UNIVERSITY *of* MISSOURI

RESEARCH REACTOR CENTER

September 11, 2015

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

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

SUBJECT: Proposed Licensing Approach for an Experimental Facility at the University of Missouri-Columbia Research Reactor to Produce Molybdenum-99

Dear Sir or Madam:

The University of Missouri-Columbia Research Reactor (MURR) is in the design and safety review stages of an experiment that will produce molybdenum-99 (Mo-99) using the Selective Gas Extraction (SGE) method. The Mo-99 will be extracted from the experiment without target removal (in situ) and without using the typical, industry standard of chemical dissolution of low-enriched uranium (LEU) targets. The unique SGE method will be designed to extract the desired fission products that are defined as byproduct materials directly from the target assemblies, that is, no Special Nuclear Material (SNM) or transuranics will be separated or extracted.

Representatives from MURR and U.S. Nuclear Regulatory Commission (NRC) Staff met on April 27, 2015, to discuss MURR's approach to licensing the SGE experimental facility. During that meeting, representatives of MURR's research and development partners also presented a detailed technical overview of the project during a closed, proprietary session. At the end of the meeting the NRC suggested that MURR submit a written document outlining how MURR proposes to license the SGE experimental facility and the bases for that approach. This letter provides MURR's summary of the proposed SGE licensing approach and the bases for requesting NRC approval of this experiment pursuant to 10 C.F.R. § 50.90 by amending

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MURR's existing Facility Operating License No. R-103. The letter also outlines why MURR believes that the SGE activities at MURR will (1) be classified as an "experiment," (2) not require MURR to be categorized as a "testing facility," (3) not cause MURR to be categorized as a "production facility," and (4) not require a Construction Permit per 10 C.F.R. § 50.90. The bases for approval of the SGE experimental facility will also explain (5) why the NRC should not consider the power generated by the SGE experimental facility in the determination of reactor core power level, which is limited to 10 MWt.

In a related matter, on August 31, 2006, MURR submitted a request to the NRC to renew Amended Facility Operating License No. R-103. That request is currently under review but it is anticipated that MURR should be relicensed within the next six (6) to eight (8) months. Therefore, the request to amend the facility operating license in order to implement the SGE experimental facility will be submitted in consideration of the licensing documentation that has been submitted as part of renewing license No. R-103.

This letter does not constitute MURR's licensing request but is intended to permit the NRC to identify areas of regulatory concern, if any, for MURR to address in its subsequent formal request.

We would appreciate any feedback at your earliest convenience as we plan on submitting our license amendment request in November of this year, 2015.

Respectfully submitted,

Ralph A. Butler, P.E.
Director

xc: Reactor Advisory Committee
Reactor Safety Subcommittee
Dr. Garnett S. Stokes, Provost
Dr. Henry C. Foley, Senior Vice Chancellor for Research
Mr. Alexander Adams, U.S. Nuclear Regulatory Commission
Mr. Geoffrey Wertz, U.S. Nuclear Regulatory Commission
Mr. Johnny Eads, U.S. Nuclear Regulatory Commission

Attachments:

1. Summary of Key MURR Positions on the Addition of the SGE Experiment to the MURR Facility
2. Overview of MURR Reactor Core and Reflector Regions

ATTACHMENT 1

Summary of Key MURR Positions

on the Addition of the SGE Experiment to the MURR Facility

I. Background

The University of Missouri-Columbia Research Reactor (MURR) holds Amended Facility Operating License No. R-103, issued on October 11, 1966, pursuant to 10 C.F.R. Part 50, authorizing the University of Missouri (MU) to operate the facility as a research reactor, initially up to a maximum steady-state power level of 5 MWt. On July 9, 1974, Amendment No. 2 was issued by the NRC authorizing the University to operate the research reactor at steady-state power levels up to 10 MWt.

MURR is a multi-disciplinary research reactor and education facility providing a broad range of analytical, radiographic and irradiation services to the research community and the commercial sector. MURR staff and colleagues perform research for improving medical diagnostic tools and finding ways to battle cancer and other diseases with radioisotopes. MURR is a leader in radiopharmaceutical research that is used for detecting and treating cancer and other chronic human diseases. Additionally, MURR is currently assisting MU's International Institute for Nano and Molecular Medicine in completing the pre-clinical development of new boron compounds to enhance Boron Neutron Capture Therapy (BNCT) for treating cancer.

MURR's focus on interdisciplinary research and development also contributes to the University's educational mission, providing rich research and training opportunities for an international population of graduate and undergraduate students. MURR-based projects cover such disciplines as anthropology and archaeology, chemistry, engineering (chemical, electrical, mechanical and nuclear), geology, materials science, medical and life sciences (including cancer diagnostics, treatment and prevention), nutrition, physics and veterinary medicine. In addition to MU students, over a five-year period MURR typically accommodates an average of over 300 faculty/research scientists and approximately 150 graduate students from the MU System (*including the Columbia, Rolla, St. Louis and Kansas City campuses*) and over 100 students from other universities who performed research involving the facility.

As an integral component of MU's campus-wide interdisciplinary research and education initiatives, MURR scientists provide lectures and demonstrations for approximately 30 MU classes each year that illustrate scientific and engineering concepts. MURR scientists and engineers conduct facility tours for over 1,000 persons each year from state, national, and international groups, professional and student chapters of organizations (*e.g., the Institute of Nuclear Materials Management*), secondary science and math classes, government and industry. MURR scientists also participate in more extensive laboratory experiences to support classes at MU and other schools for students in Chemistry/Radiochemistry, Physics and Engineering.

MURR proposes adding an additional experimental facility, the General Atomics' (GA) SGE experiment, with which target assemblies containing low-enriched uranium (LEU) will be irradiated to produce fission product Mo-99. This experiment will expand MURR's research and developmental curriculum and supply an essential isotope to the medical community.

II. Classification of the SGE Target Assemblies as an Experiment

The term "experiment" is defined in Appendix A of Regulatory Guide 2.2, "Development of Technical Specifications for Experiments in Research Reactors," and in ANSI/ANS-15.1-2007, "The Development of Technical Specifications for Research Reactors." The definitions in these documents are as follows:

In Regulatory Guide 2.2:

> *An experiment, as used herein, is any of the following:*
>
> *a. An activity utilizing the reactor system or its components or the neutrons or radiation generated therein;*
>
> *b. An evaluation or test of a reactor system operational, surveillance, or maintenance technique;*
>
> *c. An experimental or testing activity which is conducted within the confinement or containment system of the reactor; or*
>
> *d. The material content of any of the foregoing, including structural components, encapsulation or confining boundaries, and contained fluids or solids.*

In ANSI/ANI-15.1-2007:

> *Experiment: Any operation, hardware, or target that is designed to investigate non-routine reactor characteristics or that is intended for irradiation within the pool, on or in a beam port or irradiation facility. Hardware rigidly secured to a core or shield structure so as to be a part of its design to carry our experiments is not normally considered an experiment.*

The SGE experiment target assemblies will be located within two graphite reflector locations (Positions 5A and 5B as shown on the drawing provided as Attachment 2). The target assemblies will be subcritical assemblies that cannot maintain a self-supporting chain reaction and are being designed to ASME Codes for Pressure Vessels and Process Piping. In regard to the Regulatory Guide 2.2 definition (parts a, c and d), the SGE experimental facility will utilize the MURR reactor and its generated neutrons to irradiate the SGE target assemblies located in the reflector region. Also as described in ANSI/ANI-15.1-2007, the SGE experimental facility will utilize target assemblies to be irradiated in the reflector region. As such, the use of the target assemblies is consistent with the definition of an experiment in both of the cited documents.

Characterization of the SGE activities as an "experiment" is also consistent with other experimental activities at MURR. Similarly, the NRC considered the Massachusetts Institute of

Technology's (MIT) Research Reactor (MITR) Fission Converter to be categorized as an "experiment" that required a standalone cooling system. (*See* discussion later in Section V of this document).

III. Testing Facility Classification Evaluation and Assessment

MURR is a research reactor. It is MURR's position that implementation of the SGE experiment in the graphite reflector region will not require MURR to be re-categorized as a "testing facility."

The term "testing facility" is defined in 10 C.F.R. § 50.2, Definitions, as follows:

> *Testing facility* means a nuclear reactor which is of a type described in § 50.21(c) of this part and for which an application has been filed for a license authorizing operation at:
>
> (1) A thermal power level in excess of 10 megawatts; or
>
> (2) A thermal power level in excess of 1 megawatt, if the reactor is to contain:
>
> (i) A circulating loop through the core in which the applicant proposes to conduct fuel experiments; or
>
> (ii) A liquid fuel loading; or
>
> (iii) An experimental facility in the core in excess of 16 square inches in cross-section.

MURR's proposed experimental facility does not fall under any of the criteria of the 10 C.F.R. § 50.2 definition of "testing facility." With respect to Criterion (1), MURR will not exceed the current licensed reactor power level limit of 10 MW_t with implementation of the SGE experiment. Nor will the SGE experiment contain a liquid fuel loading as stated in Criterion (2)(ii).

Similarly, the SGE experimental facility is not encompassed by Criterion (2)(i) or (2)(iii) based on the proposed location of the experiment in the graphite reflector region and the MURR Technical Specification definition of "Reactor Core."

Specifically, MURR's position that the SGE experimental facility is not a "testing facility" is based on current MURR Technical Specification Definition 1.16, "Reactor Core," that states: "*The reactor core shall be considered to be the volume inside the reactor pressure vessel occupied by eight or less reactor fuel elements.*" (Note: In the relicensing application submittal in August 2006, the definition is now numbered 1.19 but the wording remains unchanged.) In other words, the MURR graphite reflector region, although a vital part of the reactor, is not a part of the reactor core, as defined in Technical Specifications.

The design of MURR allows great flexibility for ex-core experiments because the reactor fuel is protected from potential ex-core experiment failures by virtue of being inside the reactor pressure vessels. The SGE experimental facility will continue MURR's efforts to expand the set of experiments it performs to enhance its support of the supply of nationally critical

radiopharmaceuticals, in this case Mo-99. As with MURR's existing experiments, the SGE experiment can be conducted safely without compromising the reactor control system or effecting reactor fuel integrity.

IV. Production Facility Classification Evaluation and Assessment

It is MURR's position that the SGE method of harvesting Mo-99 is an experiment, and the associated activities necessary for the experiment do not require the MURR facility operating license to be changed from a "utilization facility" to a "production facility."

MURR SGE Process:

MURR's SGE experiment will create and extract Mo-99 and other radioisotopes from fission products using methods and equipment that overcome the drawbacks of previously-known systems, especially the significant generation of radioactive wastes. MURR's approach will provide gas-phase extraction of fission product radioisotopes from a LEU target assembly using a mixture including halide and an oxygen-containing species with heat to convert the fission product radioisotopes to gas. The gaseous species will be evacuated to a recovery chamber where the radioisotopes solidify for subsequent purification, while the intact LEU target assemblies will be made available for further irradiation and extraction cycles. The SGE method does not separate or extract either Special Nuclear Material (SNM) or transuranics.

NRC Definitions:

The NRC defines "produce," in the context of SNM, in 10 C.F.R. § 50.2:

> *Produce*, when used in relation to special nuclear material, means (1) to manufacture, make, produce, or refine special nuclear material; (2) to separate special nuclear material from other substances in which such material may be contained; or (3) to make or to produce new special nuclear material.

The NRC also defines "production facility," in 10 C.F.R. § 50.2:

> *Production facility* means:
>
> (1) Any nuclear reactor designed or used primarily for the formation of plutonium or uranium-233; or
>
> (2) 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
>
> (3) Any facility designed or used for the processing of irradiated materials containing special nuclear material, except (i) laboratory scale facilities designed or used for experimental or analytical purposes, (ii) 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 (iii) 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.

Analysis:

The SGE method for the extraction of Mo-99 will not separate or extract SNM from an irradiated target, and will not involve chemical dissolution and processing where all of the fission products can be released and uranium or plutonium isotopes separated from the target solution, thus the SGE experiment will not "produce" SNM or meet the definition of "production facility" as defined in 10 C.F.R. § 50.2.

Also, the SGE method for extraction of Mo-99 will not place the MURR facility within any of the three criteria for a "production facility," provided in the regulatory definition. MURR and the SGE experiment do not fall within Criterion 1 of the definition of "production facility," because MURR will continue to not be designed or used primarily for the formation of plutonium or uranium-233.

Likewise, MURR and the SGE experiment do not fall within Criterion 2, because the MURR reactor (purposely) will not be designed or used for the separation of the isotopes of plutonium.

In regard to Criterion 3 of the "production facility" definition, MURR will not become a facility designed or used for the processing of irradiated materials containing SNM. Unlike traditional "production facilities," MURR activities and the SGE method for the extraction of Mo-99 will not separate or extract SNM from an irradiated target, and will not involve chemical dissolution and processing where all of the fission products can be released and uranium or plutonium isotopes separated from the target solution. Such separation of fission products is key to classification as a "production facility."

Consider, for example, how MURR's proposed method for Mo-99 extraction will differ from the fission processes described in a document abstract titled "NRC Licensing of Isotope Production Facilities."[1] The fission processes described in that abstract include the dissolution and separation of selected fission products from conventional solid targets in heterogeneous reactors, the core of aqueous homogeneous reactors, and the uranium solution of an accelerator-driven

[1] "NRC Licensing of Isotope Production Facilities," Marcus Voth, Office of Nuclear Reactor Regulation, USNRC, ADAMS Accession No. ML113260607.

subcritical multiplier solution vessel. These processes involve either the dissolution of a solid uranium target or extraction of fission products from a uranium solution. In these cases, all fission product gases are released and SNM could be separated and extracted even if the chemical process was not intended to perform such separation.

In the conventional single-pass-through target technology, uranium targets are removed from the reactor then transferred to a processing facility for the dissolution and separation of Mo-99 from other fission products and unfissioned uranium solution from the target. The total release of fission product gases during dissolution, and the presence of the uranium (SNM) and transuranics in the process solution, are reasons why the conventional process has been limited to batch quantities of 100 grams or less of target material (see exception (iii) to Criterion 3). The SGE method does not require a uranium target to be chemically dissolved to extract the desired Mo-99. The SGE method also does not extract either SNM or other transuranics. Accordingly, the reasons that conventional processes are limited to batch quantities of 100 grams or less of target material, or Part 50 "production facility" licenses, do not apply here.

The historical evolution of the statutory and regulatory definition of "production facility" further illustrates that the proposed SGE experimental facility will not be a "production facility." The definitions of "production facility" in the Atomic Energy Act of 1954, as amended, and the NRC's implementing regulations have always focused on the production or enrichment of SNM, the separation of specific isotopes of uranium from SNM, and the attendant safety implications.[2] When the NRC revised paragraph (3)(iii) of the regulatory definition in 1974 to increase the size of exempt batches of irradiated material, the Commission focused in particular on the hazards associated with the batch size. The Commission concluded that the relatively modest increase, up to 100 grams (from 15 grams), in the batch sizes of SNM, specifically uranium enriched in the isotope 235, would not alter, materially, the radiation hazards involved for this type of operation.[3] Accordingly, the NRC concluded that no additional safety precautions were required.[4] The SGE method for harvesting Mo-99 does not result in the potential release of fission products characterized by conventional chemical dissolution and processing of irradiated uranium targets.

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2 *See, e.g.*, 42 U.S.C. §2014(v) ("The term "production facility" means (1) any equipment or device determined by rule of the Commission to be capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device as determined by the Commission."); 10 C.F.R. § 50.2(a) (" 'Production Facility' means: (1) Any nuclear reactor designed or used primarily for the formation of plutonium or uranium 233; or (2) Any facility designed or used for the separation of the isotopes of uranium or the isotopes of plutonium, except laboratory scale facilities designed or used for experimental or analytical purposes only; or (3) 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 only.") (1957).

3 *See* Part 50—Licensing of Production and Utilization Facilities, 39 Fed. Reg. 4871 (Feb. 8, 1974).

4 *Id.*

Based on the above, the addition of the SGE experimental facility at MURR will not cause MURR to be categorized as a "production facility" under the Atomic Energy Act or the NRC's implementing regulations.

V. Construction Permit Evaluation and Assessment

Although implementation of the SGE experimental facility at MURR will require a license amendment, a Construction Permit is not warranted because implementation and subsequent operation of the experiment will not constitute a "material alteration" to the MURR facility. The reasons for this position are described below.

The main components of the SGE experimental facility will consist of LEU target assemblies, a separate and dedicated cooling system for heat removal, a gas extraction system, two (2) hot cells, and ancillary equipment to support these systems.

NRC regulation 10 C.F.R. § 50.92(a), Issuance of Amendment states, in part:

> (a) In determining whether an amendment to a license, construction permit, or early site permit will be issued to the applicant, the Commission will be guided by the considerations which govern the issuance of initial licenses, construction permits, or early site permits to the extent applicable and appropriate. *If the application involves the material alteration of a licensed facility, a construction permit will be issued before the issuance of the amendment to the license [...].*

(Emphasis added.)

The NRC has provided no regulatory definition of "material alteration." The NRC Staff considered establishing one in 1995 and 1996, but abandoned the effort because of "little regulatory need to clarify the term."[5] As the NRC's Executive Director for Operations explained in SECY-96-024,

> In only one instance has a construction permit been issued before an amendment of an operating license, that is, an amendment to the operating license of a research reactor at the University of Maryland. The material alteration was the complete removal of existing control rods, rod drive mechanisms, core instrumentation, and control room equipment and replacement with those of a different design. The change rendered major portions of the safety analysis inapplicable.[6]

The Staff concluded that there was an "apparent lack of need and industry or public interest in this topic."[7] The NRC has since not provided a regulatory definition of "material alteration."

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[5] SECY-96-024, "Semiannual Status Report on Implementation of Regulatory Review Group Recommendations," at 5 (Feb. 2, 1996).

[6] *Id.*

[7] *Id.*

Nevertheless, in a 10 C.F.R. Part 50, power reactor licensing hearing, the Commission explained the meaning of the term and referred to the same research reactor application (University of Maryland) to make its point.[8] The Commission explained,

> While the term "material" is susceptible of various meanings, longstanding NRC staff practice indicates that alterations of the type that require a construction permit are those that involve substantial changes that, in effect, transform the facility into something it previously was not or that introduce significant new issues relating to the nature and function of the facility. To trigger the need for a construction permit, the change must "essentially [render] major portions of the original safety analysis for the facility inapplicable to the modified facility."[9]

The SGE experimental facility will not result in "substantial changes" to MURR or "transform" the MURR facility into something it previously was not. Consistent with the existing MURR purpose and function, adding the SGE experiment will not involve a significant increase in the probability or consequences of an accident previously evaluated in the MURR Safety Analysis Report (SAR), create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. The neutron producing core region of MURR will be minimally affected by the addition of the equipment for the experiment because the targets are located in the graphite reflector region of the reactor.

Rather, the installation and operation of this experiment, with its target assemblies, target cooling system, and associated instruments and controls, will better ensure that existing structure, system, or component (SSC) along with the design bases function of an existing SSC as described in the MURR SAR, will not be adversely affected by the SGE. The mission of MURR will be further enhanced and not transformed as a result of the SGE experimental facility.

In contrast, alterations at the University of Maryland that compelled a construction permit involved significant modifications to the reactor itself and its support systems, and major revisions to the associated accident analyses. As discussed herein, this is not the case for the SGE experiment.

In contrast to the University of Maryland example, the SGE experimental facility is more closely aligned with modifications made to the MITR, which in Amendment No. 31 (dated December 21, 1999) added a complex fission converter, containing a subcritical array of fuel that could not maintain a self-supporting chain reaction. (Like MURR, MITR also considered its activities to represent an "experiment.") The experiments at both MITR and MURR are designed to reside in or adjacent to the reactor reflector region. Both are designed with independent cooling systems,

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[8] *Carolina Power & Light, Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, n.10 (May 10, 2001) (referring to the University of Maryland example).

[9] *Carolina Power & Light, Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 391-92 (May 10, 2001) (citing *Portland General Electric Co., et al.* (Trojan Nuclear Plant), LBP-77-69, 6 NRC 1179, 1183 (1977)).

and both incorporate the use of LEU in the experiment. For MITR, the NRC did not consider the addition of a fission converter tank containing fuel elements located adjacent to the reactor's graphite reflector in the region previously occupied by the thermal column as a "material alteration" of the MITR facility. This facility had a reactivity effect on the MITR, had a separate forced cooling system, instrumentation and control inputs to the MITR reactor safety system and required Technical Specification changes. The MURR proposal will implement similar systems and equipment, instrumentation and control inputs to the MURR reactor safety system and require Technical Specification changes. As such, the MURR proposal does not constitute a "material alteration" under NRC precedent.

VI. Thermal Power from SGE Experimental Facility Evaluation and Assessment

Amended Facility Operating License No. R-103 limits MURR to operate at a steady-state reactor power level of 10 MWt. MURR uses the following calorimetric procedure to determine and maintain reactor power within the licensed limit using both primary and pool coolant system flow rates and differential temperatures:

> Reactor Power Level = [((total average primary coolant flow rate of each loop – primary demineralizer flow) x $(T_h - T_c)_{primary}$) + ((average pool coolant flow) x $(T_h - T_c)_{pool}$)] x (a unit conversion factor)

An additional backup calorimetric procedure, using secondary coolant system flow rate and differential temperature, is also performed:

> Reactor Power Level = [(secondary coolant flow rate) x $(T_h - T_c)_{secondary}$] x (a unit conversion factor)

The SGE experimental facility, which will generate approximately 700 kW_t from two (2) target assemblies, will have an independent closed cooling loop, similar to what the NRC approved for the MITR for their fission converter experiment. The coolant for this system will be totally separate from the MURR reactor pool water and pool coolant system. Since the SGE experimental facility heat exchangers will be external to the reactor pool, only target assembly inlet and outlet coolant piping within the reactor pool will be in contact with the pool water.

The SGE experiment is designed to have a very small amount (~0.2%) of heat transfer to the reactor pool and pool coolant system and no net heat transfer from the reactor pool and pool coolant system. Should any heat be transferred to the reactor pool from the SGE experiment it will conservatively be included in the calorimetric calculation for reactor power level determination.

The SGE cooling system will be instrumented to monitor coolant flow rate and inlet and outlet temperature of the experiment so a calorimetric procedure, similar to what is performed for the reactor, can be used to determine experiment power.

> Experiment Power = [(target assembly total coolant flow rate) x $(T_h - T_c)_{target\ assemblies}$] x (a unit conversion factor)

Secondary cooling for the SGE experiment will be provided by the MURR secondary cooling system that rejects heat to a cooling tower designed for dissipation of 15 MWt. The secondary coolant system cooling tower design heat load is more than sufficient to handle the combined heat load of the reactor and the SGE experimental facility (10 MW_t + ~ 700 kW_t). As is the reactor, the experiment will be subject to Technical Specifications associated with it that defines the safety limits and control features to assure safety.

In sum, because the SGE experimental facility is designed to have a very small amount (~0.2%) of heat transfer to the reactor pool and pool coolant system and no net heat transfer from the reactor pool and pool coolant system, any heat added by the experimental facility to the reactor pool will conservatively be included in the calorimetric for reactor power level determination. This will assure the reactor is operating within the reactor licensed power level limit of 10 MW_t. Accordingly, the power generated in the SGE experimental facility and cooled by a separate, independent coolant system will allow exclusion of the experiment target power from the power generated in the reactor core.

VI. Conclusion

As explained above, MURR believes the SGE experimental facility, that will provide a critical domestic supply of Mo-99, can safely be implemented and operated via the license amendment process, does not require MURR to be categorized as a "testing facility," does not change the status of MURR from a "utilization facility" to a "production facility," and will not require submittal of a Construction Permit per 10 C.F.R. § 50.90. In addition, the power generated by the SGE experiment will not result in the need to increase the reactor core licensed power level above the current limit of 10 MWt.

ATTACHMENT 2

Overview of MURR Reactor Core and Reflector Regions