

DOCKET: 70-1703

LICENSE: SNM-1513

LICENSEE: Eastman Kodak Company
Rochester, NY

SUBJECT: SAFETY EVALUATION REPORT - AMENDMENT 3, NEUTRON FLUX
MULTIPLIER DISASSEMBLY AND PACKAGING

I. BACKGROUND

By letter dated February 9, 2007, Eastman Kodak Company (Kodak) requested an amendment of SNM-1513 to authorize disassembly and packaging of the neutron flux multiplier in preparation for its transport off-site. By letter dated May 7, 2007, the Nuclear Regulatory Commission (NRC) declined to review the application because of deficiencies in its contents. By letter dated June 18, 2007, Kodak provided information to address the specified deficiencies, and by letter dated July 19, 2007, the NRC accepted the amendment application for review. In supplements dated October 5, and November 1, 2007, Kodak provided additional information.

The amendment application included a revision to Chapter 1 of the license renewal application to authorize disassembly of the flux multiplier and packaging for transport. The application also identified a new Radiation Safety Officer.

II. DISCUSSION

The NRC staff reviewed the application in the technical areas of radiation protection, nuclear criticality safety and physical protection. Reviews of each technical area are discussed below.

A. Radiation Protection

The licensee maintains a Radiation Protection Program which was approved as part of the license renewal review on March 23, 1998. The licensee's radiation protection program for current operations has been revised in accordance with the amendment application submitted to the NRC on February 9 and June 18, 2007 (ML071220302). The plan incorporates the dismantling and shipping of the flux-multiplier equipment. Based on the rem budgets in the plan, doses to workers are expected to be well below the current limits in 10 CFR Part 20 and the performance requirements in 10 CFR 70.61.

In accordance with 10 CFR 70.22(a)(7) and (a)(8), Kodak has provided a description of equipment, facilities, and procedures that will be used to protect health and minimize danger to life or property. The submitted radiation protection program is commensurate with the scope and extent of licensed activities and is sufficient to ensure compliance with the provisions of 10 CFR Part 20.

1. Radiation Protection Program Implementation and Personal Qualifications

The disassembly and packaging project will be conducted by Kodak staff with consultation from a contractor. The operations will be overseen by the contractor's project manager under the oversight of Kodak's radiation safety officer (RSO) as described in the De-fueling Work Plan submitted June 18, 2007. A quality assurance specialist with a Ph.D. in nuclear engineering will directly oversee the disassembly. This individual has personally been involved in dismantling 15 research reactors. Two Kodak staff members, consisting of a project manager with board certification in health physics and an experienced radiation technician, will dismantle and package the special nuclear material (SNM). The Kodak RSO that is responsible for the work area will be present to provide oversight and consultation during the entire de-fueling process. Kodak has appointed a new Radiation Safety Officer; Mr. John Heyer has been Kodak's RSO in previous years and is qualified for the position.

All individuals involved in the disassembly and packaging will provide documentation of annual radiation safety refresher training prior to commencing work. In addition a pre-job briefing of the work plan and de-fueling activities will be conducted to ensure a complete understanding of the procedures in the work plan.

The NRC staff find that the revised submittal dated June 18, 2007, meets the regulatory requirements for Radiation Protection Programs, pursuant to in 10 CFR 20 Subpart B.

2. Commitment to ALARA Program

The operation will be conducted in compliance with the as low as reasonable available (ALARA) program approved in the current license application, required by 10 CFR 20.1101(b). The licensee has committed to follow a rem budget for each phase of the operation to limit exposure to below 0.1 rem total effective dose equivalent and 3.4 rem for shallow dose equivalent, based on a worst case dose rate. Individual doses are conservatively estimated to be below 10% of the annual limits for radiation workers. Surveys will be conducted during operations to ensure doses are consistent with the estimates. Primary risk to exposure will occur during the dismantling and packaging of the SNM. Workers will handle the material from behind temporary shielding, using remote equipment which will allow them to stay at least one foot from the SNM. If surveys indicate that the precalculated man-rem budget is inconsistent with the actual dose rate, work will cease until a modified man-rem budget has been calculated.

In compliance with ALARA principles, the licensee will follow a work plan for disassembly and packaging of the material. The plan includes the use of written procedures, remote handling equipment, and temporary lead and Plexiglas shielding. These components display the key ALARA concepts of time, distance, and shielding and are compliant with the regulatory requirements in 10 CFR 20.1101.

3. Commitment to Written Procedures

The De-fueling Work Plan contains the radiation protection procedures to be implemented during disassembly, packaging, and shipment of the SNM. The procedures specify the training required prior to beginning disassembly. The licensee's procedures include requirements for air sampling, swipe tests, and surveys to ensure doses remain ALARA. The procedures also

indicate the type of personal protective equipment and a preplanned rem-budget to bound the doses during each phase of the operation. If procedural questions arise during disassembly all work ceases until the contractor's project manager and the Kodak RSO resolve the issue. The staff finds that the De-fueling Work Plan satisfies the radiation protection procedure requirements specified in 10 CFR 70.22.

4. Ventilation and Respiratory Protection Programs

Contamination control measures will be set up around the work area to control air flow and to provide a change station for donning personal protective equipment and conducting a routine frisk of workers. Contamination measures such as sticky floor mats and wash areas will also be placed at the entrance and exit points. A temporary isolation barrier will be set up in the de-fueling work area to help maintain a negative air flow of 300 ft³/min into the cavity. The air will be exhausted through a high-efficiency particulate air (HEPA) filter. The cladding surrounding the fuel will make release of air-borne radioactive material highly unlikely. Disassembly, removal, and packaging will be conducted in the same contamination controlled area.

The licensee has committed to using personal protective equipment in the controlled area. The equipment will include light clothes, eye covering, and remote handling tools. The ventilation and respiratory protection programs are consistent with the regulatory requirements specified in 10 CFR 20 Subpart H.

5. Radiation Surveys and Monitoring Programs

Personnel involved in de-fueling will wear whole body dosimeter badges with alarm capability and extremity badges. Surveys and air samples will be routinely conducted during the de-fueling. Contamination swipe samples will also be collected inside the fuel box. The air samples and swipes will be analyzed prior to fuel bundle disassembly. Elevated levels of airborne radioactive material will result in the use of HEPA purifying respirators as warranted. If removable activity is discovered, the licensee will decontaminate the accessible surfaces of the SNM. Once the fuel has been sealed into shipping drums, the external dose rates will be measured prior to shipping. Radiation surveys and monitoring will be conducted in accordance with Regulation Guide 8.25.

6. Evaluation Findings

Upon completion of the review of the radiation protection program for the disassembly of Californium Flux Multiplier (CFX), the NRC staff concluded that conformance by Kodak to amendment submittal dated February 9, 2007, and subsequent attachments, is adequate to assure safe operations. The amendment meets the requirements of 10 CFR Parts 19, 20, and 70 with respect to radiation protection.

B. Nuclear Criticality Safety

NRC staff reviewed Kodak's license amendment application dated February 9, 2007, the additional documents (RAI response, criticality safety analysis for de-fueling operations, and de-fueling Work Plan) provided by letter dated June 18, 2007, and the 70.24 exemption request dated October 5, 2007.

Overall responsibility for NCS for Kodak's CFX de-fueling operation rests with the contracted program manager. The program manager has delegated a person knowledgeable in NCS to serve as the supervisor and quality assurance lead during the de-fueling operation. The supervisor also has responsibility for related NCS analysis and training. Licensee and contractor personnel, involved in the de-fueling operation, will receive training that covers parameters that affect NCS and criticality alarm response.

The licensee commits to the preferred use of passive engineered controls for NCS. The NCS controlled parameters used for the de-fueling operation are mass, geometry, moderation, and interaction. The licensee does not use computer codes for NCS analysis. The licensee commits to the following ANSI standards as endorsed in NRC Regulatory Guide 3.71, Rev. 1, "Nuclear Criticality Safety Standards for Fuels and Material Facilities":

- ANSI/ANS-8.1-1998, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors;"
- ANSI/ANS-8.3-1997, "Criticality Accident Alarm System;"
- ANSI/ANS-8.19-2005, "Administrative Practices for Nuclear Criticality Safety;"
- ANSI/ANS-8.20-1991, "Nuclear Criticality Safety Training;" and
- ANSI/ANS-8.23-2007, "Nuclear Criticality Accident Emergency Planning and Response."

The licensee will perform the de-fueling operation in accordance to the de-fueling work plan. Before disassembly of the CFX, the operators will verify that the cadmium control blades are installed. As fuel plates are removed they are grouped according to size. Each group will be staged no closer than 10 centimeters from any other group. No more than 500 grams of material will be outside the CFX and 6M2R containers at one time. The licensee will remove the moderating material from the fuel before placing the fuel in the 2R containers. The Work Plan may be changed with the approval of both the project manager and the operations supervisor, provided that the changes do not alter the mass limit for SNM outside the CFX and 6M2R containers.

The licensee commits to provide a redundant Criticality Accident Alarm System (CAAS) in the cavity where the CFX is located for the duration of the de-fueling operation. The alarm system has already been installed and will be tested on a monthly basis. The CAAS will meet the 10 CFR 70.24 requirements.

The licensee has also requested an exemption from the CAAS requirements (10 CFR 70.24) for the corridor and loading dock areas outside the cavity where the packaged SNM will be transported or staged, before loading onto the truck. The licensee has demonstrated that the available fuel is much less than the critical mass for a 6M2R shipping container. Thus, a criticality event is not credible as long as the 6M2R containers are closed. In addition, no single container contains enough SNM to cause a criticality in any credible configuration.

The staff recommends that License Condition 13 be revised as follows:

The licensee is hereby exempt from the requirements of 10 CFR 70.24 in specified areas of the Kodak facility for the movement and staging of materials packaged for transport.

C. Safety Determinations

The NRC staff has reviewed the license amendment application dated February 9, 2007, and the response dated June 18, 2007, and has determined the following:

The staff at Kodak's is qualified to perform the flux multiplier disassembly and packaging operation, and will be adequately trained to perform the operation, in accordance with NRC regulations, with respect to accidental criticality.

Kodak's proposed equipment and facilities for the flux multiplier disassembly and packaging are adequate to protect health and minimize danger to life and property from accidental criticality.

Kodak's procedures are adequate to protect health and minimize danger to life or property from accidental criticality.

Kodak's CAAS, in the cavity, is sufficient to alert personnel if accidental criticality occurs. An exemption to the 10 CFR 70.24 CAAS requirements for the corridors and loading dock that will be used to transport and stage packaged SNM will not endanger life or property, or the common defense and security.

The staff concurs that Kodak's operations with the flux multiplier will ensure that fissile material will be possessed, stored, and used safely, according to the requirements in 10 CFR Part 70. Based on this review, the staff concluded that the licensee's NCS program meets the requirements of 10 CFR Part 70 and provides reasonable assurance for the protection of public health and safety, and the environment.

D. Physical Security

The NRC staff reviewed Kodak's proposed provisions for enhanced physical security to provide for the disassembly and packaging operation, and for movement of the packages through the facility to the transport vehicle and determined that these provisions are adequate to meet the applicable requirements of 10 CFR Part 73. License Condition 14 is revised to incorporate these enhanced provisions as follows:

The licensee shall follow the physical protection plan entitled "Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate Strategic Significance," dated April 26, 2000 (transmitted by letter dated April 27, 2000), as

it may be further revised in accordance with the provisions of 10 CFR 70.32(e), and in accordance with statements, representations, and conditions in submittals dated June 3, 2002, and February 9 and June 18, 2007.

III. NATIONAL ENVIRONMENTAL POLICY ACT REVIEW

The amendment of materials license's issued pursuant to 10 CFR 70, authorizing use of radioactive materials for research and development, belong to a category of actions that the Commission has declared to be a categorical exclusion. Accordingly, the NRC staff determined that the criteria from 10 CFR 51.22(c)(14)(v), for a categorical exclusion have been met, and neither an environmental assessment nor an environmental impact statement is warranted for the license amendment.

An Environmental Assessment was prepared for the portion of the amendment review that addresses granting an exemption from the criticality accident alarm system requirements of 10 CFR 70.24. This Environmental Assessment resulted in a Finding of No Significant Impact, which was published in the *Federal Register* on November 14, 2007 (72 FR 64090).

IV. CONCLUSION

Based upon review of the license amendment application and the supplemental information, the NRC staff has determined that the licensee's equipment and facilities related to the neutron flux multiplier disassembly and packaging are adequate to protect health and minimize danger to life or property, and the licensee's proposed procedures to protect health and to minimize danger to health and minimize danger to life or property, are adequate, in accordance with 10 CFR 70.23(a)(3) and (a)(4), respectively. The NRC staff has concluded that the physical security provisions are adequate in accordance with 10 CFR 70.23(a)(10).

Based on the preceding discussion, the staff concludes that there is reasonable assurance that the changes to be authorized by the issuance of the requested amendment will not constitute an undue risk to the health and safety of the public, workers, or the environment. In addition, they do not have a negative effect on the licensee's compliance with the regulatory requirements imposed by the Commission in 10 CFR Parts 20, 51, and 70. Therefore, the staff recommends approval of the amendment application.

The Region I inspection staff have no objections to the proposed action.

V. PRINCIPAL CONTRIBUTORS

Mary Adams
Matthew Bartlett
Blake Purnell
Edward Johannemann