

# UNIVERSITY of MISSOURI

## RESEARCH REACTOR CENTER

February 5, 2018

Attention: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

REFERENCE: Docket 50-186  
University of Missouri-Columbia Research Reactor  
Renewed Facility Operating License No. R-103

SUBJECT: Written communication as specified by 10 CFR 50.4(b)(1) regarding revisions to the  
"License Amendment Request to Implement Selective Gas Extraction Target  
Experimental Facility at the University of Missouri Research Reactor," submitted to the  
U.S. Nuclear Regulatory Commission, by letter dated May 3, 2017

By letter dated May 3, 2017, the University of Missouri Research Reactor (MURR) submitted a license amendment request (LAR) to the U.S. Nuclear Regulatory Commission (NRC) in order to conduct an experiment that would produce molybdenum-99 (Mo-99) in large quantities as part of its role in supplying critical medical radioisotopes to the domestic and international community. The experiment would utilize General Atomics' (GA) Selective Gas Extraction (SGE) process, which consists of irradiating target rods containing low-enriched uranium (LEU) pellets in the reactor graphite reflector region in order to produce fission product Mo-99. The Mo-99 would then be extracted from the LEU in dedicated hot cells using the SGE technology. Included with the LAR submittal were eight (8) attachments, six (6) of which contained proprietary information which was withheld from public disclosure pursuant to 10 CFR § 2.390.

By letter dated June 19, 2017, MURR submitted two (2) additional attachments (Attachment 9 – GA Design Report No. 30441R00038, "Computational Fluid Dynamics Analysis of Target Housing Design Calculation Report," and Attachment 10 – GA Design Report No. 30441R00041, "Critical Heat Flux Testing at the University of Wisconsin Final Report") to supplement the May 3, 2017 submittal to further assist the NRC in review of the LAR. One (1) version of each attachment contained proprietary information which was withheld from public disclosure pursuant to 10 CFR § 2.390.

By letter dated September 7, 2017, the NRC requested additional information and clarification regarding the proposed LAR in the form of thirty-eight (38) questions (numbered 1 through 38).

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NRR



By letter dated October 17, 2017, MURR submitted one (1) additional attachment (Attachment 11 – GA Design Report No. 30441R00045, “Target Cooling System Flow Test Report”) to supplement the May 3, 2017 submittal to further assist the NRC in review of the LAR. One (1) version of the attachment contained proprietary information which was withheld from public disclosure pursuant to 10 CFR § 2.390.

By letter dated November 1, 2017, the NRC requested additional information and clarification regarding the proposed LAR in the form of eighteen (18) questions (numbered 39 through 57).

By letter dated December 6, 2017, MURR responded to the September 7, 2017, request for additional information (Questions 1 through 38).

By letter dated January 16, 2018, MURR responded to the November 1, 2017, request for additional information (Questions 39 through 57).

Enclosed are two (2) versions of five (5) attachments (b through k), which have been revised based on the following changes:

1. Target Rod/Pellet fabrication tolerance changes:
  - a) Target Pellet Outside Diameter (OD)
  - b) Target Rod Cladding Inside Diameter (ID)
  - c) Target Rod Cladding surface finish
  - d) Target Pellet length
  - e) Target Pellet surface roughness
2. Composition of gas inside the Target Rod changed from 100% He to 95% He-5% Air.
3. Figure update in Attachment 1 (Figure 7) and 8 (Figure 7) to remove the Target Cartridge locating pins from the Target Housing.
4. Figure update in Attachment 8 (Figure 14) showing the modification to the Target Cartridge locking mechanism.

The Target Rod/Pellet fabrication tolerance changes were required because the original fabrication tolerances were too strict on a mass production scale. The composition of helium gas is explained in detail in the response to RAI No. 34.1, submitted to the NRC by letter dated December 6, 2017. The design modification to the Target Housing was made as a result of the mechanical tool testing, and not a result of the flow testing. The modification does not affect the cross-sectional flow within the Target Cartridge. The removed pins were originally meant to guide the Target Cartridge into its final position in the Target Housing; however, they are no longer required because finding the labyrinthine feature was not very difficult during testing. This modification is described in detail in Section 2.1.4 of Attachment 1 and Section 3.2.3.1 of Attachment 8. The Target Cartridge locking mechanism is explained in detail in the response to RAI No. 43, submitted to the NRC by letter dated January 16, 2018.

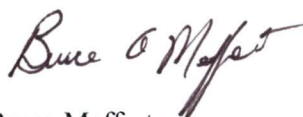


A revision bar with the new text in the color blue annotates revisions to these documents.

One (1) version of each attachment contains proprietary information, and we request that you withhold it from public disclosure per 10 CFR § 2.390. These documents are clearly labeled "Withhold from Public Disclosure Under 10 CFR 2.390." The other attachments are redacted versions that can be disclosed to the public. Also attached is the affidavit (executed by Christina A. Back), dated January 26, 2018, which explains the reasoning for the request.

If there are questions regarding these responses, please contact me at (573) 882-5118. I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

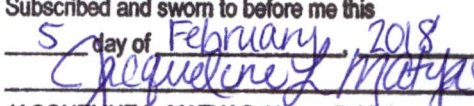


Bruce Meffert  
Reactor Manager

ENDORSEMENT:  
Reviewed and Approved



Matthew R. Sanford  
Interim Director

State of Missouri  
County of Boone  
Subscribed and sworn to before me this 5 day of February, 2018  
  
JACQUELINE L. MATYAS, Notary Public  
My Commission Expires: March 26, 2019



JACQUELINE L. MATYAS  
My Commission Expires  
March 26, 2019  
Howard County  
Commission #15634308

xc: Reactor Advisory Committee  
Reactor Safety Subcommittee  
Isotope Use Subcommittee

Dr. Mark McIntosh, Vice Chancellor for Research, Graduate Studies and Economic Development  
Mr. Alexander Adams Jr., U.S. Nuclear Regulatory Commission  
Mr. Geoffrey A. Wertz, U.S. Nuclear Regulatory Commission  
Mr. Johnny Eads, U.S. Nuclear Regulatory Commission

Enclosures:

- a. General Atomics Affidavit of Christina A. Back, dated January 26, 2018
- b. Attachment 1 – License Amendment Request to Implement Selective Gas Extraction (SGE) Target Experimental Facility (TEF) at the University of Missouri Research Reactor – Redacted Version
- c. Attachment 1 – License Amendment Request to Implement Selective Gas Extraction (SGE) Target Experimental Facility (TEF) at the University of Missouri Research Reactor – Un-redacted Version
- d. Attachment 4 – GA Design Report No. 30441R00021, "Target Assembly Thermal Analysis" – Redacted Version
- e. Attachment 4 – GA Design Report No. 30441R00021, "Target Assembly Thermal Analysis" – Un-redacted Version
- f. Attachment 6 – GA Design Report No. 30441R00031, "Mo-99 Target Assembly Nuclear Design for Once-Through Operation" – Redacted Version

- g. Attachment 6 – GA Design Report No. 30441R00031, “Mo-99 Target Assembly Nuclear Design for Once-Through Operation” – Un-redacted Version
- h. Attachment 7 – GA Design Report No. 30441R00032, “RELAP Accident Analysis and FRAPTRAN Target Rod Transient Analysis Design Calculation Report” – Redacted Version
- i. Attachment 7 – GA Design Report No. 30441R00032, “RELAP Accident Analysis and FRAPTRAN Target Rod Transient Analysis Design Calculation Report” – Un-redacted Version
- j. Attachment 8 – GA Design Report No. 30441R00017, “ANSYS Target Cartridge, Housing Structural Analysis Design Calculation Report” – Redacted Version
- k. Attachment 8 – GA Design Report No. 30441R00017, “ANSYS Target Cartridge, Housing Structural Analysis Design Calculation Report” – Un-redacted Version



**GENERAL ATOMICS**  
**AFFIDAVIT OF CHRISTINA A. BACK**

I, Christina A. Back, Vice President of Nuclear Technologies and Materials, General Atomics, do hereby affirm and state:

- (1) I have been delegated the function of reviewing information described in paragraph 3 which General Atomics requests be withheld from public disclosure or publication and I am authorized to execute this affidavit on behalf of General Atomics.
- (2) The affidavit is submitted under the provisions of 10CFR Part 2.390 to withhold documents containing confidential commercial and proprietary information (as set forth in paragraph 3 following) of General Atomics from public disclosure or publication.
- (3) General Atomics (GA) has partnered with The University of Missouri Research Reactor (MURR) and Nordion to develop the Reactor-Based Mo-99 Supply System (RB-MSS) Project using its Selective Gas Extraction process. The information sought to be withheld is related to the analysis, design, development and licensing of General Atomics' technology for deployment at MURR.

This information is contained in the following revised documents submitted as supporting information for MURR's *"License Amendment Request to Implement Selective Gas Extraction Target Experimental Facility at the University of Missouri Research Reactor."*

<b>License Amendment Request Attachment No.</b>	<b>TITLE</b>
1	License Amendment Request to Implement Selective Gas Extraction (SGE) Target Experimental Facility (TEF) at the University of Missouri Research Reactor
4	GA Report 30441R00021: "Target Assembly Thermal Analysis"
6	GA Report 30441R00031: "Mo-99 Target Assembly Nuclear Design for Once-Through Operation"
7	GA Report 30441R00032: "RELAP Accident Analysis and FRAPTRAN Target Rod Transient Analysis Design Calculation Report"
8	GA Report 30441R00017: "ANSYS Target Cartridge, Housing Structural Analysis Design Calculation Report"

Nonproprietary redacted versions of these documents are being simultaneously provided where the proprietary information on each page has been appropriately redacted.

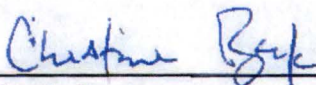


- (4) In making this application for withholding of proprietary information of which it is the owner, General Atomics relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4), a2.390(a)(4), and 10CFR2.390(b) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential." The material for which exemption from disclosure is hereby sought is all "confidential commercial information," and/or also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (5) Pursuant to Paragraph (4) above, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
- a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Atomics' competitors without license from General Atomics constitutes a competitive economic advantage over other companies;
  - b. Information which, if used by a competitor, would reduce his or her expenditure of resources or improve his or her competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
  - c. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.
  - d. The information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence by General Atomics, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by General Atomics. No public disclosure has been made, and it is not available in public sources.
  - e. The information classified as proprietary was developed and compiled by General Atomics at a significant cost to General Atomics. This information is classified as proprietary because it contains detailed data and analytical results not available elsewhere. This information would provide other parties, including competitors, with information from General Atomics technical database and the results of evaluations performed by General Atomics. Release of this information would improve a competitor's position without the competitor having to expend similar resources for the development of the database. A significant effort has been expended by General Atomics to develop this information.
  - f. The research, development, engineering, and analytical costs associated with General Atomics' unique selective gas extraction system and process comprise a substantial investment of time and resources by General Atomics, whose precise



value is difficult to quantify, but clearly is substantial and extends beyond the original development cost. Public disclosure of the information sought to be withheld is likely to cause substantial harm to General Atomics' competitive position.

**GENERAL ATOMICS**



Christina A. Back

Vice President, Nuclear Technologies and Materials

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California  
County of San Diego

On January 26, 2018 before me, Brenda B. Dawson, Notary Public, personally appeared Christina A. Back, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.



(Signature of Notary)

