[DNFSB LETTERHEAD]

July 7, 1992

The Honorable Richard A. Claytor
Assistant Secretary for Defense Programs
U.S. DepArtment of Energy
Forrestal Building, Room 4A-014
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Claytor:

Enclosed for your consideration and action, where appropriate, are a number of observations concerning the Supercompactor and Repackaging Facility at the Rocky Flats Plant. These observations were developed by four members of the Defense Nuclear Facilities Safety Board staff, who are identified in the enclosure. The observations are based on a review of available documents, and on discussions and interviews with Department of Energy staff and contractor personnel at the Rocky Flats Plant on June 25-26, 1992.

If you need further information, please let me know.

Sincerely,

John T. Conway
Chairman

Enclosure:

Copy to:
Hon. Leo P. Duffy, EM-l
Hon. Paul L. Ziemer, EH-1
Mr. Steven M. Blush, NS-l

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

July 7, 1992

MEMORANDUM FOR: Board Members
Technical Director

FROM: G. R. George

VIA: S. L. Krahn, Rocky Flats Team Leader

SUBJECT: Trip Report for Review of the Rocky Flats Plant Supercompactor and Repackaging Facility (SARF)

DATE OF TRIP: June 25-26, 1992

1. Purpose: On June 25-26,1992, four members (G. R. George, M. V. Helfrich, R. D. Hurt, and J. J. McConnell) of the Defense Nuclear Facilities Safety Board (DNFSB) Technical Staff visited the Department of Energy (DOE) Rocky Flats, Plant to review the status of the Supercompactor and Repackaging Facility (SARF). During the site visit, the DNFSB staff members met with DOE Rocky Flats Office (DOE-RFO) and EG&G Rocky Flats, Inc. (EG&G) personnel, reviewed documentation, and toured Building 776 and SARF. The review focused primarily on readiness reviews, criticality safety, and safety analysis and documentation. This trip report documents the review.

2. Background: SARF is intended to reduce the volume of transuranic (TRU) and TRU-mixed waste stored on site, Its operation would also create more space for storing low-level waste, and prepare TRU waste for eventual storage at DOE's Waste Isolation Pilot Plant.

    a. SARF incorporates a three-stage process, the stages in the process are known as precompaction, supercompaction, and repackaging. During precompaction, performed only for soft waste, the contents of up to four 55-gallon drums are compacted into one 35-gallon drum. In supercompaction, the 35-gallon drum is compressed into a "puck." In the repackaging stage, a maximum of four pucks is packaged into each loadout drum.

    b. SARF consists of one 1,105 cubic-foot glovebox, two airlock entrances (one for hard and one for soft waste), and a loadout station for two drums, SARF is computer-controlled, although it is manually-operated. It ties into a portion of the existing Building 776 heating, ventilation, and air conditioning system (which contains less than 200 grams of plutonium), using high-efficiency particulate air (HEPA) prefilters.

    c. SARF is designed to compact "candidate" waste drums containing a certain range

of hazardous and radioactive material concentrations. A very stringent administrative control system exists to prevent the compaction of non-candidate waste drums.

d. The cold operations demonstration was conducted on June 29-30. DOE-RFO anticipated requesting approval for hot operations by July 8. Hook-up of the ventilation system and testing would be conducted from July 8 through July 17, and hot operations would begin on or about July 17.

3. Discussion and Observations: An initial meeting was held on June 25 with the DOE-RFO SARF Program Manager and DOE-RFO Readiness Review Team Leader (G. Doyle) and the EG&G SARF Program Manager (D, A. Shepherd) on the overall status of SARF. Subsequent meetings were held on June 25 and 26 to discuss specific issues. These sessions included: a meeting with the EG&G manager of Environmental and Waste Management Self-Assessment (C. J. Wolfe) and the EG&G Operational Readiness Review (ORR) Committee Chairman (G. E. Francis) to discuss the EG&G ORR; a discussion with the EG&G SARF Procedure Writer (R. D. Gillespie) regarding the software tracking system for the waste drums and procedures developed for starting up, operating, shutting down, and decontaminating the SARF; a review of the SARF Safety Evaluation Report; and a meeting with the EG&G criticality safety engineer (R. S. Malinosky) responsible for SARF. A tour of SARF was conducted on June 26. The following observations were made as a result of the meetings and tour.

a. Readiness Reviews

(1) EG&G is currently finishing its ORR. DOE-RFO is also in the final stages of its assessment, called a Readiness Review (RR). The RR is a random sampling and validation of approximately ten percent of the EG&G ORR. The RR also evaluated a random sample of criteria outside the scope of the EG&G ORR to determine whether the criteria

(2) These reviews focused on identifying requirements and standards applicable to SARF and then assessing compliance with these safety criteria. To this end, DOE and the contractor expended significant effort to identify criteria from all sources, including DOE orders and other standards. The ORR and RR teams also ensured that adequate objective evidence was available (i.e., programs were sufficiently implemented) to allow meaningful assessments of the criteria.

(3) The DNFSB staff members who participated in the SARF review believe the DOE-RFO RR is not adequate to assess whether SARF is ready to be operated safely, primarily because the RR does not adequately incorporate several elements of a thorough and complete 0RR addressed in DNFSB Recommendation 90-4 and the D0E Implementation Plan for that Recommendation. Specifically:

(a) The review teams were not independent of the SARF program and there was no formal DOE Headquarters involvement.

(b) Assessment of level of knowledge was made primarily through record reviews with few interviews. Level of knowledge on topics not unique to SARF was assumed to be adequate.

(c) Vital Safety Systems that are not unique to SARF were assumed to be adequate and were therefore not evaluated.

(d) The Building 776 FSAR was not evaluated and was assumed to be adequate.

(e) The adequacy of SARF support functions and personnel was not assessed.

(f) There was no formal plan leading to final operator qualifications. Nine operators were considered fully qualified even though the HVAC system is not yet connected.

(g) Neither the EG&G ORR nor the DOE-RFO RR documented the approaches used to evaluate their readiness criteria.

(h) The cold operations demonstration did not meet the intent of a graded start-up program such as that performed for Building 559, Analytical Chemistry Laboratory. It did not evaluate all procedures, it did not include abnormal events, and it did not involve support personnel.

(4) In addition, several lessons learned from the Building 559 ORR and DNFSB Recommendation 91-4 were not applied to SARF;

(a) EG&G, DOE-RFO, and the limited HQ assessments were all conducted in parallel over an extended period of time.

(b) The ORR did not confirm that workers on site will be adequately protected during SARF operations.

(5) The DOE DP-6.l SARF Readiness Evaluation Program requires the preparation of "...Readiness Review Process documentation sufficient to provide the Defense Facilities Safety Board [sic] with a comprehensive description of the design, development and acceptance process ...[because] the Defense Facilities Safety Board may choose to examine the acceptability of operating the SARF." The plan neither requires submission of this documentation to the DNFSB, nor envisions a presentation to the

DNFSB prior to start-up of SARF.

b. Criticality Safety

(1) Criticality safety is an issue that warrants careful consideration for SARF. Although stringent limitations (discussed below) on the quantity of fissile materials permitted in SARF at any time significantly reduce the likelihood of a criticality accident, SARF does have the potential for such an accident. It is conceivable that bits of plutonium or high-enriched uranium could be arranged in a critically safe way, only to be compressed into a supercritical mass in SARF. The frequent presence of polyethylene waste in the drums adds the prospect of an efficient moderator. According to EG&G criticality engineers, the critical mass of finely dispersed bits of weapons-grade plutonium in compressed polyethylene can be as low as 360 grams. If an accidental criticality did occur, it could be larger than normally anticipated, since the supercritical mass would be assembled in a high-pressure, tightly-contained environment. Dispersal of the mass would be delayed in comparison with assembly of a supercritical mass in a glovebox or open area. The number of generations of neutrons produced is directly related to how long the supercritical mass stays together.

(2) An appendix in the SARF Safety Evaluation Report (SER) covers in detail the potential public health consequences of the release of the gaseous fission products of an accidental criticality. The SER calculates the lethal range for worker exposure to radiation from an accidental criticality. In both cases, the SER recognizes the possibility of a larger-than-average criticality event. Plutonium mass limits and administrative controls applicable to SARF are covered adequately in the SER.

(3) The criticality alarm system covering SARF will be the overall Building 776/777 system. The placement of the alarms was examined recently by the EG&G criticality engineers to ensure that potential SARF accidental criticalities would be within the area of coverage of the detectors.

(4) Conduct of Operations in a nuclear facility can affect criticality safety. For example, workers may initiate actions, perhaps in an unfamiliar situation, without realizing their significance to criticality safety. In Building 559, substantial improvements in day-to-day, operational criticality safety were made before restart. Conduct of operations, mass limit postings, operator training, and Building 559 liaison with criticality engineering were all strengthened greatly. Conduct of operations in Building 776, which includes SARF, is not up to the level achieved in Building 559, in part because the Rocky Flats Conduct of Operations program is only about one-third implemented in the building. In most respects, no improvements have been made at all.

(5) Drum mass limits and measurements--Ultimately, the best way to prevent an accidental criticality in SARF is to ensure that the mass of fissile material in drums earmarked for compaction is sufficiently small. The administrative limit on Fissile material in a single drum is 50 grams. No drum is supposed to enter SARF if it contains more than 50 grams of plutonium or uranium-235. There is a separate administrative mass limit of 200 grams for final ("loadout") drums. It is clearly important to prevent drums with large fissile inventories from entering SARF.

The main line of defense against drums with excessive quantities of plutonium entering SARF is the Passive/Active Drum Counter (PADC in Building 371. DNFSB staff members observed a demonstration of this instrument and interviewed its operators. The PADC measures spontaneous and induced neutrons, and provides an estimate of the mass of plutonium in a drum. The instrument was designed and built for this application at the Los Alamos National Laboratory. It is primarily a material accounting instrument and is maintained by Safeguards Measurements. From the point of view of criticality safety, the question is not how accurate the instrument is, but how confident one can be that fissile masses greater that the 50-gram limit would not escape detection.

For several reasons, DNFSB staff members are fairly confident that the instrument and its operators would detect an anomalously large fissile mass. First, the instrument is quite sensitive, it can detect a few grams of plutonium in a 55-gallon drum. Second, the great majority of the drums measured so far contain just a few grams of plutonium; high-inventory drums are out of the ordinary and would probably catch the operators' attention. Third, most of the phenomena that could cause inaccuracies in the measurement would tend to have a conservative effect, making the instrument overestimate the fissile inventory. Examples include the production of neutrons by alpha-n reactions, the presence of a greater-than-normal amount of plutonium-240, induced fission of uranium-235, and neutron multiplication in beryllium. Only the presence of neutron poisons, such as discarded Raschig rings, would cause the fissile inventory of a drum to be underestimated. The poisons would make accidental criticality less likely in direct proportion to their effect on the neutron measurement, so they should not present a problem.

(6) Drum control--Drum measurements are currently made in Building 371, although the EG&G Safeguards Measurements group hopes to obtain a similar instrument for Building 776 in the near future. Control of each drum between the time the measurement is made and the time it is compacted is clearly important. Each drum is marked with a variety of identification numbers and has a "traveler" attached. This document contains information on the drum's history, including measurement results. There are quite a few administrative controls designed to ensure that drums and travelers do not get separated, and that only the correct drums get into SARF. Vigilance in

this area is important.

c. Safety Analysis and Documentation

(1) DNFSB staff members reviewed the SARF SER for general scope and content. It compares well in most respects with supercompactor safety analyses approved by the Nuclear Regulatory Commission (NRC). The criticality safety sections of the SER are discussed in another part of this report. In most other respects, the SAR appears adequate for a relatively small operation like SARF. There is adequate discussion of system design, operating procedures, and instrumentation and controls. The SER covers routine expected worker exposures and releases to the environment under normal operating circumstances. Potential accidents are defined adequately (with one exception, noted below). Precautions taken to prevent accidents and consequences of accidents are discussed in adequate detail.

(2) The only major technical deficiency of the SER is the omission of containment-breaching accidents. The calculated dose to the public of any hypothetical accident in a nuclear processing plant will always be low if it is assumed that the worst possible accident would not breach the ventilation system or the building structure itself. A thorough safety analysis of a plutonium processing plant should consider containment-breaching accidents. NRC guidance to potential plutonium processing licensees requires that containment-breaching accidents be considered. The Final Safety Analysis Report Review Team Report considered such accidents for Buildings 559 and 707 at Rocky Flats. The same types of serious accidents should be covered in the SARF SER or the Building 776/777 Safety Analysis Report.

(3) The method for assessing and documenting the authorization basis for SARF appears inconsistent. DOE-RFO considered SARF to be a change to an existing facility when DOE-RFO opted to evaluate the safety requirements using the process described in DOE Order 5480.21, Unreviewed Safety Questions. Yet, at several points in the process of evaluating potential unreviewed safety questions, DOE-RFO considered SARF to be a new facility that did not change existing building conditions.

(4) Because the SARF SER concluded that no unreviewed safety questions exist for SARF, DOE-RFO established no new Operational Safety Requirements (OSR's) or Limiting Conditions for Operation (LCO's) for SARF operations. Yet, the DOE Implementation Plan for DNFSB Recommendation 90-6 states that, "The contractor shall develop and implement an Operational Safety Requirement (OSR) which includes a limiting condition for operation ...to assure that future operations do not lead to the accumulation of more than 400 grams of plutonium in any one

system of ducts," DNFSB staff members believe that, as required pursuant to the Implementation Plan, new OSR's and LCO's should be established to address the potential build-up of plutonium in Building 776 ventilation ducts that would be used for SARF operations.

4. Recommended Follow-Up Activities: Given DOE's intended schedule for starting up SARF, and given the scope and nature of the observations documented in this trip report, the DNFSB staff members who participated in the review of SARF believe it would be prudent for the Board to obtain a briefing from DOE on the Readiness Review for, and anticipated operations of, SARF.

Copy to:
General Counsel
General Manager
Rocky Flats Team Members