SAFETY EVALUATION REPORT
REUTER-STOKES, LLC
EXEMPTION FROM TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS*
SECTION 70.24, "CRITICALITY ACCIDENT REQUIREMENTS"
DOCKET NO. 07002872
SPECIAL NUCLEAR MATERIALS LICENSE NUMBER 1826

BACKGROUND AND REGULATORY REQUIREMENTS

Reuter-Stokes, LLC is authorized to possess limited quantities of special nuclear material (SNM) per its SNM license, SNM-1826. The authorized SNM quantities exceed a minimum critical mass as defined by Title 10 of the *Code of Federal Regulations* (10 CFR) 70.4; therefore, Reuter-Stokes, LLC is required to maintain a criticality accident alarm system (CAAS) in each area where SNM is handled, used, or stored in accordance with 10 CFR 70.24(a).

Per 10 CFR 70.17, the Commission may grant certain exemptions from the requirements of 10 CFR Part 70 as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. Furthermore, §70.17 allows certain exemptions to be granted upon application of any interested party or upon its own initiative. The mass thresholds established in §70.24(a) are predicated on the existence of criticality hazards. Although the mass quantities of fissionable isotopes authorized in SNM-1826 exceed a minimum critical mass as defined by §70.4, limited mass may principally limit the likelihood of inadvertent criticality. Therefore, the staff performed on its own initiative an evaluation to determine whether an exemption from the requirements of §70.24(a) is warranted.

STAFF REVIEW AND ANALYSIS

Per §70.24(a), each licensee authorized to possess greater than 700 grams uranium-235 (^{235}U), 520 grams uranium-233 (^{233}U), 450 grams plutonium (Pu), 1500 grams ^{235}U if no uranium enriched to more than 4 weight percent (wt.%) ^{235}U is present, or 450 grams of any combination thereof, is required to maintain a CAAS in each area where SNM is handled, used, or stored. These mass quantities are reduced by 50% if massive moderators or reflectors made of graphite, heavy water, or beryllium may be present. Reuter-Stokes, LLC is authorized to possess limited quantities of SNM per its SNM license, SNM-1826. Authorized possession quantities of fissionable isotopes apposite to nuclear criticality safety are provided in Table 1.

Table 1
SNM-1826 authorized possession quantities of fissionable isotopes.

Isotope	Form	Mass (grams)
^{239}Pu	sealed neutron source	112
^{238}Pu	sealed neutron source	2.5
^{235}U	metal, oxide, or uranyl nitrate	449
^{235}U	sealed sources	1
$^{234}U/^{235}U$	metal, oxide, or uranyl nitrate	10

In accordance with §70.24(a), Reuter-Stokes, LLC is required to maintain a CAAS given SNM-1826 authorizes possession of more than a combined 450 grams Pu and ^{235}U. Although more than a minimum critical mass as defined in §70.4, the likelihood of inadvertent criticality may be principally limited given the physiochemical form and limited quantities of the SNM involved. The staff performed a series of independent calculations using the SCALE/KENOVI: CSAS6 3D Eigenvalue Monte Carlo application with the continuous energy ENDF/B-VII.1 cross-section library. The staff's independent analysis considered fully reflected spherical geometries consisting of spatially uniform ^{239}Pu and ^{235}U metal. For each of the configurations considered, the staff assumed 125 grams ^{239}Pu and 510 grams ^{235}U with varying degrees of interstitial moderation. Theoretical density light-water was assumed as the moderation and reflection source. Massive moderators or reflectors made of graphite, heavy water, or beryllium were not considered as these materials are not present in any meaningful quantity or relative location for the licensee's operations.

The staff determined that for k_{eff} to exceed 0.95,[1] near optimum moderation is required. This configuration is highly contrived, however, and does not represent credible conditions for the licensee's operations. The assumed fissionable mass was approximately 10% higher than possession limits (114.5g Pu, 460g ^{235}U), and all fissionable mass was assumed to be metal. The fissionable mass was assumed to be spatially uniform and homogeneously mixed with interstitial moderator, and the mixture was assumed to be spherical and suspended by full light-water reflection. There is no credible mechanism in which the fissionable mass, some of which is contained in sealed sources, could coalesce into a sphere with uniform spatial distribution, become optimally moderated in a homogeneous mixture, and maintain a spherical geometry under moderated conditions. Furthermore, this configuration would represent several unlikely changes in process conditions. Mass is administratively controlled via maximum limits imposed on each location in which SNM is handled, used, or stored, and significant volumes of moderator are not available under normal and credible abnormal conditions. The staff determined that the normal and credible abnormal conditions associated with the licensee's operations are far less reactive than the conditions required for criticality. The staff determined that the licensee's operations with the mass quantities authorized in SNM-1826 do not pose a credible criticality risk or at least that the likelihood of criticality is exceedingly low despite the absence of controls or facility features.

EXEMPTION FROM 10 CFR 70.24(a)

Is Authorized by Law

In accordance with the requirements in 10 CFR 70.17(a), the Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

[1] $k_{eff} = k_{calc} + \beta + \sigma_\beta$ where $\beta + \sigma_\beta$ assumed to be 2.0% Δk

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its review of Reuter-Stokes' NCS Program and determined that the exemption is permissible under the Atomic Energy Act of 1954, as amended, and that no other legal or regulatory prohibition exists that would preclude the activities that would be authorized by the exemption. Therefore, the NRC staff, upon its own initiative, finds that exempting Reuter-Stokes from the §70.24(a) for maintaining a CAAS in each area in which SNM is handled, used, or stored, is authorized by law, in accordance with §70.17(a).

Does Not Endanger Life or Property or Common Defense and Security

The NRC staff determined that the licensee's operations with the mass quantities authorized in SNM-1826 do not pose a credible criticality risk or at least that the likelihood of criticality is exceedingly low despite the absence of controls or facility features. Therefore, the installation and maintenance of a CAAS would not provide a meaningful reduction to the risk to workers or the public, and the absence of CAAS monitoring would not endanger life or property or the common defense and security.

Is in the Public Interest

There are no safety benefits to having a CAAS if a criticality is not credible. In addition, the presence of a CAAS incurs certain risks to workers as a result of false actuation, including injury during evacuation and disruption of operations. It can result in increased routine radiation exposures to personnel who must calibrate, test, and maintain the system. Thus, installation of an alarm system where there is a negligible risk of criticality can result in a net reduction in safety. Furthermore, the reduction in occupational exposures and injuries resulting from unnecessary evacuations is also in the public interest. Therefore, since the exemption would avoid potential net reductions in safety caused by the installation of unnecessary systems, and would reduce potential occupational exposures and injuries resulting from unnecessary evacuations, the staff finds that this exemption is in the public interest.

Environmental Review

The NRC's regulations in 10 CFR 51.22 provide that certain licensing and regulatory actions that fall within the categories of actions that the Commission has found do not individually or cumulatively have a significant effect on the human environment do not require preparation of an environmental assessment (EA) or environmental impact statement (EIS). The provisions of 10 CFR 51.22(d)(1) state that certain categories of actions are excluded from the requirement to prepare an EA or EIS, provided that:

- any ground disturbance is limited to previously disturbed areas
- there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite,
  no significant increase in individual or cumulative public or occupational radiation exposure, and
- no significant increase in the potential for or consequences from radiological accidents.

10 CFR 51.22(d)(1) provides a categorical exclusion for changes to inspection or surveillance requirements, if the above criteria are met.

The NRC staff finds that granting Reuter-Stokes an exemption from the 10 CFR 70.24(a) requirement meets the criteria for a categorical exclusion under 10 CFR 51.22(d)(1) and that there are no special circumstances in this case that require an EA or EIS. There is no planned ground disturbance associated with this exemption. The exemption does not change any chemical or nuclear process, and there is no change in types or amounts of effluents that may be released offsite. There is no change in the licensee's operations, therefore there would be no significant increase in individual or cumulative public or occupational radiation exposure. Due to the physiochemical form and limited quantities of the SNM involved, inadvertent criticality is not credible or its likelihood is exceedingly low, and there would be no increase in the potential for or consequences from radiological accidents. Therefore, pursuant to 10 CFR 51.22, an EIS or EA does not need to be prepared in connection with the approval of this exemption.

EVALUATION FINDINGS

Based on the review discussed in this report, the staff concluded that an exemption from the requirements of 10 CFR 70.24(a) is warranted, authorized by law, and will not endanger the life or property or the common defense and security and is otherwise in the public interest.

The following license condition will be added to the SNM-1826 license:

SNM-1826
License Condition 18

> The licensee is exempted from the requirements of 10 CFR 70.24(a) insofar as such requirements apply to the materials, quantities, and authorized uses specified in License Conditions 6(A) through (F), 7(A) through (F), 8(A) through (F), and 9(A) through (F).

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