

**VIA OVERNIGHT DELIVERY SERVICE**

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**Subject: Docket No. 50-89, Facility License R-38, and  
Docket No. 50-163, Facility License R-67;  
Submission of General Atomics TRIGA® Mark I and Mark F Annual Reports for  
Calendar Year 2015 (3 Copies each)**

**Reference: General Atomics Letter No. 38/67-4721, dated March 24, 2016.**

**Dear Ms. Vaaler:**

By letter dated March 24, 2016 (Ref.), General Atomics (GA) intended to submit calendar year 2015 annual reports for its Mark I and Mark F TRIGA reactors. Unfortunately, the reports submitted with the referenced letter were inadvertently for calendar year 2014, rather than for calendar year 2015. Consequently, the referenced letter was revised and re-sent as this letter numbered 38/67-4721A. Thus, enclosed herein are the subject annual reports for calendar year 2015 as required by the applicable Technical Specifications of GA's Mark I (License R-38) and Mark F (License R-67) TRIGA® research reactors. These reports cover operations for the calendar year 2015. The sections of these reports are numbered consistent with the items of information referred to in Section 7.6d of the Technical Specifications for the Mark I TRIGA® reactor and in 8.6d of the Technical Specifications for the Mark F TRIGA® reactor.

Should you need additional information concerning the above, please contact me at (858) 455-2823 or by email [keith.asmussen@ga.com](mailto:keith.asmussen@ga.com) or Mr. John Greenwood at (858) 455-4526 or at [john.greenwood@ga.com](mailto:john.greenwood@ga.com).

Very truly yours,



Keith E. Asmussen, Ph.D., Director  
Licensing, Safety and Nuclear Compliance

**Enclosures: 1) TRIGA® Mark I Reactor/Annual Report/Calendar Year 2015, dated  
March, 2016 (3 Copies)  
2) TRIGA® Mark F Reactor/Annual Report/Calendar Year 2015, dated  
March, 2016 (3 Copies)**

**cc: Mr. Alexander Adams, Jr. (NRC)**



**TRIGA<sup>®</sup> Mark I Reactor**

**ANNUAL REPORT**

**CALENDAR YEAR 2015**

**Prepared to satisfy the requirements of  
U.S. Nuclear Regulatory Commission  
Facility License R-38  
Docket No. 50-89**

**MARCH 2016**



**GENERAL ATOMICS TRIGA REACTORS FACILITY  
TRIGA Mark I Reactor  
ANNUAL REPORT  
Calendar Year 2015**

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## **1. INTRODUCTION**

This report documents operation of the General Atomics (GA) TRIGA®<sup>1</sup> Mark I Non-Power Reactor for the period January 1, 2015 through December 31, 2015. The TRIGA Mark I Reactor, possessed by GA at its San Diego, California facilities as authorized under License No. R-38 (Amendment No. 36) granted by the U.S. Nuclear Regulatory Commission (Docket No. 50-89) was not operated during the reporting period.

This report is being prepared and submitted to satisfy the requirements of Section 7.6(d) of the R-38 Technical Specifications, as amended. This report is presented in six parts, consistent with the information required by the applicable Technical Specifications.

## **2. SUMMARY OF FACILITY ACTIVITIES**

### **2.1 Decommissioning Activities**

During Calendar Year (CY) 2015, the TRIGA Mark I Reactor was in Decommissioning Status. There were no decommissioning activities performed during this period specifically in the Mark I Reactor.

### **2.2 Facility Status**

The Mkl reactor was in DECON status during CY 2015. There have been no changes since the last reporting period.

### **2.3 Decommissioning Schedule**

Decommissioning of the Mark I Reactor will continue upon completion of the characterization of the Mark F reactor liner, biological shield, and soil behind the shield and beneath the floor of the reactor pit. In this way, efforts between the two reactors can be coordinated to better utilize personnel, equipment, and material.

### **2.4 Radioactive Material Shipments**

During 2015 one (1) radioactive shipment or transfer was made from the Mkl facility.

On July 31, 2015, one DOT Type A Package, sealed sources, fifty-five (55) gallon drum was shipped from the GA site to Philotechnics with a final destination of Waste Control Specialists (WCS), Andrews, TX. The package contained 53.65 MBq (1.45mCi) of solid oxide Co-60. Note that this shipment contained three (3) sealed sources, only one of which was associated with the Mkl reactor.

## **3. MAINTENANCE OPERATIONS**

All maintenance activities performed during the reporting period generally fall into three categories: (i) routine preventive maintenance, (ii) routine calibration activities, and (iii) activities associated with replacement of older components and systems due to age. All maintenance activities are recorded in the TRIGA Reactor Facility Decommissioning Logbook. Facility Maintenance Checklists are completed on a regular schedule, at weekly, quarterly, and annual frequencies. All maintenance operations performed on the TRIGA Mark I Reactor Facility were minor in nature. There were no major maintenance operations performed during the reporting period.

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<sup>1</sup> ® TRIGA is a registered trademark of General Atomics

#### 4. 10CFR50.59 FACILITY MODIFICATIONS AND SPECIAL EXPERIMENTS

No applications for Facility Modification under the provisions of 10CFR50.59 were submitted for the R-38 facility during the CY2015 reporting period.

There were no Special Experiments submitted for the R-38 facility during CY2015.

#### 5. RADIOACTIVE EFFLUENTS RELEASED TO THE ENVIRONS

During CY2015, no liquid radionuclide effluent was released into the GA main site sanitary sewer system. Table 5.1 lists data on the radiological gaseous and particulate effluent released to unrestricted areas from the TRIGA facilities. TM1 indicates the MkI and TMF the MkF facility. MFP indicates Mixed Fission Products. All airborne releases were well within the allowable State of California and NRC (10CFR20) limits.

Table 5.1: Gas and Particulate Effluents

January 1, 2015 through June 30, 2015						
Release Point (ID)	Effluent	Flow Rate (ft/min)	Stack Area (ft <sup>2</sup> )	m <sup>3</sup> /min (3)	pCi/m <sup>3</sup>	Total Ci Released (2)
TRIGA Reactor Facility (building 21) (1)						
TM1	MFP	1100	1.46	45.45	0.007	8.33E-8
TMF	MFP	1367	1.5	58.02	0.009	1.37E-7
					TOTAL	2.20E-7
TMF	IODINES	1367	1.5	58.02	0.050(4)	7.60E-7
July 1, 2015 through December 31, 2015						
Release Point (ID)	Effluent	Flow Rate (ft/min)	Stack Area (ft <sup>2</sup> )	m <sup>3</sup> /min (3)	pCi/m <sup>3</sup>	Total Ci Released (2)
TRIGA Reactor Facility (building 21) (1)						
TM1	MFP	1033	1.46	42.68	0.005	5.59E-8
TMF	MFP	1344	1.5	57.05	0.005	7.47E-8
					TOTAL	1.31E-7
TMF	IODINES	1344	1.5	57.05	0.050(4)	7.47E-7

(1) Measured - Airborne effluents from selected facilities are monitored. The samples are collected weekly and analyzed using low-level alpha/beta counting systems. The average concentration (pCi/m<sup>3</sup>) over the six month period is obtained for each release point (alpha and beta concentrations are added).

(2) Ci Released = (182 operating days) (24 hr/day) (60 min/hr) (1e-6 uCi/pCi) (1e-6 Ci/uCi) (#m<sup>3</sup>/min) (average pCi/m<sup>3</sup>) Note: Operating days may be different based on dates the ventilation system is shut down.

(3) Flow Rate X Stack Area (Note: 0.0283 m<sup>3</sup> = 1 ft<sup>3</sup>).

(4) MDA for GA instrumentation.

#### 6. ENVIRONMENTAL SURVEYS

During CY2015, the Environmental Monitoring Program (EMP) for the TRIGA Reactors Facility remained essentially unchanged from the prior year. The applicable EMP includes the following monitoring equipment and actions:



- o Three (3) stack air samplers situated on the roof of the TRIGA Reactor Facility and three (3) environmental air samplers situated at or adjacent to the GA site perimeter in accordance with the GA Special Nuclear Material License (SNM-696).
- o Daily liquid effluent monitoring from the GA Main Sewerage Outfall Pump House, for gross alpha and beta radioactivity concentrations.
- o External radiation monitoring of the TRIGA Reactor Facility using sixteen (16) passive area dosimeters, as well as radiation meter surveys conducted periodically.
- o Since there were no planned decommissioning activities the use of the Continuous Air Monitor (CAM) was still discontinued. It will be placed in use any time in the future when there are aggressive decommissioning activities with a potential for generating airborne contamination.

## 7. SUMMARY OF RADIATION EXPOSURES AND RADIOLOGICAL SURVEYS

The following data summarizes measured personnel occupational radiation exposures and radiological surveys of the TRIGA Reactors Facility during CY 2015. Personnel who are listed on the TRIGA Reactors Facility Work Authorization (WA #600-14 and as of August 21, 2015 WA #600-15) and specific Radiological Work Permits (RWPs) were monitored for radiation exposure; these individuals included 16 General Atomics Staff and 24 Non-General Atomics Staff employees. The following exposures were primarily as a result of remediation of the Mk F pit and to a lesser degree Mk F shipment activities.

### 7.1 General Atomics Staff Whole Body Exposures <sup>2</sup>

Number of individuals monitored:	16
High Exposure:	0.005 REM
Low Exposure:	0.000 REM
Average Exposure:	<0.001 REM

### 7.2 Non-General Atomics Staff Whole Body Exposures <sup>3</sup>

Number of individuals monitored:	24
High Exposure:	0.010 REM
Low Exposure:	0.000 REM
Average Exposure:	0.002 REM

### 7.3 Routine Wipe Surveys of Mark I Reactor Facility

High Wipe:	49.6	dpm/100 cm <sup>2</sup>
Low Wipe:	< 1	dpm/100 cm <sup>2</sup>
Average Wipe:	4.3	dpm/100 cm <sup>2</sup>

<sup>2</sup> Includes reactor facility staff and facility support staff authorized to work at the TRIGA Reactor Facility. These personnel may also work routinely at other GA radiation facilities; therefore, this dose represents cumulative exposure at all GA facilities.

<sup>3</sup> Includes non-GA sub-contractor personnel who were granted periodic access to the TRIGA Reactor Facility for the performance of work. These personnel may also work routinely at other GA radiation facilities; therefore, this dose represents cumulative exposure at all GA facilities

**7.4 Routine Radiation Measurements of Mark I Reactor Facility**

High Measurement:	1.6	mR/hr
Low Measurement:	< 0.2	mR/hr
Average Level:	< 0.2	mR/hr



**TRIGA<sup>®</sup> Mark F Reactor**

**ANNUAL REPORT**

**CALENDAR YEAR 2015**

Prepared to satisfy the requirements of  
U.S. Nuclear Regulatory Commission  
Facility License R-67  
Docket No. 50-163

**MARCH 2016**



**GENERAL ATOMICS TRIGA REACTORS FACILITY  
TRIGA Mark F Reactor  
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## 1. INTRODUCTION

This report documents operation of the General Atomics (GA) TRIGA<sup>®1</sup> Mark F non-power reactor for the period January 1, 2015 through December 31, 2015. The TRIGA Mark F Reactor possessed by GA under License No. R-67 (Amendment No. 45) granted by the U.S. Nuclear Regulatory Commission (Docket No. 50-163), at its San Diego, California facilities, was not operated for the duration of the reporting period.

This report is being prepared and submitted to satisfy the requirements of Section 8.6(d) of the R-67 Technical Specifications, as amended. This report is presented in six parts, consistent with the information required by the applicable Technical Specifications.

## 2. SUMMARY OF FACILITY ACTIVITIES

### 2.1 Decommissioning Status

During Calendar Year (CY) 2015, the TRIGA Mark F Reactor was in a Decommissioning status. The major tasks accomplished during this reporting period were:

- Removal of hazardous material contaminants (Pb and Cd) from the walls and floor of the reactor pit and fuel storage canal. The contaminants were present in the surface layer of epoxy/gunite.
- Collection of twenty (20) core samples from within the reactor pit and fuel storage canal.

### 2.2 Facility Status

The MkF reactor was in DECON status during CY 2015. The reactor pit/canal was remediated of hazardous contaminants (Pb and Cd) and core samples extracted.

### 2.3 Decommissioning Schedule

Removal of the Epocast coating and about ¼ " of gunite from the walls and floor of the pit and fuel storage canal was conducted during April-May 2015. Following completion of this task, eight (8) core samples were collected from the MkF pit walls and floor during July-August 2015. Sample results showed measurable quantities of Co-60, Eu-152 and Eu-154. Statistical analyses indicated an additional twelve (12) core samples would allow full characterization of the volume of material requiring remediation. These additional samples were acquired in December 2015. The plan and schedule for completion of the decommissioning of the Mk F is dependent on the results of the characterization of the gunite, steel, concrete and soil contained within the core samples. Characterization of the depth and amount of contamination is expected to be complete in early 2016. This will determine the volume of material requiring removal and allow a statement of work to be written for structural analysis and excavation.

### 2.4 Radioactive Material Shipments

During 2015 two (2) separate radioactive shipments or transfers were made from the Mk F facility to different facilities.

On June 24, 2015, two excepted package-limited quantity wooden crates containing spent ion exchange resins were shipped from GA to Energy Solutions Bear Creek. Philotechnics acted as broker. The packages together contained 4.0 mCi solid oxide Co-60 and Cs-137. In addition, one low specific activity (LSA-II) fifty-five (55) gallon drum containing lead/steel was

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<sup>1</sup> ®TRIGA is a registered trademark of General Atomics

shipped to the same facility. The drum contained 25.0 mCi solid oxide Co-60.

On July 31, 2015 a shipment of mixed waste, dry active waste, HEPA filters and sealed sources was made to three separate processing facilities. The shipment was brokered by Philotechnics. Specifics of the shipment components are as follows:

One Low Specific Activity (LSA II) fifty-five (55) gallon drum containing mixed waste shipped to Perma-Fix of Florida. The drum contained 61.1 mCi solid oxide Cd-113m, Co-60, Cs-137 and Eu-152.

One Type A Package fifty-five (55) gallon drum containing sealed sources shipped to Waste Control Specialists, Andrews, TX. The package contained 1.45 mCi solid oxide Co-60. Note that one of the sources in this shipment was associated with the Mkl reactor.

One non-DOT regulated fiber box containing HEPA filters shipped to Energy Solutions Bear Creek. The package contained 0.07 mCi solid oxide Cd-113m, Co-60, Cs-137 and Eu-152.

Seven non-DOT regulated fifty-five (55) gallon drums containing dry active waste shipped to Energy Solutions Bear Creek. The drums together contained 1.38 mCi solid oxide Cd-113m, Co-60, Cs-137 and Eu-152.

One Low Specific Activity (LSA I) fifty-five (55) gallon drum containing dry active waste shipped to Energy Solutions, Bear Creek. The drum contained 16.87 mCi solid oxide Cd-113m, Co-60, Cs-137 and Eu-152.

### **3. MAINTENANCE OPERATIONS**

All maintenance activities, performed during the reporting period, generally fall into three categories: (i) routine preventive maintenance, (ii) routine calibration activities, and (iii) activities associated with replacement of older components and systems due to age. All maintenance activities are recorded in the TRF Decommissioning Logbook. Facility Maintenance Checklists are completed on a regular schedule at weekly, quarterly, and annual frequencies. All maintenance operations performed on the TRIGA Mark F Reactor Facility were minor in nature. There were no major maintenance operations performed during the reporting period.

### **4. 10CFR50.59 FACILITY MODIFICATIONS AND SPECIAL EXPERIMENTS**

No applications for Facility Modification under the provisions of 10CFR50.59 were submitted for the R-67 facility during the CY2015 reporting period.

There were no Special Experiments submitted for the R-67 facility during CY2015.

### **5. RADIOACTIVE EFFLUENTS RELEASE TO THE ENVIRONS**

During CY2015, no liquid radionuclide effluent was released into the GA main site sanitary sewer system. Table 5.1 lists data on the radiological gaseous and particulate effluent released to unrestricted areas from the TRIGA facilities. TM1 indicates the Mkl and TMF the MkF facility. MFP indicates Mixed Fission Products. All airborne releases were well within the allowable State of California and NRC (10CFR20) limits.



**Table 5.1: Gas and Particulate Effluents**

January 1, 2015 through June 30, 2015						
Release Point (ID)	Effluent	Flow Rate (ft/min)	Stack Area (ft <sup>2</sup> )	m <sup>3</sup> /min (B)	pCi/m <sup>3</sup>	Total Ci Released (A)
TRIGA Reactor Facility (building 21) (1)						
TM1	MFP	1100	1.46	45.45	0.007	8.33E-8
TMF	MFP	1367	1.5	58.02	0.009	1.37E-7
					TOTAL	2.20E-7
TMF	IODINES	1367	1.5	58.02	0.050(4)	7.60E-7
July 1, 2015 through December 31, 2015						
Release Point (ID)	Effluent	Flow Rate (ft/min)	Stack Area (ft <sup>2</sup> )	m <sup>3</sup> /min (B)	pCi/m <sup>3</sup>	Total Ci Released (A)
TRIGA Reactor Facility (building 21) (1)						
TM1	MFP	1033	1.46	42.68	0.005	5.59E-8
TMF	MFP	1344	1.5	57.05	0.005	7.47E-8
					TOTAL	1.31E-7
TMF	IODINES	1344	1.5	57.05	0.050(4)	7.47E-7
<p>(1) Measured - Airborne effluents from selected facilities are monitored. The samples are collected weekly and analyzed using low-level alpha/beta counting systems. The average concentration (pCi/m<sup>3</sup>) over the six month period is obtained for each release point (alpha and beta concentrations are added).</p> <p>(2) Ci Released = (182 operating days) (24 hr/day) (60 min/hr) (1e-6 uCi/pCi) (1e-6 Ci/uCi) (#m<sup>3</sup>/min) (average pCi/m<sup>3</sup>) Note: Operating days may be different based on dates the ventilation system is shut down.</p> <p>(3) Flow Rate X Stack Area (Note: 0.0283 m<sup>3</sup> = 1 ft<sup>3</sup>).</p> <p>(4) MDA for GA instrumentation.</p>						

**6. ENVIRONMENTAL SURVEYS**

During CY2015, the Environmental Monitoring Program (EMP) for the TRF remained essentially unchanged from the prior year. The applicable EMP includes the following monitoring equipment and actions:

- o Three (3) stack air samplers situated on the roof of the TRIGA Reactor Facility and three (3) environmental air samplers situated at or adjacent to the GA site perimeter in accordance with the GA Special Nuclear Material License (SNM-696).
- o Daily liquid effluent monitoring from the GA Main Sewerage Outfall Pump House, for gross alpha and beta radioactivity concentrations.
- o External radiation monitoring of the TRIGA Reactor Facility using sixteen (16) passive area dosimeters, as well as radiation meter surveys conducted periodically.
- o A Continuous Air Monitor (CAM), situated in the Mark F Reactor Room (21/107), continuously samples room air for airborne radioactivity. CAM air filters are collected each week and analyzed for radioactivity.

**7. SUMMARY OF RADIATION EXPOSURES AND RADIOLOGICAL SURVEYS**

The following data summarizes measured personnel occupational radiation exposures and radiological surveys of the TRIGA Reactors Facility during CY 2015. Personnel who are listed on the TRIGA Reactors Facility Work Authorization (WA #600-14 and as of August 21, 2015 WA #600-15) and specific Radiological Work Permits (RWPs) were monitored for radiation

exposure; these individuals included 16 General Atomics Staff and 24 Non-General Atomics Staff employees. The following exposures were primarily as a result of the remediation of the Mk F pit and, to a lesser extent, Mk F radioactive shipment activities.

#### 7.1 General Atomics Staff Whole Body Exposures <sup>2</sup>

Number of individuals monitored:	16
High Exposure:	0.005 REM
Low Exposure:	0.000 REM
Average Exposure:	<0.001 REM

#### 7.2 Non-General Atomics Staff Whole Body Exposures <sup>3</sup>

Number of individuals monitored:	24
High Exposure:	0.010 REM
Low Exposure:	0.000 REM
Average Exposure:	0.002 REM

#### 7.3 Routine Wipe Surveys Of Mark F Reactor Facility

High Wipe:	79.2	dpm/100 cm <sup>2</sup>
Low Wipe:	< 1.0	dpm/100 cm <sup>2</sup>
Average Wipe:	9.3	dpm/100 cm <sup>2</sup>

#### 7.4 Routine Radiation Measurements Of Mark F Reactor Facility

High Measurement:	<0.2	mR/hr
Low Measurement:	< 0.2	mR/hr
Average Level:	< 0.2	mR/hr

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<sup>2</sup> Includes reactor facility staff and facility support staff authorized to work at the TRIGA Reactor Facility. These personnel may also work routinely at other GA radiation facilities; therefore, this dose represents cumulative exposure at all GA facilities.

<sup>3</sup> Includes non-GA personnel who were granted periodic access to the facility for the performance of work. These personnel may also work routinely at other GA radiation facilities; therefore, this dose represents cumulative exposure at all GA facilities.