USGS TRIGA Reactor
Proposed License Amendment #15

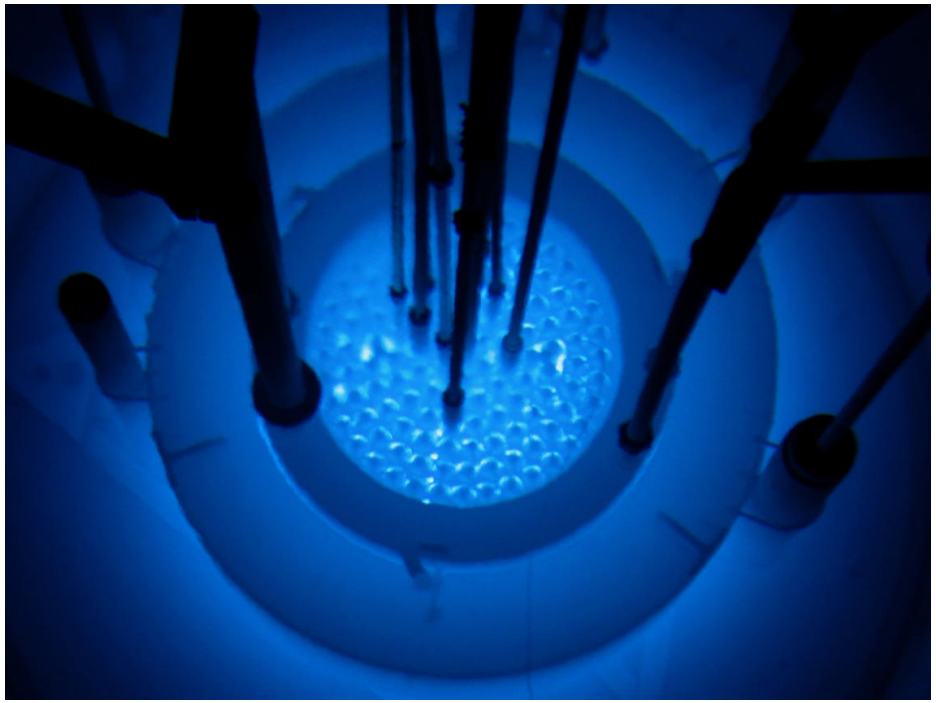
In Support of Experiments Using Special Nuclear Materials and Licensed Area Changes

Presented by Jonathan Wallick, Reactor Director

on 2021-03-30

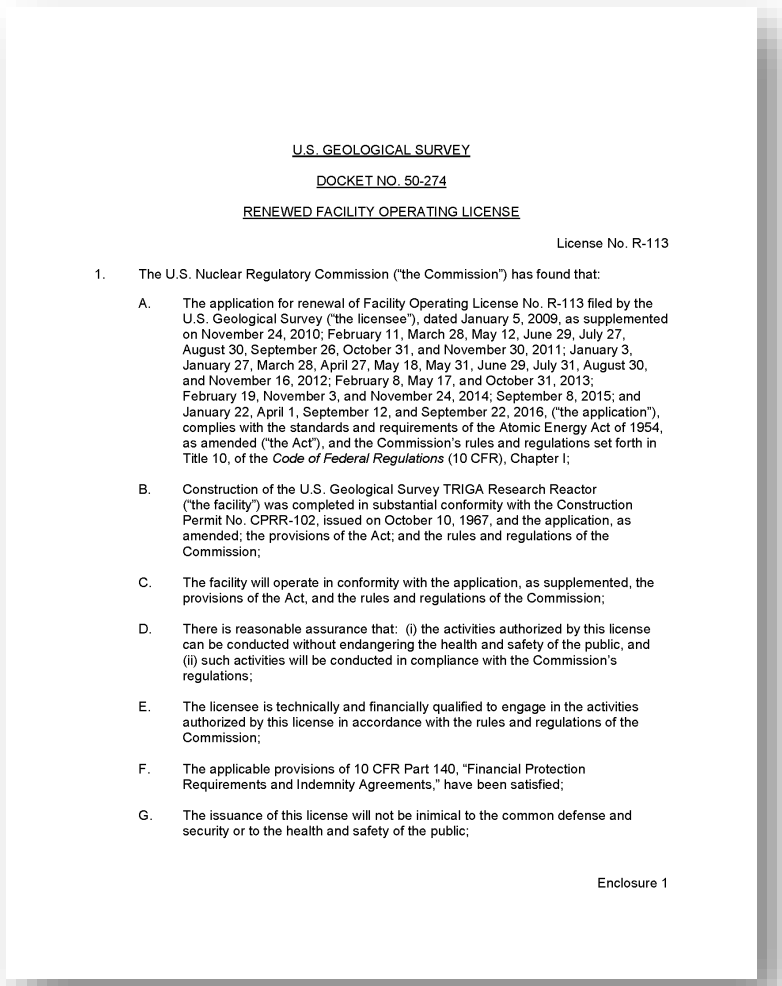
License Amendment Request Overview

- Experiments proposed at the reactor facility using the reactor for irradiation of materials need increased limits and the ability to separate materials.
- Space in the same building as the reactor is being acquired for use as a Neutron Activation Analysis laboratory and other uses.



GSTR Reactor Core

Permitted Experiment Changes



U.S. GEOLOGICAL SURVEY

DOCKET NO. 50-274

RENEWED FACILITY OPERATING LICENSE

License No. R-113

1. The U.S. Nuclear Regulatory Commission ("the Commission") has found that:

A. The application for renewal of Facility Operating License No. R-113 filed by the U.S. Geological Survey ("the licensee"), dated January 5, 2009, as supplemented on November 24, 2010; February 11, March 28, May 12, June 29, July 27, August 30, September 26, October 31, and November 30, 2011; January 3, January 27, March 28, April 27, May 18, May 31, June 29, July 31, August 30, and November 16, 2012; February 8, May 17, and October 31, 2013; February 19, November 3, and November 24, 2014; September 8, 2015; and January 22, April 1, September 12, and September 22, 2016, ("the application"), complies with the standards and requirements of the Atomic Energy Act of 1954, as amended ("the Act"), and the Commission's rules and regulations set forth in Title 10, of the *Code of Federal Regulations* (10 CFR), Chapter I;

B. Construction of the U.S. Geological Survey TRIGA Research Reactor ("the facility") was completed in substantial conformity with the Construction Permit No. CPRR-102, issued on October 10, 1967, and the application, as amended; the provisions of the Act; and the rules and regulations of the Commission;

C. The facility will operate in conformity with the application, as supplemented, the provisions of the Act, and the rules and regulations of the Commission;

D. There is reasonable assurance that: (i) the activities authorized by this license can be conducted without endangering the health and safety of the public, and (ii) such activities will be conducted in compliance with the Commission's regulations;

E. The licensee is technically and financially qualified to engage in the activities authorized by this license in accordance with the rules and regulations of the Commission;

F. The applicable provisions of 10 CFR Part 140, "Financial Protection Requirements and Indemnity Agreements," have been satisfied;

G. The issuance of this license will not be inimical to the common defense and security or to the health and safety of the public;

Enclosure 1

- Requesting changes to license conditions:
  - 01 - 2.B.2.c – Increase from 2 g total to 5 g total. Allow separations of experiments using up to 1 g of SNM.
  - 02 - 2.B.3.d – Increase from 5 Curies total to 15 Curies total of byproduct material.
  - 03 - 2.B.3.f – Remove "non-fueled" from the condition.

Condition Change 01 – SNM

- 2.B.2.c – Increase from 2 g total to 5 g total. Allow separations of experiments using up to 1 g of SNM.
  - Total increase to allow for more experiments to be run simultaneously.
  - Experiments in nuclear fuel reprocessing and medical isotope production techniques require separation of materials post-irradiation.
  - Separations allow reuse of the material, reduce waste and cost to a major degree.
  - Minor amounts of material are to be used, less than 1 gram per experiment is already the administrative restriction at the facility.
  - Typical amounts will be in the microgram to milligram range, current intent is to never approach the 1-gram limit.

Condition Change 01 – SNM

- Production versus Utilization Facility determination:
  - Definition and conditions found in 10 CFR 50.2, three clauses: A production facility means:
    - Any nuclear reactor designed or used primarily for the formation of plutonium or uranium-233; or
      - This facility is not designed or used primarily as such, meeting exception to this condition.
    - Any facility designed or used for the separation of the isotopes of plutonium, except:
      - Laboratory scale facilities designed or used for experimental or analytical purposes only; or
        - » This facility meets the condition for exception, as a laboratory scale facility designed or used for experimental or analytical purposes only, therefore, allowing separation of plutonium isotopes.

Condition Change 01 – SNM

- Any facility designed or used for the processing of irradiated materials containing special nuclear material, except:
  - laboratory scale facilities designed or used for experimental or analytical purposes,
    - » This facility meets the condition for exception, as a laboratory scale facility designed or used for experimental or analytical purposes only, therefore, allowing processing of irradiated materials containing SNM

- The third condition allows for three different types of facilities to be excepted from the definition of a production facility.
  - Review of the history of the 10 CFR 50.2 definitions for production facilities and utilization facilities demonstrates the intention of the regulation. *No records of 10 CFR 50.2 from 1956 until 1994 are electronically available showing otherwise.*

Condition Change 01 – SNM

- The second and third exceptions are:

Material Breeding exception for non-labs

  - facilities in which the only special nuclear materials contained in the irradiated material to be processed are uranium enriched in the isotope U-235 and plutonium produced by the irradiation, if the material processed contains not more than 10^{-6} grams of plutonium per gram of U-235 and has fission product activity not in excess of 0.25 millicuries of fission products per gram of U-235, and

Medical Isotope exception for non-labs

  - facilities in which processing is conducted pursuant to a license issued under parts 30 and 70 of this chapter, or equivalent regulations of an Agreement State, for the receipt, possession, use, and transfer of irradiated special nuclear material, which authorizes the processing of the irradiated material on a batch basis for the separation of selected fission products and limits the process batch to not more than 100 grams of uranium enriched in the isotope 235 and not more than 15 grams of any other special nuclear material.

Condition Changes 02 and 03 - Byproduct Material

- 2.B.3.d – Increase from 5 Curies total to 15 Curies total of byproduct material.
  - Total increase to allow for more experiments to be run simultaneously.
  - Allows additional sealed sources for experiments to be on hand at facility.
- 2.B.3.f – Remove “non-fueled” from the condition.
  - Allows for all reactor-based experiments to be separated, instead of just non-fueled.
  - Same rationale as before for SNM separations, experiments in nuclear fuel reprocessing and medical isotope production techniques require separation of materials post-irradiation.

Condition Changes Overall

- Reactor Staff and Experiment Collaborators have experience in separations of non-fueled experiments.
- Experiment Collaborators have extensive experience with fueled experiment separations, actinide and lanthanide separations.
  - Colorado School of Mines is primary collaborator for separation experiments:
    - Currently licensed through Colorado for such experiments on the CSM campus.
    - Permitted by USGS Broad Scope license to perform such experiments on the Denver Federal Center.
    - CSM representation may speak further on qualifications.

Licensed Area Changes

- Add Laboratory and Storage Spaces in Reactor Building
  - Approximately 3152 sq. ft. total (~82% increase).
  - Laboratory that was a Neutron Activation Analysis laboratory using our reactor.
  - The others are a mix of lab and storage spaces currently in use by our collaborator or available.
  - Updates to Indemnity agreement, E. Plan, PSP, ROM, etc. will be done.

Denver Federal Center - Overview

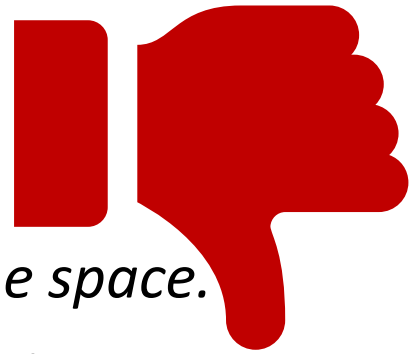
Benefits

- Additional experiment type flexibility and capability.
  - *Need for separations is for cleanup and recycling/reuse of material in continued experiments.*
  - *Separations enables new research, which is critical to nuclear technology development, a nationwide critical mission.*
  - *Reduces waste and cost since experiments are otherwise one-shots, wasteful, and expensive.*
  - *Increases accountability, reduces ambiguities, and clarifies authority by moving all reactor-related activities under one license.*
  - *Reduces the number of transfers and administrative paperwork associated with experiments.*
  - *Increases ability to conduct short lived experiments by eliminating transfers and required time to transfer.*
  - *Shortens the chain of custody and improves safety/security.*

Benefits

- Additional areas for experiment performance and storage of reactor-related materials.
  - *Increased activities mean expanding space to safely perform those activities and store materials.*
- Expands support for USGS and external scientific experiments through NAA lab expansion.
  - *Capability was lost across the survey, as the only group performing NAA was lost, as well as problems and losses at other elemental analysis labs.*
  - *Current reactor staff have experience performing NAA on many different geological and energy related samples.*

Drawbacks



- Additional costs in facility rental agreements.
  - *No actual cost increases as another USGS group already rents the space.*
- Need for more personnel to support NAA service but is being pursued in either case.
  - *One person was running the NAA service for USGS, retired in late 2018. Budget still exists for that position, so no extra cost. Reactor seeks to restore NAA capability to the USGS and external users.*
- Handling of radioactive materials of SNM category.
  - *Vastly higher activity and dose rate samples are routinely handled at facility. Already licensed to handle these amounts of SNM. Bringing several qualified collaborators with decades of experience onboard.*

Stakeholder Positions

U.S.G.S

- Very positive: Support of reactor facility heightened with decision to continue operating reactor and expanding capability is critical.
- Also reduces taxpayer costs in re-establishing NAA work inside survey instead of contracting.

Collaborator – Colorado School of Mines

- Positive: Expansion of work capabilities, streamlining research process, reduces waste and cost of experiments.
- Improve partnership with USGS to establish nuclear science research center.

Nuclear Regulatory Commission + Public

- Independent and to be determined

Contact Information

If you have any questions after the presentation or the public meeting (non-security related, of course):

- Jonathan Wallick
  - Reactor Director at USGS TRIGA Reactor Facility
  - jwallick@usgs.gov
  - (303)236-1463

Questions