



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

February 1, 2017

Ms. Charlotte Engstrom, Vice President
and General Counsel
General Atomics
P.O. Box 85608
San Diego, CA 92186-9784

**SUBJECT: GENERAL ATOMICS TRIGA® REACTOR FACILITY – UPDATE OF THE
ISOTOPE SPECIFIC RADIOLOGICAL RELEASE CRITERIA FOR THE
DECOMMISSIONING OF THE MARK 1 AND MARK F REACTORS
(CAC NOS. L53111 AND L53112)**

Dear Ms. Engstrom:

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated December 18, 2015, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15362A506), as supplemented by letter dated August 15, 2016, (ADAMS Accession No. ML16242A319), General Atomics (GA, the licensee) submitted a request to update the isotope specific radiological release criteria applicable to the decontamination of GA's TRIGA® Reactor Facility, in San Diego, California, where GA's Mark 1 and Mark F non-power research reactors, License No. R-38 and License No. R-67, respectively, are located.

In its submittal, GA notes that while planning for the final stages of decommissioning, it is important to know what levels of residual activity (for each individual radionuclide of interest) are acceptable to the NRC for release of GA's TRIGA® Reactor Facility (including the associated land area) for unrestricted use. These levels (i.e., release criteria) are the primary factors for determining the volume of concrete and other materials that will need to be removed from the reactor structure and the amount of contaminated or activated soil that may need to be excavated. That information will, in turn, drive the scope of the decontamination efforts, including the extent of building demolition required, the volume of low-level waste that must be packaged and shipped offsite for disposal, various other associated costs, and the schedule for completing the decommissioning of GA's TRIGA® Reactor Facility.

Historically, GA has obtained the release of its facilities and land areas for unrestricted use based upon meeting the radiological release criteria provided in NRC-approved decommissioning plans. Examples include GA's Hot Cell Decommissioning Plan and the General Atomics' Site Decommissioning Plan. Both of these plans contain tables with soil and concrete rubble radiological release criteria (in pico-Curies per gram) for specific individual radionuclides of interest. With only one exception, the above NRC-approved plans and the set of radiological release criteria contained therein have been the basis for the release for unrestricted use of every building (~35) and all land areas comprising GA's original site (~415 acres). The only exception has been GA's TRIGA® Reactor Facility (and associated licensed land area), which is located in the middle of its site.

GA's NRC-approved TRIGA® Reactor Facility Decommissioning Plan (July 1999) does not contain a table of isotope specific radiological release criteria applicable to activated concrete in the reactor pit configuration or to activated or contaminated soil (e.g., the soil behind the biological shield). Instead, the criteria are expressed as acceptable surface contamination levels (floors and walls), and exposure rates in $\mu\text{R/hr}$ at one meter above the surface, which cannot be directly translated into soil and concrete rubble radiological release criteria.

These radiological release criteria were chosen consistent with the guidance contained in NRC Regulatory Guide (RG) 1.86, "Termination of Operating Licenses for Nuclear Reactors," dated June 1974, and NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," draft for comment dated June 1992. These documents represented the most contemporary guidance available for the selection of NRC-approved generic radiological release criteria, as well as an acceptable process for conducting Final Status Surveys (FSS), when the TRIGA® Reactor Facility Decommissioning Plan was assembled by GA in April 1997 and subsequently revised in January 1999.

Subsequent to the NRC's approval of the TRIGA® Reactor Facility Decommissioning Plan in June 1999, the staff consolidated and updated the policies and guidance of the NRC's decommissioning program in a three-volume NUREG series, NUREG-1757, "Consolidated Decommissioning Guidance," which was first published in September 2003. NUREG-1757 replaced NUREG-1727, "NMSS Decommissioning Standard Review Plan," and NUREG/BR-0241, "NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees," and became the new standard for reactor and materials licensees seeking to terminate their NRC licenses, thereby rendering RG 1.86 mostly obsolete (note that RG 1.86 has since been withdrawn by the NRC, effective August 12, 2016 (81 FR 53507)). In addition, NUREG/CR-5849 was replaced by NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," which was first published in December 1997.

Now that the GA TRIGA® Reactor Facility is nearing completion of the decontamination and dismantlement project and will soon be entering into the FSS and license termination phase of decommissioning, the licensee has requested to update the radiological release criteria in its TRIGA® Reactor Facility Decommissioning Plan. This update will make changes to the NRC-approved decommissioning plan to (1) be consistent with the newer decommissioning guidance documents available, and (2) provide clear, isotope specific radiological release criteria for the portions of the facility still undergoing dismantlement and decontamination in order to ensure that any remaining residual radioactivity is below the level required for unrestricted site release. As explained below, the NRC staff has concluded that this approach represents an acceptable method for the licensee to meet the unrestricted release criteria requirements established in the NRC-approved decommissioning plan by following the more contemporary NUREG-1757 and MARSSIM guidance.

Although GA's December 18, 2015, letter, as supplemented, requested NRC approval of the isotope specific radiological release criteria for the TRIGA® Reactor Facility, upon review of the requirements outlined in License No. R-38 and License No. R-67 and the associated decommissioning guidance, the NRC staff has determined that GA does not require additional NRC approval or authorization to use the methods described in the submittal because the letter describes an acceptable method by which GA can decommission its site in compliance with the previously approved TRIGA® Reactor Facility Decommissioning Plan. However, the NRC staff did conduct a review to ensure that the underlying parameters and assumptions established for

successful use of the NUREG-1757 and MARSSIM guidance during license termination would be met by GA's proposed decommissioning approach.

Specifically, GA proposed to adopt the derived concentration guideline levels (DCGLs) contained in NUREG-1757, Volume 2, "Characterization, Survey, and Determination of Radiological Criteria," for the screening of soil as the isotope specific radiological release criteria to be used for release for unrestricted use of residual soil and concrete at the GA TRIGA® Reactor Facility. Use of the NUREG-1757 screening DCGL's during the FSS and license termination phase for the remainder of the GA decommissioning project is a conservative approach compared to use of the radiological release criteria currently contained in the TRIGA® Reactor Facility Decommissioning Plan because the screening values are significantly lower than those in the GA plan. In addition, using these criteria to establish the appropriate release guidelines for the activated concrete and soil remaining at the GA site ensures that the revised approach meets the previously approved radiological release limits.

Although the screening levels found in NUREG-1757, Appendix H, "Criteria for Conducting Screening Dose Modeling Evaluations," Table H.2, "Screening Values of Common Radionuclides for Soil Surface Contamination Levels," are directly applicable to soil, the licensee noted that the application of soil screening levels to rubblized concrete was approved in GA's NRC-approved Site Decommissioning Plan (approved by the NRC in September 1996).

The NRC staff evaluated GA's proposal to use the NUREG-1757 soil screening levels as the isotope specific radiological release criteria to be used for release for unrestricted use of residual soil and concrete at the GA TRIGA® Reactor Facility, and determined the following:

- The particular site conditions (e.g., physical configuration and source-term conditions) are compatible and consistent with the decommissioning modeling assumptions that established the screening level DCGLs.
- The remaining residual radioactivity on building surfaces (e.g., walls, floors, ceilings) is surficial and non-volumetric, is mostly fixed, and the screening criteria are not being applied to surfaces such as buried structures (e.g., drainage pipes) or equipment within the building.
- The remaining residual radioactivity in soils is contained in the top layer of the surface soil; the unsaturated zone and the ground water are initially free of residual radioactivity; and the vertical saturated hydraulic conductivity at the specific site is greater than the infiltration rate (e.g., there is no ponding or surface runoff).

These parameters are initial assumptions necessary to use the NUREG-1757 screening values as DCGLs for isotope specific radiological release criteria, and the staff has concluded that GA's proposed use of the soil screening levels is in accordance with these restrictions.

In addition, the NRC staff evaluated GA's proposal to remove only those portions of the TRIGA® Reactor Facility concrete structure(s) and soils which exceed the screening levels for the radionuclides of interest, which are Cobalt-60, Cesium-137, Europium-152, and Europium-154 for the GA facility, and to demonstrate that the facility meets the radiological release criteria for license termination using accepted sampling and measurement techniques found in MARSSIM. As a result of this evaluation, the staff determined the following:

- The analytical results of the characterization efforts completed to date allow GA to establish with reasonable accuracy and precision the location and extent of volumetric activated concrete and soils as a function of activation product concentration. This facilitates estimation of what volume of activated concrete and soil will need to be removed, and from what location, in order to meet the radiological release criteria.
- The use of MARSSIM will ensure that the “sum of fractions,” or unity rule, is used to evaluate the remaining residual activity from all isotopes against the screening values since Table H.2 in NUREG-1757 is intended for the evaluation of single radionuclides only.
- The use of MARSSIM principles to evaluate the ongoing remediation and decommissioning efforts at the GA TRIGA® Reactor Facility will ensure that the surveys conducted and documentation submitted to the NRC in support of license termination will meet the associated requirements and expectations of the Commission, as well as protecting public health and safety and the environment.

Based on the above considerations, the NRC staff has determined that the method proposed by the licensee (i.e., using the NUREG-1757 screening DCGLs as the isotope specific radiological release criteria to be used for release for unrestricted use of residual soil and concrete) effectively ensures that GA will meet or exceed the limitations established by the current radiological release criteria in the approved decommissioning plan. In addition, the staff concluded that the proposed decommissioning method is consistent with the NRC-approved decommissioning plan and authorized under the current facility licenses because the proposed method will ensure that the decommissioning criteria in the current TRIGA® Reactor Facility Decommissioning Plan are met. Therefore, GA’s use of the proposed decommissioning method does not require additional NRC approval.

Accordingly, the NRC staff concludes that GA’s use of the isotope specific radiological release criteria listed in NUREG-1757, Volume 2, Appendix H. Table H.2, for Cobalt-60, Cesium-137, Europium-152 (as adjusted to conform with the NRC’s Memorandum of Understanding with the U.S. Environmental Protection Agency), and Europium-154, in order to demonstrate that residual radioactivity has been remediated to a level that would permit release for unrestricted use of residual soil and concrete at the GA TRIGA® Reactor Facility, is acceptable.

C. Engstrom

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In accordance with 10 CFR Part 2, "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

If you have any questions regarding this action, please contact Marlayna Vaaler of my staff at 301-415-3178, or by e-mail at Marlayna.Vaaler@nrc.gov.

Sincerely,

/RA/

Bruce A. Watson, CHP, Chief
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket Nos.: 50-089 and 50-163
License No.: R-38 and R-67

cc: General Atomics Service List

C. Engstrom

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If you have any questions regarding this action, please contact Marlayna Vaaler of my staff at 301-415-3178, or by e-mail at Marlayna.Vaaler@nrc.gov.

Sincerely,

/RA/

Bruce A. Watson, CHP, Chief
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery,
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Office of Nuclear Material Safety
and Safeguards

Docket Nos.: 50-089 and 50-163
License No.: R-38 and R-67

cc: General Atomics Service List

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