UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

March 30, 2020

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

SUBJECT: GENERAL ATOMICS - NRC INSPECTION REPORT 050-00089/2020-001; 050-00163/2020-001

Dear Ms. Engstrom:

This letter refers to the U.S. Nuclear Regulatory Commission (NRC) inspection conducted from March 9-11, 2020, at your General Atomics facility in San Diego, California. This inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, independent radiological measurements, and interviews with personnel.

The NRC reviewed decommissioning activities being conducted at the Mark I and Mark F reactor facility. The inspection included an NRC confirmatory radiological survey to verify the results of your recently completed final status survey. A preliminary exit briefing was held with Michael Grogan, Senior Director, Licensing, Safety and Nuclear Compliance, and other members of your staff on March 11, 2020. A final exit briefing will be provided to your staff when the results of the confirmatory survey are available.

The enclosed report presents the results of this inspection. In summary, the NRC determined that General Atomics conducted site activities in accordance with license and regulatory requirements. No violations were identified, and no response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, its enclosure, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy or proprietary information so that it can be made available to the Public without redaction.

Should you have any questions concerning this inspection, please contact Dr. Robert Evans, Senior Health Physicist, at 817-200-1234 or the undersigned at 817-200-1156.

Sincerely,

Heather J. Gepford, PhD, CHP, Chief
Materials Licensing and Decommissioning Branch
Division of Nuclear Materials Safety

Docket Nos.: 050-00089; 050-00163
License Nos.: R-38; R-67

Enclosure:
NRC Inspection Report 050-00089/2020-001; 050-00163/2020-001

cc w/encl:
P. Pater, General Atomics
G. Perez, California Department of Public Health

**U.S. NUCLEAR REGULATORY COMMISSION**
**Region IV**

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|---|---|
| Docket Nos.: | 050-00089; 050-00163 |
| License Nos.: | R-38; R-67 |
| Report Nos.: | 050-00089/2020-001; 050-00163/2020-001 |
| Licensee: | General Atomics |
| Facility: | Torrey Pines Mesa Site<br>TRIGA Reactor Facility |
| Location: | 3550 General Atomics Court<br>San Diego, California 92121 |
| Inspection Dates: | March 9-11, 2020 |
| Inspector: | Robert J. Evans, PhD, PE, CHP, Senior Health Physicist<br>Materials Licensing and Decommissioning Branch<br>Division of Nuclear Materials Safety |
| Accompanied by: | Heather J. Gepford, PhD, CHP, Chief<br>Materials Licensing and Decommissioning Branch<br>Division of Nuclear Materials Safety |
| Approved By: | Heather J. Gepford, PhD, CHP, Chief<br>Materials Licensing and Decommissioning Branch<br>Division of Nuclear Materials Safety |
| Attachments: | Supplemental Inspection Information<br>Confirmatory Survey Results |

Enclosure

## EXECUTIVE SUMMARY

General Atomics
NRC Inspection Report 050-00089/2020-001; 050-00163/2020-001

This U.S. Nuclear Regulatory Commission (NRC) inspection was a routine, announced inspection of licensed activities being conducted at the General Atomics TRIGA Reactor Facility in San Diego, California. In summary, the licensee conducted decommissioning activities in accordance with license and regulatory requirements.

Research and Test Reactor Decommissioning

- The licensee maintained site staffing in accordance with license, quality assurance, and decommissioning plan requirements. Adequate staff was available for the work in progress. (Section 1.2.a)

- The licensee conducted site decommissioning in accordance with the NRC-approved decommissioning plan. The licensee and its contractors developed comprehensive work instructions, and the work was conducted in accordance with these procedural requirements. (Section 1.2.b)

- The licensee implemented its radiation protection program in accordance with license and regulatory requirements. The licensee monitored workers for occupational exposures, and no individual exceeded the regulatory limits. (Section 1.2.c)

- The licensee implemented its effluent control and environmental monitoring programs in accordance with license and regulatory requirements. (Section 1.2.d)

- The licensee implemented its audit and review programs in accordance with license and regulatory requirements. The licensee continued to submit annual reports to the NRC that included the information required by the two reactor licenses. (Section 1.2.e)

- The licensee developed and implemented an emergency plan as required by the decommissioning plan. (Section 1.2.f)

- The licensee conducted transportation activities in accordance with U.S. Department of Transportation regulations. (Section 1.2.g)

Inspection of Remedial and Final Surveys at Permanently Shutdown Reactors

- The licensee developed a final status survey plan that met the intent of the 1999 decommissioning plan, as supplemented, and NRC guidance documents. The licensee implemented the final status survey program in accordance with the instructions provided in the final status survey plan. (Section 2.2.a)

- The NRC conducted a confirmatory survey in selected survey units. The preliminary survey results indicated that the surfaces met the release criteria; however, additional remediation may be necessary in the excavated pit based on the licensee's early soil sample screening results. (Section 2.2.b)

## Report Details

Site Status

The licensee constructed the Mark I reactor in 1957 and began operating the reactor in May 1958. The reactor was originally licensed to operate at a power level of 10 kilowatts thermal power and was later upgraded to 250 kilowatts. The Mark I reactor was permanently shut down in 1997.

The licensee constructed and began operating the Mark F reactor in 1960. This reactor was rated at 1,500 kilowatts of steady state thermal power. This reactor was permanently shut down in early 1995. The remaining fuel from both reactors was shipped offsite in 2010 to a storage facility in Idaho.

The NRC revised the Mark I and Mark F licenses in August 1999, authorizing the licensee to decommission the reactor facility in accordance with instructions provided in the General Atomics TRIGA Reactor Facility Decommissioning Plan (DP) dated July 1999.

Since the previous NRC inspection, conducted in August 2019 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML19247C512), the licensee remediated portions of a drain line located beneath the Mark F floor. This work included removal of floor concrete, removal of sections of the piping, decontamination of internal pipe surfaces, and excavation of contaminated soil. The licensee shipped all remaining radioactive material for offsite processing and disposal, except for some dry active wastes that remain onsite.

At the time of the inspection, the final status survey of the reactor facility was essentially complete. The licensee's staff planned to collect additional judgmental samples in selected final status survey units. The licensee plans to complete the final status survey report and submit the report to the NRC. The licensee plans to use the information provided in the final status survey report, in part, to support a future request to terminate the two reactor licenses.

## 1 Research and Test Reactor Decommissioning (Inspection Procedure 69013)

### 1.1 Inspection Scope

The purpose of this inspection was to determine if dismantlement and decontamination activities were being conducted safely and in accordance with regulatory requirements, licensee commitments, and the NRC-approved DP.

### 1.2 Observations and Findings

a. Organization and Staffing

The staffing requirements are described in the technical specifications for the two reactor licenses (ADAMS Accession Nos. ML13312A797 and ML14063A627), the licensee's quality assurance program document, and the NRC-approved DP. The inspector compared the current organization to license requirements. The inspector determined that the licensee's organizational structure was staffed with qualified individuals in accordance with technical specifications, quality assurance, and DP requirements. The licensee had adequate staff for the work in progress.

Since the previous inspection, the former decommissioning project manager was replaced by the current TRIGA reactor physicist-in-charge. In addition, the licensee assigned a new individual to the position of chairperson for the Compliance and Radiation Safety Working Group. All other positions on the organization chart were filled with qualified individuals who were present during previous inspections.

b. Work Controls

The licensee is authorized to conduct decommissioning activities in accordance with the instructions provided in the NRC-approved DP dated July 1999. The inspector discussed the status of decommissioning with licensee representatives and toured the Mark I and Mark F reactor facility to observe recently completed work.

The licensee developed a work plan for the remediation of the two reactor pits. Radiological Work Authorization W/A 600-18 was developed and approved by the licensee in June 2018. The work authorization was reapproved by the licensee in September 2019. The document included work instructions, radiological controls, as low as is reasonably achievable (ALARA) goals, and emergency plans. The primary hazard was accidental falls, and the licensee and its contractor implemented stringent fall protection requirements.

During the NRC's August 2019 inspection, staff from Oak Ridge Associated Universities conducted a confirmatory survey on behalf of the NRC. The results of the survey were documented in a technical report dated November 26, 2019 (ADAMS Accession No. ML19337D382). The contractor identified a contaminated drain line in the Mark F reactor room that required additional investigation by the licensee.

The licensee subsequently determined that the drain line had fractured underneath the floor slab. The licensee conducted remediation work that included cutting of the concrete floor, removing portions of the drain line, cleaning the drain line, and excavating contaminated soil around the drain line. The licensee implemented the reclamation work using both the work plan and a radiation work permit.

Radiation Work Permit 3614 was issued for remediation of the concrete and soil. The permit included the personnel protective equipment requirements. The work included use of portable ventilation, general area air sampling, and ventilation exhaust air sampling. The permit was issued in September 2019 and expired at the end of 2019. The licensee remediated approximately 11 cubic yards of waste material. The waste material was subsequently packaged and shipped offsite for processing and disposal by a waste broker.

The inspector confirmed that the licensee conducted site decommissioning work in accordance with approved procedures.

c. Health Physics/Radiation Protection

The inspector reviewed the licensee's radiation protection program to ensure compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 and license requirements.

The inspector reviewed the licensee's occupational exposure records for calendar year 2019 to ensure that no individual exceeded the limits specified in 10 CFR 20.1201. The licensee monitored workers for external exposures only. Based on the type of work being conducted and the results of air sampling, the licensee suspended internal exposure dose assessments and bioassay sampling as allowed by 10 CFR 20.1502.

The licensee monitored 34 workers who were authorized to work at the reactor facility in 2019. For the year, the highest total effective dose equivalent exposure was 8 millirem with a regulatory limit of 5,000 millirem per year as specified in 10 CFR 20.1201. Occupational exposures were lower than previous years due to a reduction in the radioactive source term present at the reactor facility.

The technical specifications for each reactor license required the licensee to implement a radiation monitoring system including continuous area radiation monitoring, airborne radiation monitoring, and annual calibration of equipment. The inspector reviewed representative records for 2019-2020 and interviewed the staff responsible for maintaining the radiation monitoring system in service. The records indicated that the licensee continued to operate and maintain the equipment in accordance with technical specification requirements. No air sample result exceeded the procedural action levels, and no valid high radiation monitoring alarms were received during the inspection period.

The licensee maintained records demonstrating that the monitoring system components were calibrated and functionally checked for operability on a routine basis, as required by site procedures and technical specifications. One of four radiation monitors failed the calibration check in January 2020 and was replaced at that time. At the time of the inspection, all four radiation monitors were in service.

Technical specifications also required continuous air monitoring at all times when the facility was not secured. The licensee had two air monitoring systems for the two reactor rooms. At the time of the inspection, the Mark F monitor was still in service, while the Mark I monitor had been removed from service. The licensee considered the Mark I reactor to be secured, since all decommissioning activities had been completed. However, the licensee continued to maintain general area air samplers in service, to monitor the facility air for potential airborne radioactivity.

The licensee conducted weekly general area air sampling within the reactor facility at three locations. The inspector reviewed the results for samples recently collected. No sample result exceeded the action level indicating that the licensee was not experiencing airborne radioactivity problems.

In addition to general area air sampling, the licensee collected routine and non-routine air samples using portable equipment to support decommissioning work in progress. The inspector reviewed a representative sample of these records and confirmed that airborne contamination levels were maintained below the respective procedural action levels. The inspector noted that air sample results were at or near background levels during remediation of the Mark F reactor room drain line. The licensee plans to summarize the air sample results in the next annual report.

The licensee's staff conducted routine contamination monitoring of areas containing radioactive material. Routine monitoring included swipe surveys for removable contamination and measurement of ambient gamma radiation levels. The inspector

reviewed representative records of sampling conducted since the last inspection. No area within the building exceeded the procedural action levels for removable contamination or ambient gamma radiation levels.

The inspector conducted a limited review of the licensee's maintenance and calibration program for radiation detection instrumentation. The inspector noted that instruments in use were calibrated and had been source checked as required. Also, instruments in use were capable of detecting radiation of the type and at the levels expected for the location of usage. The inspector determined that the licensee's instrument calibration program complied with license requirements.

The training requirements were specified in Section 2.5 of the DP. The licensee's training program included annual refresher training, work authorization and work permit review, and updated procedure reviews as necessary. The licensee maintained a decommissioning training matrix which tracked employee training. The inspector verified that the licensee had established and implemented a training and qualification program for all personnel involved in decommissioning activities.

d. Effluent Control and Environmental Monitoring

The inspector reviewed the licensee's effluent control and environmental monitoring programs to verify compliance with regulatory and license requirements. In accordance with the NRC-approved DP, the licensee was required to sample reactor building ventilation system exhausts, environmental airborne effluents, and potentially contaminated liquids. The technical specifications required the licensee to maintain records of gaseous and liquid radioactive effluents and environmental monitoring surveys. The technical specifications also required the licensee to summarize the radioactive effluents released and describe any environmental surveys performed outside of the facility in the annual reports.

The technical specifications required the licensee to submit the annual reports to the NRC by April 15th of each calendar year. The reports for 2019 were not available for review during the inspection. However, the inspector reviewed some of the effluent control and environmental monitoring data that will be included in the annual report.

The licensee monitored the ambient gamma radiation levels using 33 passive area dosimeters located inside and outside the reactor building. The inspector reviewed the environmental dosimeter records for 2019. The highest measurement, 113 millirem per year, was attributed to storage of radioactive waste within the controlled area. These wastes have since been shipped offsite.

The licensee conducted monthly ambient gamma radiation surveys along the reactor facility fence. The inspector reviewed the survey records for 2019-2020. The most recent survey results ranged from 10-18 microroentgen per hour (µR/hr), results that were essentially at background levels. During early 2019, slightly elevated measurements, up to 22 µR/hr, were identified in the yard where radioactive wastes were being temporarily stored. All survey results for 2019-2020 were well below the regulatory limits for posting as radiation areas (5,000 µR/hr) and for exposure rates in unrestricted areas (2,000 µR/hr).

The licensee's Compliance & Radiation Safety Working Group conducted annual public dose assessments. The assessment for 2019 was not available at the time of the inspection. The public dose assessment for 2018 was completed in April 2019. The licensee estimated that the maximum dose to a member of the public in 2018 was less than 32 millirem per year with a regulatory limit of 100 millirem per year. Most of the assessed dose was based on environmental dosimeter measurements near the nearest resident location. A small fraction of the dose was attributed to airborne effluents.

e. Audits and Reviews

The inspector reviewed the licensee's programs and procedures for audits and reviews for compliance with license and regulatory requirements.

The technical specifications described the requirements of the Criticality and Radiation Safety Committee. The licensee subsequently renamed this committee the Compliance and Radiation Safety Working Group. The working group is required to meet at least annually to review facility changes, records, performance, occurrences, and incidents. The committee also conducted annual ALARA reviews. The next annual working group meeting was scheduled for April 2020. Since the working group had not met since the last inspection, the inspector did not review the licensee's implementation of the working group requirements.

The licensee is required by the DP to implement a quality assurance program including routine audits. Details of the audit program are provided in site procedures. In August 2019, the licensee conducted a combined audit of the health physics program and nuclear calibration laboratory. The auditor identified one concern related to the purchasing of goods and services without the required quality assurance review. Corrective actions included a procedure revision to ensure that the required quality assurance reviews are completed prior to purchasing goods or services.

The licensee conducted annual radiation protection program reviews as required by 10 CFR 20.1101(c). Each annual review included selected radiation protection program areas. The last annual review was conducted in March 2019. This review concentrated on records, required health physics activities, sealed source leak tests, and the nuclear material accountability program. The auditor did not identify any non-compliances or findings. The next review was not complete at the time of the inspection and was not reviewed during the inspection.

f. Emergency Planning

Section 7 of the NRC-approved DP required the licensee to have an emergency plan in place during decommissioning activities. The licensee developed an emergency procedure for the reactor facility. The 2016 procedure was included in Radiological Work Authorization W/A 600-18. The procedure included instructions for a medical incident, fire, security event, earthquake, structural damage, and radiological releases. At the time of the inspection, the primary hazards at the site were industrial injuries such as slips, trips, and falls. The potential for a radiological event was limited since most of the radioactive material had been removed from the site.

The licensee conducted and documented monthly emergency equipment inspections. The inspected equipment included fire extinguishers, first aid kits, and emergency lights.

The licensee was required to train site staff to respond to emergencies. The licensee established and maintained a training matrix of all site workers that included emergency response team training.

g. Solid Radioactive Waste Management and Transportation

The licensee and its contractor completed four waste shipments since the last inspection. Two shipments consisted of dry active waste, including potentially radioactive trash. The material was shipped by a broker on behalf of the licensee, and the material was shipped for processing prior to disposal. The remaining two shipments consisted of concrete and soil debris for reprocessing before disposal. The licensee maintained records on file for the four shipments. The licensee continued to possess some dry active waste that will be shipped when the project has been completed.

Although recent shipments were conducted by a broker, the licensee maintained a matrix of transportation training requirements for site workers who may package and ship radioactive material. The inspector noted that the licensee's staff who conducted transportation activities had been trained, and their training was documented on the training matrix.

Based on the available records and interviews with site staff, the inspector concluded that the licensee and its broker conducted these shipments in accordance with transportation regulations. The inspector also confirmed that the licensee had implemented a training program to ensure that applicable employees attended function specific-training.

1.3 Conclusions

The licensee maintained site staffing in accordance with license, quality assurance, and DP requirements. Adequate staff was available for the work in progress.

The licensee conducted site decommissioning in accordance with the NRC-approved DP. The licensee and its contractors developed comprehensive work instructions, and the work was conducted in accordance with these procedural requirements.

The licensee implemented its radiation protection program in accordance with license and regulatory requirements. The licensee monitored workers for occupational exposures, and no individual exceeded the regulatory limits.

The licensee implemented its effluent control and environmental monitoring programs in accordance with license and regulatory requirements.

The licensee implemented its audit and review programs in accordance with license and regulatory requirements. The licensee continued to submit annual reports to the NRC that included the information required by the two reactor licenses.

The licensee developed and implemented an emergency plan as required by the DP.

The licensee conducted transportation activities in accordance with U.S. Department of Transportation regulations.

## 2 Inspection of Remedial and Final Surveys at Permanently Shutdown Reactors (Inspection Procedure 83801)

### 2.1 Inspection Scope

The scope of this inspection effort was to verify that: (1) the reactor facility was decontaminated to acceptable residual radioactivity levels as specified in the NRC-approved DP; (2) the licensee implemented its NRC-approved final status survey program; and (3) the licensee's final status survey results were acceptable for release of the facility for unrestricted use.

### 2.2 Observations and Findings

#### a. Review of Final Status Survey Program

The final status survey program requirements are provided in Section 4 of the NRC-approved DP dated July 1999. The DP provides release criteria for surfaces but not volumetric material such as soil and concrete. By letters dated December 18, 2015, and August 15, 2016 (ADAMS Accession Nos. ML15362A506 and ML16242A319), the licensee requested approval of volumetric release criteria for the reactor facility. By letter dated February 1, 2017 (ADAMS Accession No. ML16285A300), the NRC approved the licensee's request.

In addition to approval of volumetric release criteria, the licensee's 2015-2016 submittals and the NRC's 2017 reply changed the survey methodology that the licensee would use during the final status survey. The licensee committed to use the guidance provided in NUREG-1575, Revision 1, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," instead of the out-of-date instructions as provided in the DP.

The licensee developed a final status survey plan (FSSP) that included portions of the 1999 DP, as revised by the 2015-2017 letters. The licensee submitted the original FSSP to the NRC by email dated July 16, 2019 (ADAMS Accession No. ML19247C586). Based on the results of the NRC's August 2019 confirmatory survey (ADAMS Accession No. ML19337D382), the licensee updated the FSSP to include three new survey units and to provide instructions for release of a contaminated subsurface pipe (ADAMS Accession No. ML20049A039). The inspector reviewed the updated FSSP and concluded that the instructions were consistent with MARSSIM guidance and DP requirements.

The inspector reviewed the licensee's implementation of the FSSP. At the time of the inspection, the final status survey had been completed in all survey units, but the licensee's staff planned to take additional judgmental samples in several areas. The licensee also recently decontaminated and surveyed the drain pipe internal surfaces.

The licensee used a cesium-iodide detector to collect a count rate measurement at various locations along the length of the pipe. The licensee converted the count rates to exposure rates using a conversion factor. This information will be used as part of the licensee's method to release the pipe from the Mark F license through dose modeling instead of comparison to surface screening values.

The inspector reviewed a representative final status survey package for comparison to FSSP requirements. The documentation included worker instructions, instrumentation requirements, survey coverage requirements, and documentation requirements. The inspector noted that the number of survey points was greater than the minimum number of locations needed for the survey unit, indicating that the licensee designed and implemented the final status survey program with conservatism. None of the survey results exceeded the associated surface derived concentration guideline levels.

b. Confirmatory Survey

The inspector conducted confirmatory surveys of select areas within the reactor facility. A confirmatory survey is a radiological survey conducted by the NRC to verify the results of the licensee's final status survey. The radionuclides of concern included cesium-137, a beta-gamma emitter, and strontium-90, a beta-emitter.

The confirmatory survey consisted of fixed-point measurements of surface contamination levels for total radioactivity, surface scans for gamma radiation levels, and collection of soil samples for offsite analysis. The inspector concentrated on the areas and survey units (SUs) that were identified with contamination in excess of the release criteria during the previous confirmatory survey, conducted in August 2019 (ADAMS Accession No. ML19337D382), or areas not been previously confirmatory surveyed. These survey units included the Mark F canal (SU-2), Mark F reactor room floor and lower walls (SU-5), the excavated area in the Mark F reactor room (SU-5A), mezzanine room 1 (SU-8), TRIGA waste yard (SU-10), reactor facility roof (SU-15), and the sub-critical pit (SU-16).

The inspector conducted scan surveys for ambient gamma radiation levels using a Ludlum Model 19 microroentgen meter calibrated to cesium-137 (serial number 33532, calibration due date of 12/9/20) and a Ludlum Model 18 analyzer with Model 44-10 probe calibrated to cesium-137 (serial numbers 15504 and PR10110268, calibration due date of 11/26/20). The scan surveys were conducted primarily to locate areas for fixed point surface measurement or soil sampling. The licensee had not established an action level for ambient gamma radiation levels. The results of the scan surveys are presented in Attachment 2, Table 1, in units of counts per minute (cpm) and µR/hr, depending on the meter used in that survey unit. The licensee's results for each survey unit, if available, are presented for comparison. In summary, no significantly elevated gamma exposure rates were identified by either the inspector or the licensee.

The inspector conducted 65 fixed point measurements in six of seven survey units. The seventh survey unit, the excavated pit in the Mark F reactor room, was evaluated via soil sampling. The inspector collected fixed point measurements at or near the licensee's final status survey sample points. The inspector measured the gross alpha and gross beta activity levels at each sample point. Although the licensee compared only the net beta contamination levels to the screening criteria, the inspector also measured the alpha contamination levels to ensure that no area had alpha contamination problems. Three measurements were duplicate measurements, to confirm the results of the first measurement. The results of the fixed-point measurement survey are presented in Appendix 2, Tables 2 and 3, in units of disintegrations per minute per 100 square centimeters (dpm/100 $cm^2$) for comparison to the surface release criteria as presented in Table 2-6 of the DP.

In summary, the surface contamination measurements indicated that one sample point in the waste yard exceeded the release criteria. However, the inspector collected a second measurement at the same location, and the second sample result was less than the release criteria limit. The inspector considered the first sample measurement to be an outlier. All other sample points were less than the respective release criteria for that survey unit. In addition, all alpha measurements, including the outlier measurement mentioned above, were below the release criteria indicating that alpha contamination was not a concern at the reactor facility.

Tables 2 and 3 include the licensee's sample results for the same (or nearby) sample locations. The differences in measurements were due to differences in material-specific background values and slight variations in the sampled locations. All of the licensee's sample results were lower than the respective release criteria for that survey unit.

The inspector collected four soil samples from the excavated pit in the Mark F reactor room. The samples were split with the licensee. The inspector shipped the samples to the NRC's contractor for gamma spectroscopy analysis and determination of strontium-90 concentrations. The NRC's soil sample results were not available at the conclusion of the onsite inspection and will be presented to the licensee when received.

The licensee conducted an onsite screen of the four split samples. The early screen results suggest that two of four samples contained cesium-137 in concentrations that will exceed the release criteria. This suggests that additional remediation of the excavated pit may be necessary. The licensee shipped its samples to an offsite laboratory for formal analysis. The licensee's staff agreed to share the results of their samples with the NRC when received by the licensee from the laboratory.

### 2.3 Conclusions

The licensee developed a FSSP that met the intent of the 1999 DP, as supplemented, and NRC guidance documents. The licensee implemented the final status survey program in accordance with the instructions provided in the FSSP.

The NRC conducted a confirmatory survey in selected survey units. The preliminary survey results indicated that the surfaces met the release criteria; however, additional remediation may be necessary in the excavated pit based on the licensee's early soil sample screening results.

## 3 Exit Meeting Summary

The inspector presented the preliminary inspection results to the licensee's staff at the conclusion of the onsite inspection on March 11, 2020. A briefing will be provided to the licensee's staff when the soil sample results are available. During the inspection, the licensee did not identify any information reviewed by the inspector as proprietary.

## SUPPLEMENTAL INSPECTION INFORMATION

### Partial List of Persons Contacted

Licensee

E. Drees, Nuclear Engineer
J. Greenwood, Manager, TRIGA Reactors
M. Grogan, Senior Director, Licensing, Safety and Nuclear Compliance
R. Klasen, Senior Staff Technician
P. Pater, Manager, Health Physics
R. Trimble, Health Physicist

### Inspection Procedures (IPs) Used

| | |
|---|---|
| IP 69013 | Research and Test Reactor Decommissioning |
| IP 83801 | Inspection of Remedial and Final Surveys at Permanently Shutdown Reactors |

### Items Opened, Closed and Discussed

Opened

None

Closed

None

Discussed

None

## CONFIRMATORY SURVEY RESULTS

**Table 1: Gamma Radiation Scan Survey Results**

| Location | Meter | Description | NRC's Exposure Rates | Licensee's Exposure Rates |
|---|---|---|---|---|
| Office | Ludlum 19 | Background | 8 µR/hr | 12-15 µR/hr sitewide |
| Parking lot | Ludlum 18/44-10 | Background | 12,000-14,000 cpm | N/A |
| SU-2 | Ludlum 19 | Mark F canal | 10-14 µR/hr | 9-30 µR/hr |
| SU-5 | Ludlum 18/44-10 | Mark F floor/walls | 14,000-18,000 cpm | 12-18 µR/hr |
| SU-5A | Ludlum 18/44-10 | Mark F excavated pit | 20,000-28,000 cpm | N/A |
| SU-8 | Ludlum 19 | Mezzanine 1 | 12-17 µR/hr | 12-18 µR/hr |
| SU-10 | Ludlum 18/44-10 | TRIGA waste yard | 11,000-19,000 cpm | 12-20 µR/hr |
| SU-15 | Ludlum 18/44-10 | Mark I/Mark F roof | 7,000-10,000 cpm | 10-21 µR/hr |
| SU-16 | Ludlum 19 | Sub-critical pit | 27-30 µR/hr | 13-22 µR/hr |

**Table 2: Total Surface Activity Measurements, Beta**

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-2, 5 | Mark F canal floor | 378 | 49 | concrete | 450 | -1010 |
| SU-2, 6 | Mark F canal floor | 466 | 137 | concrete | 1257 | -300 |
| SU-2, 7 | Mark F canal floor | 383 | 54 | concrete | 495 | -1050 |
| SU-2, 7 duplicate* | Mark F canal floor | 393 | 64 | concrete | 587 | -1050 |
| SU-2, 8 | Mark F canal floor | 327 | -2 | concrete | -18 | -1330 |
| SU-2, near 8 | Mark F canal floor | 324 | -5 | concrete | -46 | -1330 |
| SU-2, 2 | Mark F canal track | 187 | -14 | metal | -128 | -1170 |
| SU-2, 11 | Mark F canal wall | 229 | -100 | concrete | -917 | -1170 |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-2, 19 | Mark F canal wall | 258 | -71 | concrete | -651 | -950 |
| SU-2, 52 | Mark F canal floor | 311 | -18 | concrete | -165 | 450 |
| SU-2, 53 | Mark F canal floor | 343 | 14 | concrete | 128 | 110 |
| SU-2, 55 | Mark F canal wall | 248 | -81 | concrete | -743 | -1140 |
| SU-5, near 1 | Mark F room floor | 438 | 109 | concrete | 1,000 | 320 |
| SU-5, near 1, duplicate* | Mark F room floor | 406 | 77 | concrete | 706 | 320 |
| SU-5, 3 | Mark F room floor | 260 | 59 | floor tile | 541 | -420 |
| SU-5, 5 | Mark F room floor | 317 | 116 | floor tile | 1,064 | -140 |
| SU-5, 8 | Mark F room floor | 262 | 61 | floor tile | 559 | -580 |
| SU-5, 12 | Mark F room floor | 270 | 69 | floor tile | 633 | -370 |
| SU-5, 15 | Mark F room floor | 394 | 65 | concrete | 596 | 270 |
| SU-5, 18 | Mark F room floor | 261 | 60 | floor tile | 550 | -370 |
| SU-5, 24 | Mark F room wall | 286 | 7 | cinderblock | 64 | -1180 |
| SU-5, 27 | Mark F room wall | 289 | 10 | cinderblock | 92 | -1100 |
| SU-5, 31 | Mark F room wall | 314 | 35 | cinderblock | 321 | -1380 |
| SU-5, 40 | Mark F room wall | 288 | 9 | cinderblock | 83 | -1330 |
| SU-5, 54 | Control room wall | 295 | 16 | cinderblock | 147 | -1120 |
| SU-5, 56 | Control room floor | 289 | 88 | metal | 807 | -860 |
| SU-5, near 57 | Control room floor | 283 | 82 | metal | 752 | -1070 |
| SU-5, 60 | Control room floor | 271 | 70 | floor tile | 642 | -830 |
| SU-5, 71 | Control room wall | 283 | 4 | cinderblock | 37 | -1470 |
| SU-8, 1 | Mezzanine 1 floor | 510 | 181 | concrete | 1,660 | 3390 |
| SU-8, near 1 | Mezzanine 1 floor | 473 | 144 | concrete | 1,321 | 3390 |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-8, 6 | Mezzanine 1 floor | 341 | 12 | concrete | 110 | 660 |
| SU-8, 10 | Mezzanine 1 floor | 336 | 7 | concrete | 64 | 820 |
| SU-8, near 18 | Mezzanine 1 floor | 354 | 25 | concrete | 229 | 680 |
| SU-8, 30 | Mezzanine 1 wall | 206 | -73 | cinderblock | -670 | -990 |
| SU-8, 40 | Mezzanine 1 wall | 239 | -40 | cinderblock | -367 | -830 |
| SU-8, 47 | Mezzanine 1 floor | 387 | 58 | concrete | 532 | 70 |
| SU-8, 48 | Mezzanine 1 wall | 282 | 3 | cinderblock | 28 | -890 |
| SU-8, 49 | Mezzanine 1 wall | 299 | 20 | cinderblock | 183 | -1230 |
| SU-8, 50 | Mezzanine 1 wall | 304 | 25 | cinderblock | 229 | 1290 |
| SU-10, 11 | Waste yard floor | 2013 | 1632 | asphalt | 14,192 | 190 |
| SU-10, 11, duplicate* | Waste yard floor | 418 | 37 | asphalt | 339 | 190 |
| SU-10, 13 | Waste yard floor | 265 | -64 | concrete | -587 | -110 |
| SU-10, 16 | Waste yard floor | 269 | -60 | concrete | -550 | 470 |
| SU-10, 31 | Waste yard floor | 401 | 72 | concrete | 661 | 720 |
| SU-10, 33 | Waste yard floor | 349 | 20 | concrete | 183 | -900 |
| SU-10, 51 | Waste yard floor | 355 | 26 | concrete | 239 | 650 |
| SU-15, 30 | Mark I/Mark F roof | 314 | -67 | rock/asphalt | -615 | 1660 |
| SU-15, 39 | Mark I/Mark F roof | 326 | -55 | rock/asphalt | -505 | 1930 |
| SU-15, 51 | Mark I/Mark F roof | 316 | -65 | rock/asphalt | -596 | 1950 |
| SU-15, 56 | Mark I/Mark F roof | 177 | -24 | metal | -220 | -790 |
| SU-15, 59 | Mark I/Mark F roof | 324 | -57 | rock/asphalt | -523 | 2300 |
| SU-15, 62 | Mark I/Mark F roof | 198 | -183 | rock/asphalt | -1,679 | 620 |
| SU-15, 63 | Mark I/Mark F roof | 317 | -64 | rock/asphalt | -587 | 2610 |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-15, 69 | Mark I/Mark F roof | 199 | -182 | rock/asphalt | -1,670 | 1020 |
| SU-16, 1 | Subcritical pit floor | 424 | 95 | concrete | 872 | 1660 |
| SU-16, sump | Subcritical pit floor | 469 | 140 | concrete | 1,284 | N/A |
| SU-16 | Subcritical pit floor | 439 | 110 | concrete | 1,009 | N/A |
| SU-16 | Subcritical pit floor | 424 | 95 | concrete | 872 | N/A |
| SU-16 | Subcritical pit floor | 404 | 75 | concrete | 688 | N/A |
| SU-16 | Subcritical pit floor | 414 | 85 | concrete | 780 | N/A |
| SU-16 | Subcritical pit wall | 424 | 95 | concrete | 872 | N/A |
| SU-16 | Subcritical pit wall | 451 | 122 | concrete | 1,119 | N/A |
| SU-16 | Subcritical pit wall | 377 | 48 | concrete | 440 | N/A |
| SU-16 | Subcritical pit wall | 437 | 108 | concrete | 991 | N/A |

* Duplicate measurement taken at same sample point as first measurement

**Table 2: Total Surface Activity Measurements, Alpha**

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-2, 5 | Mark F canal floor | 6 | -3 | concrete | -29 | N/A |
| SU-2, 6 | Mark F canal floor | 3 | -6 | concrete | -57 | N/A |
| SU-2, 7 | Mark F canal floor | 14 | 5 | concrete | 48 | N/A |
| SU-2, 7 duplicate* | Mark F canal floor | 11 | 2 | concrete | 19 | N/A |
| SU-2, 8 | Mark F canal floor | 4 | -5 | concrete | -48 | N/A |
| SU-2, near 8 | Mark F canal floor | 9 | 0 | concrete | 0 | N/A |
| SU-2, 2 | Mark F canal track | 4 | -1 | metal | -10 | N/A |
| SU-2, 11 | Mark F canal wall | 6 | -3 | concrete | -29 | N/A |
| SU-2, 19 | Mark F canal wall | 5 | -4 | concrete | -38 | N/A |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-2, 52 | Mark F canal floor | 7 | -2 | concrete | -19 | N/A |
| SU-2, 53 | Mark F canal floor | 4 | -5 | concrete | -48 | N/A |
| SU-2, 55 | Mark F canal wall | 9 | 0 | concrete | 0 | N/A |
| SU-5, near 1 | Mark F room floor | 17 | 8 | concrete | 77 | N/A |
| SU-5, near 1, duplicate* | Mark F room floor | 9 | 0 | concrete | 0 | N/A |
| SU-5, 3 | Mark F room floor | 3 | -2 | floor tile | -19 | N/A |
| SU-5, 5 | Mark F room floor | 5 | 0 | floor tile | 0 | N/A |
| SU-5, 8 | Mark F room floor | 4 | -1 | floor tile | -10 | N/A |
| SU-5, 12 | Mark F room floor | 8 | 3 | floor tile | 29 | N/A |
| SU-5, 15 | Mark F room floor | 6 | -3 | concrete | -29 | N/A |
| SU-5, 18 | Mark F room floor | 3 | -2 | floor tile | -19 | N/A |
| SU-5, 24 | Mark F room wall | 5 | 0 | cinderblock | 0 | N/A |
| SU-5, 27 | Mark F room wall | 5 | 0 | cinderblock | 0 | N/A |
| SU-5, 31 | Mark F room wall | 4 | -1 | cinderblock | -10 | N/A |
| SU-5, 40 | Mark F room wall | 9 | 4 | cinderblock | 38 | N/A |
| SU-5, 54 | Control room wall | 7 | 2 | cinderblock | 19 | N/A |
| SU-5, 56 | Control room floor | 3 | -2 | metal | -19 | N/A |
| SU-5, near 57 | Control room floor | 4 | -1 | metal | -10 | N/A |
| SU-5, 60 | Control room floor | 5 | 0 | floor tile | 0 | N/A |
| SU-5, 71 | Control room wall | 4 | -1 | cinderblock | -10 | N/A |
| SU-8, 1 | Mezzanine 1 floor | 7 | -2 | concrete | -19 | N/A |
| SU-8, near 1 | Mezzanine 1 floor | 14 | 5 | concrete | 48 | N/A |
| SU-8, 6 | Mezzanine 1 floor | 6 | -3 | concrete | -29 | N/A |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-8, 10 | Mezzanine 1 floor | 4 | -5 | concrete | -48 | N/A |
| SU-8, near 18 | Mezzanine 1 floor | 6 | -3 | concrete | -29 | N/A |
| SU-8, 30 | Mezzanine 1 wall | 6 | 1 | cinderblock | 10 | N/A |
| SU-8, 40 | Mezzanine 1 wall | 9 | 4 | cinderblock | 38 | N/A |
| SU-8, 47 | Mezzanine 1 floor | 12 | 3 | concrete | 29 | N/A |
| SU-8, 48 | Mezzanine 1 wall | 4 | -1 | cinderblock | -10 | N/A |
| SU-8, 49 | Mezzanine 1 wall | 10 | 5 | cinderblock | 48 | N/A |
| SU-8, 50 | Mezzanine 1 wall | 6 | 1 | cinderblock | 10 | N/A |
| SU-10, 11 | Waste yard floor | 66 | 58 | asphalt | 555 | N/A |
| SU-10, 11, duplicate* | Waste yard floor | 8 | 0 | asphalt | 0 | N/A |
| SU-10, 13 | Waste yard floor | 5 | -4 | concrete | -38 | N/A |
| SU-10, 16 | Waste yard floor | 6 | -3 | concrete | -29 | N/A |
| SU-10, 31 | Waste yard floor | 3 | -6 | concrete | -57 | N/A |
| SU-10, 33 | Waste yard floor | 6 | -3 | concrete | -29 | N/A |
| SU-10, 51 | Waste yard floor | 7 | -2 | concrete | -19 | N/A |
| SU-15, 30 | Mark I/Mark F roof | 5 | -3 | rock/asphalt | -29 | N/A |
| SU-15, 39 | Mark I/Mark F roof | 6 | -2 | rock/asphalt | -19 | N/A |
| SU-15, 51 | Mark I/Mark F roof | 9 | 1 | rock/asphalt | 10 | N/A |
| SU-15, 56 | Mark I/Mark F roof | 11 | 7 | metal | 67 | N/A |
| SU-15, 59 | Mark I/Mark F roof | 7 | -1 | rock/asphalt | -10 | N/A |
| SU-15, 62 | Mark I/Mark F roof | 8 | 0 | rock/asphalt | 0 | N/A |
| SU-15, 63 | Mark I/Mark F roof | 6 | -2 | rock/asphalt | -19 | N/A |
| SU-15, 69 | Mark I/Mark F roof | 3 | -5 | rock/asphalt | -48 | N/A |

| Survey unit, Sample No. | Description | Gross counts/min | Net counts/min | Material type | NRC's results dpm/100 $cm^2$ | Licensee's results dpm/100 $cm^2$ |
|---|---|---|---|---|---|---|
| SU-16, 1 | Subcritical pit floor | 13 | 4 | concrete | 38 | N/A |
| SU-16, sump | Subcritical pit floor | 9 | 0 | concrete | 0 | N/A |
| SU-16 | Subcritical pit floor | 16 | 7 | concrete | 67 | N/A |
| SU-16 | Subcritical pit floor | 19 | 10 | concrete | 96 | N/A |
| SU-16 | Subcritical pit floor | 13 | 4 | concrete | 38 | N/A |
| SU-16 | Subcritical pit floor | 16 | 7 | concrete | 67 | N/A |
| SU-16 | Subcritical pit wall | 18 | 9 | concrete | 86 | N/A |
| SU-16 | Subcritical pit wall | 11 | 2 | concrete | 19 | N/A |
| SU-16 | Subcritical pit wall | 14 | 5 | concrete | 48 | N/A |
| SU-16 | Subcritical pit wall | 21 | 12 | concrete | 115 | N/A |

* Duplicate measurement taken at same sample point as first measurement

GENERAL ATOMICS - NRC INSPECTION REPORT 050-00089/2020-001;
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Distribution:
SMorris, ORA
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LHowell, DNMS
BTharakan, DNMS
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BWatson, NMSS
R4DNMS_MLDB

cc:
Paul Pater, Manager, Health Physics
General Atomics
P.O. Box 85608
San Diego, CA 92186-9784
paul.pater@ga.com

Gonzalo Perez, Chief
California Dept. of Public Health (CDPH)
Radiologic Health Branch
P.O. Box 997414, MS 7610
Sacramento, CA 95899-7414
Gonzalo.Perez@cdph.ca.gov

ADAMS ACCESSION NUMBER: ML20090B701

■ SUNSI Review By: RJE | ADAMS: ■ Yes ☐ No | ☐ Non-Publicly Available ■ Publicly Available | ■ Non-Sensitive ☐ Sensitive | Keyword: NRC-002

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