupling. A deliberate effort is required to force the female locking ring fitting to "lock" onto the plastic male fitting. If the worker should forget to force the locking ring closed while donning the suit, the fittings could become disengaged at the work station.

As a temporary solution to the problem, WSRC has developed a clip to be attached to the spring-loaded locking ring in the closed and locked position. The clip is made of spring steel and is installed in the indentation behind the locking ring of the female coupler. The objective is to prevent the coupler from disengaging if it should rub against an object or become loosened by work activity. The plastic suit-donning procedure was revised as of June 10, 1993, to implement this temporary solution to the supplied air hose disconnect problem.

The Equipment and Materials Technology (E&MT)/Materials Consulting Group was requested to investigate the incidents of breathing air hoses separating from the plastic suits. The E&MT tested seven (7) different types of supplied-air hose connectors used at DOE facilities, Naval shipyards, and in the commercial nuclear industry. The tests for coupler integrity included the Parker, Foster, Cejn, Hansen, Snap-tite, Schrader (four types) and Swage-Lok couplers. The results of the tests indicated that the Cejn coupler was superior to the others, and it has been recommended for future use at SRS. This recommendation is currently being evaluated by DOE.

General Observations: The ALARA organization and philosophy at SRS is formulated with elements that are found in ALARA programs in the commercial nuclear industry. The emphasis placed on the worker having total responsibility for keeping his/her exposures as-low-as-reasonably-achievable has proven to be the most effective method of minimizing personnel exposures in hostile radiation environments. To be successful, this process requires that new employees receive extensive training in the principles of ALARA and that experienced workers receive periodic refresher training on lessons-learned from projects that have been completed. This training is supplemented by the pre-job and post-job briefings that are an integral part of the conduct-of-operations for a project where the potential for high radiation exposure to workers exist. The SRS ALARA management indicated that these elements are included in their site-wide ALARA program. The DNFSB staff will continue to monitor the ALARA program at SRS.

Future Actions:

Future visits to SRS will focus on the ALARA awareness of workers to assess the effectiveness of the recently formed ALARA management organization.

The DNFSB technical staff will continue to monitor the use of plastic suits at SRS until a permanent solution to the problems observed is developed.

The normalization of worker exposures to a meaningful baseline, so that ALARA techniques implemented in DOE facilities can be evaluated, will be encouraged.