Meeting to discuss Part 2 of an Experimental Facility at the University of Missouri-Columbia Research Reactor to Produce Molybdenum-99

Nordion®
A Sotera Health company

Non-Proprietary Session
February 26, 2018

Presentation 1
Project Overview and Update

- Overview of the University of Missouri-Columbia Research Reactor (MURR)
- Overview of the Experimental Facility to Produce Molybdenum-99
- Key Considerations – Environmental Report

Presentation 2
Licensing Approach

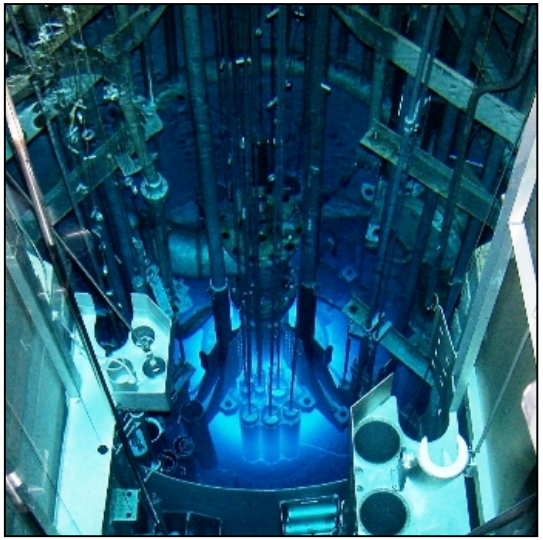
- Basis for License Amendment for Part 1 and Part 2
- Construction Permit and “Material Alteration”
- “Class 104 License” vs. “Class 103 License”

Presentation 3
Accident Analyses

- Nuclear Criticality Safety Program
- Chemical Accidents
- Emergency Planning
- Integrated Safety Analysis Methodology
- Maximum Hypothetical Accident

Presentation 1
Project Overview and Update

Overview of the University of Missouri-Columbia Research Reactor (MURR)



Overview of MURR

Leading the Nation's 25 University-operated Research Reactors

Facility	Power
University of Missouri-Columbia (MURR®)	10 MW
Massachusetts Institute of Technology	6 MW
University of California-Davis	2 MW
Rhode Island Nuclear Science Center	2 MW
Oregon State University	1 MW
University of Texas, Austin	1 MW
North Carolina State University	1 MW
Pennsylvania State University	1 MW
Texas A&M University	1 MW
University of Massachusetts-Lowell	1 MW
University of Wisconsin	1 MW
Washington State University	1 MW
Ohio State University	500 kW

Facility	Power
Kansas State University	250 kW
Reed College	250 kW
University of California-Irvine	250 kW
University of Maryland	250 kW
Missouri University of Science and Technology (Rolla, MO)	200 kW
University of Arizona	100 kW
University of Florida	100 kW
University of Utah	100 kW
Purdue University	1 kW
Rensselaer Polytechnic Institute	100 W
Idaho State University	5 W
University Of New Mexico	5 W

Overview of MURR

Location:

University of Missouri main campus in Columbia, Missouri

[200 km West of St Louis].

History:

- First critical on October 1966 (Initially licensed at 5 MW)
- Started 100 hour/week operation at 5 MW in 1969
- Uprated and licensed at 10 MW in 1974
- Started 100 hour/week operation at 10 MW in 1974
- Started ≥150 hours/week operation at 10 MW in 1977
- Became actively involved in the RERTR program to convert from HEU to LEU fuel in February 2006
- New license received January 2017 for another 20 years of operation
- License amendment request for Mo-99 production submitted May 2017 to NRC
- Preliminary LEU Conversion SAR submitted August 2017 to NRC

Purpose: Multi-disciplinary research and education facility also providing a broad range of analytical and irradiation services to the research community and the commercial sector.

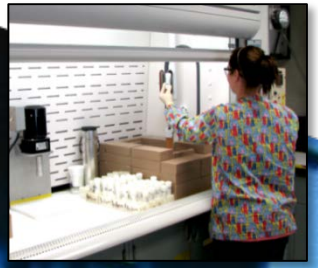
Overview of MURR

- MURR operates 24 hours a day, seven days a week, 52 weeks a year – 90% of the time at 10 MW
- ~200 full time-time employees
- In 2017, MURR produced 38 different isotopes with 1,527 shipments to 9 different countries (3 continents)
- Each and every week MURR supplies the active ingredients for FDA-approved Quadramet®, TheraSpheres®, and Lutathera®

Overview of MURR

Distinct Subcultures *working together under the same roof to improve the quality of life*

Research & Development

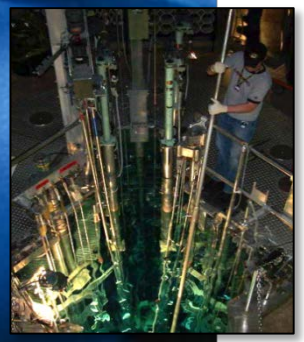


Education

Products & Services

Our core mission is Research

Reactor Operations

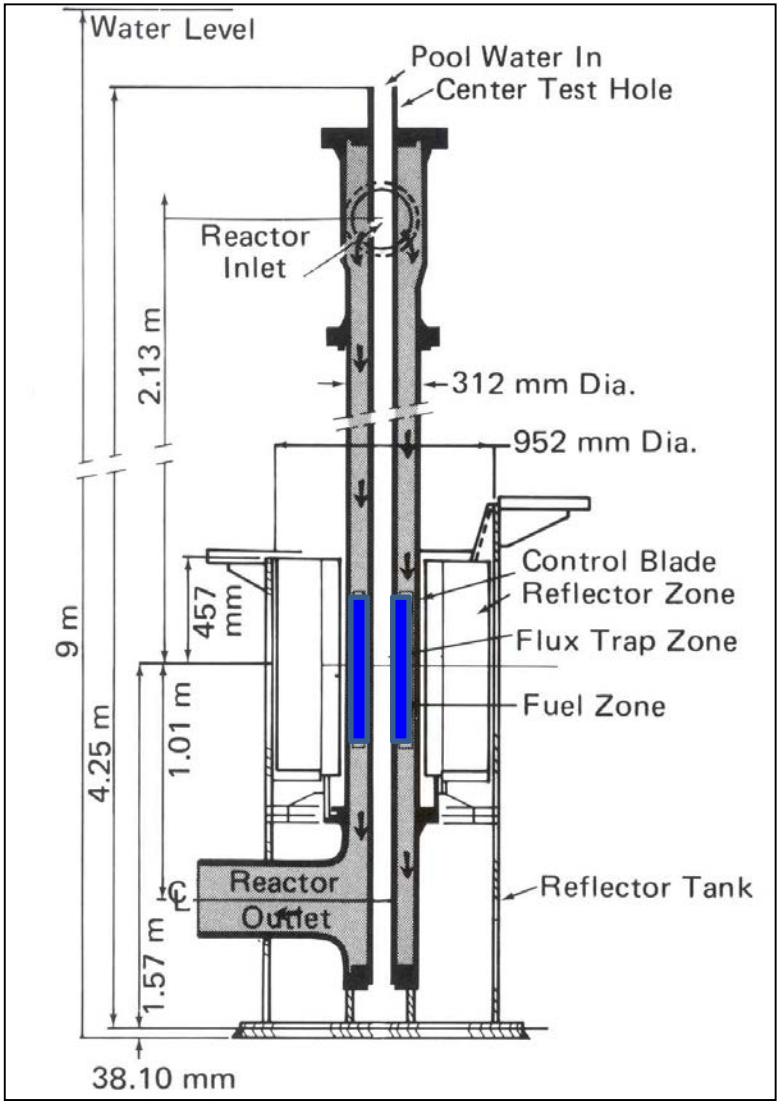


Overview of MURR - Key Reactor Parameters

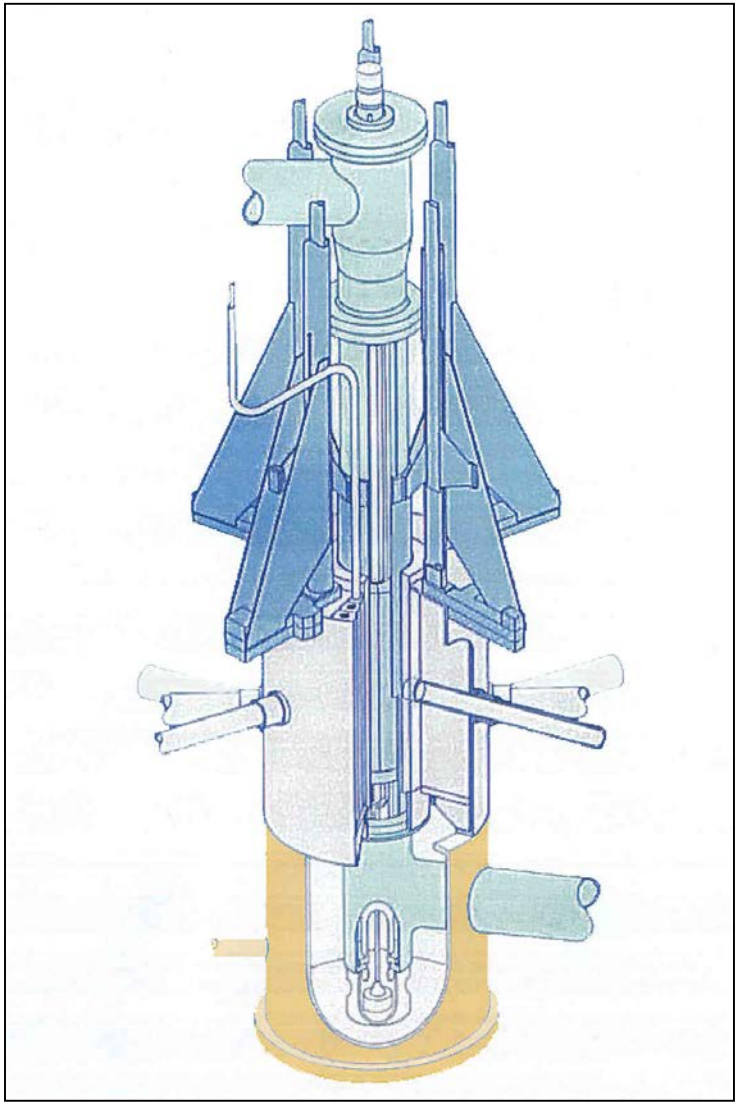
MURR® is a pressurized, reflected, heterogeneous, open pool-type, which is light-water moderated and cooled:

- Maximum power – 10 MW_{th}
- Peak flux in center test hole – 6.0E14 n/cm^2-s
- Core – 8 fuel assemblies (775 grams of U-235/assembly)
- Control blades – 5 total: 4 BORAL® shim-safety, 1 SS regulating
- Reflectors – beryllium and graphite
- Forced primary coolant flow rate – 3,750 gpm (237 lps)
- Primary coolant temps – 120 °F (49 °C) in, 136 °F (58 °C) out
- Primary coolant system pressure – 85 psia (586 kPa)
- Forced pool coolant flow rate – 1,200 gpm (76 lps)
- Pool coolant temps – 100 °F (38 °C) in, 106 °F (41 °C) out
- Beamports – three 4-inch (10 cm), three 6-inch (15 cm)

Reactor Core Assembly 2D View



Reactor Core Assembly 3D View



Presentation 1
Project Overview and Update

Overview of the Experimental Facility to Produce Molybdenum-99

Experimental Facility Project Team

General Atomics (GA)

Target and Reactor Systems Design and Manufacturing

- Trusted resource for high-technology systems
- Experts in nuclear fuel cycle, including uranium mining and processing
- Experts in reactor design: TRIGA® research reactors in operation around the world for over 50 years

University of Missouri Research Reactor (MURR)

Premium Reactor Operator and Research Center

- 10 megawatt facility; highest-powered university research reactor in the United States
- Operates 52 weeks per year
- 35+ years of successful and innovative radiopharmaceutical R&D and collaborations with industry
- Strong record of regulatory compliance (NRC, FDA, DOT)
- Experts in volume radiochemical processing and international shipping
- Nordion's partner in supply of TheraSphere for over 20 years

Nordion

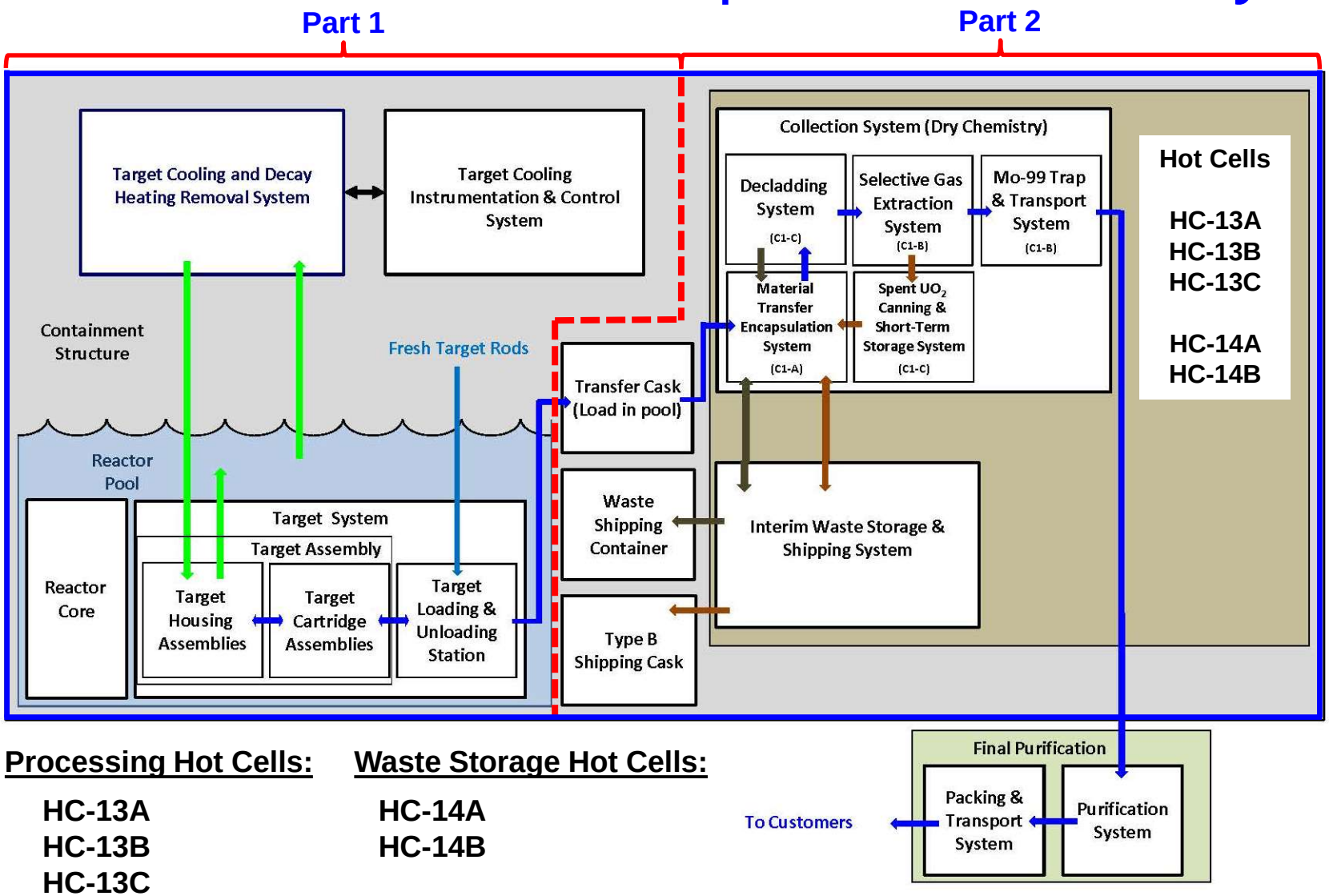
Premier Isotope Producer and Distributor

- Experts in Mo-99 purification into medical grade product since 1975
- Strong record of regulatory compliance (US FDA, EMEA, Health Canada)
- cGMP/GLP - licensed facility
- Global leading supplier of Mo-99 with extensive marketing, sales and distribution expertise
- Global licensed transport container fleet

Nordion/General Atomics/MURR Project Overview

- Nordion has exclusively licensed GA's Selective Gas Extraction (SGE) technology for Mo-99 production.
- Project funding is via NNSA Cooperative Agreement with GA. Nordion is providing the required private investor funding for the implementation at MURR.
- Nordion has a 20-year reactor services agreement with MURR.
- MURR plans on supplying a first-stage extract that will be processed and purified at existing cGMP Nordion facilities.
- Mo-99 supplied by SGE technology will work seamlessly in all existing Tc-99m generators.

Overview of Mo-99 Experimental Facility



Processing Hot Cells:

HC-13A
HC-13B
HC-13C

Waste Storage Hot Cells:

HC-14A
HC-14B

Project Overview - Schedule

License Amendment Request Part 1 – "In-pool" Activities

- May 3, 2017: MURR submitted LAR Part 1 to the NRC
- June 9, 2017: NRC accepted requested licensing action – tentative completion review date of June 2018
- June 19, 2017: MURR submitted supplemental information to NRC – additional Design Reports in the form of 2 attachments
- September 7, 2017: NRC requested additional information (in the form of 38 questions)
- October 17, 2017: MURR submitted supplemental information to NRC – additional Design Report in the form of 1 attachment
- November 1, 2017: NRC requested additional information (in the form of 18 questions)

Project Overview - Schedule

License Amendment Request Part 1 – "In-pool" Activities

- December 6, 2017: MURR submitted responses to the September 7, 2017 RAIs
- January 16, 2018: MURR submitted responses to the November 1, 2017 RAIs
- February 5, 2018: MURR submitted revised attachments to the NRC based on target rod/pellet fabrication tolerance changes
- Items still outstanding:
  - ✓ Target Rod/Cartridge Handling Report
  - ✓ Canadian Nuclear Laboratories Post-Irradiation Examination Report
  - ✓ Follow up information to RAIs 7.1, 7.4, 7.8, 7.10, 10.1, 13, 15.1, and 15.2 based on February 7, 2018 conference call between MURR and NRC staff

Project Overview - Schedule

License Amendment Request Part 2 – “Ex-pool” Activities

- Schedule on the submittal of LAR Part 2 will be discussed during the closed meeting session

Presentation 1
Project Overview and Update

Key Considerations – Environmental Report

Presentation 1
Project Overview and Update

Key Considerations – Environmental Report

- MURR is an existing facility (recent relevant Mo-99 applicants involve a new facility).
- NUREG-1537 Interim Staff Guidance (ISG) provides regulatory guidance, but modifications to the licensing approach are allowed.
  - Chapter 19, recognizes the important distinction between existing and new facilities, and explicitly notes that certain information identified therein may not be applicable to some applications.
  - The NUREG envisions parameters not existing at MURR.
    1) MURR is not proposing to construct a Part 70 “target fabrication area”
    2) MURR will not possess or use special nuclear material for target fabrication/scrap recovery
- Providing the full panoply of information described in Chapter 19 of the ISG is both unnecessary and unduly burdensome in these circumstances.

Presentation 1
Project Overview and Update

Key Considerations – Environmental Report

- The NRC recently published an Environmental Assessment and Finding of No Significant Impact for MURR's license renewal proceeding.
  - The NRC compiled detailed information on MURR to support the NWMI construction permit Environmental Impact Statement
- The environmental impacts of MURR's proposed license amendment are minimal relative to those associated with the construction of entirely new facilities; therefore a modified NRC approach is warranted.

Presentation 2
Licensing Approach

- Basis for License Amendment for Part 1 and Part 2
- Construction Permit and “Material Alteration”
- “Class 104 License” vs. “Class 103 License”

Presentation 2
Licensing Approach

Basis for License Amendment for Part 1 and Part 2

Presentation 2
Licensing Approach

Key Considerations – Licensing for Part 1

Activity:	Target assemblies (LEU target rods in cartridges) irradiated in the reflector region of the existing reactor. A separate and dedicated cooling system for heat removal, and associated instrumentation and controls.
Existing License authorizes MURR:	"to possess, use, and operate the facility as a utilization facility."
Changes to License Needed?	No.
Changes to TS Needed?	Yes.
Licensing Action:	License Amendment Request (LAR) seeking NRC approval of the necessary changes was submitted on May 3, 2017

Presentation 2
Licensing Approach

License Amendment Request Part 2 – “Ex-pool” Activities

- Key Areas of Discussion
  - Environmental (discussed in Presentation 1)
  - License Scope
  - Construction
  - Process

Presentation 2
Licensing Approach

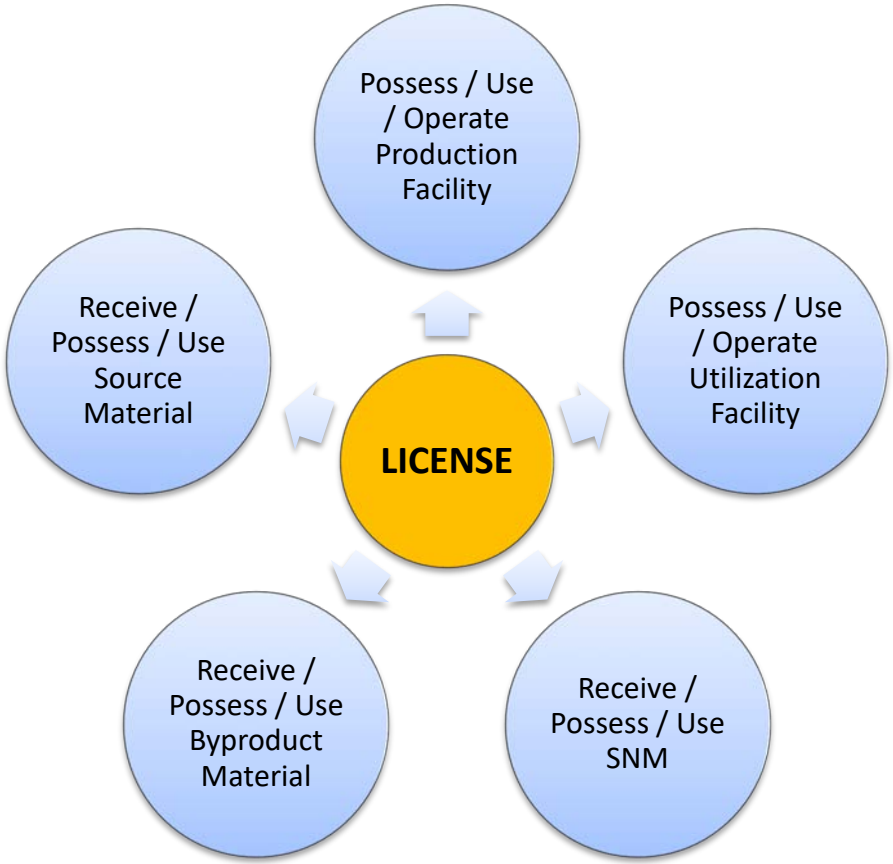
Key Considerations – Licensing for Part 2

Activity:	Irradiated target assemblies moved from reactor to a nearby, stand-alone "hot cell," where the SGE process would separate Mo-99 from the irradiated LEU. Additions and modifications to existing instrumentation and controls at the facility (*e.g.*, ventilation and electrical systems).
Existing License authorizes MURR:	"to possess, use, and operate the facility as a utilization facility."
Changes to License Needed?	Yes. Section 2.B.1 would need to be revised to authorize MURR "to possess, use, and operate the facility as a utilization and production facility."
Changes to TS Needed?	Yes.
Licensing Action:	LAR to be submitted accordingly.

Presentation 2
Licensing Approach

NRC Licensing Authority

- The AEA makes it unlawful to engage in certain **activities** (*e.g.*, possessing a production facility, § 101) without a license.
- The AEA authorizes the NRC to issue **licenses** to conduct such activities (*e.g.*, § 104).
- AEA § 161.h explicitly authorizes the NRC to "**combine in a single license one or more of such activities**" (emphasis added). *See also* 10 C.F.R. § 50.52.



Presentation 2
Licensing Approach

THE NRC HAS PREVIOUSLY APPROVED:	
Combining Production and Utilization Activities in a Single License for Medical Radioisotope Facilities	**Authorizing New Activities Under Existing Licenses via License Amendment**
For the B&W MIPS facility (SECY-09-0101, approved by the Commission in SRM-SECY-09-0101): "The staff conclude[d] that there is no legal impediment under section 161.h of the AEA to issuing one 10 CFR 50 operating license for the entire MIPS facility (i.e., numerous reactors and one or more production facilities)."	For example, the NRC approved an amendment of the Honeywell Metropolis Works fuel cycle facility license (issued under Part 40) to authorize the possession of byproduct material (under Part 30). ML070570354

Presentation 2
Licensing Approach

Key Considerations – Licensing for Part 2

- The SGE experiment is an ideal candidate for the single license approach:
  - Production and utilization activities will share certain common systems.
    - Benefits of Single License: provides a practical means to regulate common systems shared among and between the production and utilization facilities; streamlines requirements applicable to MURR and promotes regulatory efficiency.
    - Problems with Multiple Licenses: Dividing up systems would be unnecessarily burdensome with no commensurate safety or security benefit.
- Nothing in the AEA requires the NRC to issue a new license if an existing licensee seeks authorization for an additional activity.
- Nothing in the AEA prohibits the NRC from amending an existing license to authorize a new activity.

Presentation 2
Licensing Approach

Construction Permit and “Material Alteration”

Presentation 2
Licensing Approach

Key Considerations – Construction Permit

10 C.F.R. 50.23	
"A construction permit for the construction of a production or utilization facility will be issued before the issuance of a license . . . ."	MURR's Part 1 LAR **does not** (and its Part 2 LAR will not) request "the issuance of a license."
" . . . A construction permit for the alteration of a production or utilization facility will be issued before the issuance of an amendment of a license . . . as provided in § 50.92."	MURR's Part 1 LAR **does** (and its Part 2 LAR will) request approval of the "alteration" of the existing MURR facility and "the issuance of an amendment of a license" to authorize an additional activity.

Presentation 2
Licensing Approach

Key Considerations – Construction Permit

- **10 C.F.R. § 50.10(c)** ". . . No person may begin the construction of a production or utilization facility on a site on which the facility is to be operated until that person has been issued [] a construction permit under this part . . . ."
  - MURR seeks approval for "alterations" to an existing facility to enable an additional licensed activity.
  - The majority of the facility infrastructure *already exists* at the "site on which the facility is to be operated." The hot cells will interface with the electrical and ventilation systems.
  - MURR does not seek to "begin" greenfield construction.
  - In any event, MURR already "has been issued [] a construction permit under [Part 50]" (CPRR-68) to construct the existing infrastructure that MURR now seeks to *modify*.

Presentation 2
Licensing Approach

Key Considerations – Construction Permit

- **10 C.F.R. § 50.92:** "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."
  - Accordingly, the appropriate consideration is whether the LARs involve a material alteration of the existing licensed facility.

Presentation 2
Licensing Approach

Key Considerations – Construction Permit

LAR Part 2 Does Not Involve a "Material Alteration"

- In 1999, the NRC approved an amendment to the Massachusetts Institute of Technology Nuclear Reactor (MITR) operating license to allow installation of a complex fission converter experiment.
  - The experiment had a reactivity effect on the MITR, required a separate forced cooling system, necessitated additional instrumentation and control inputs to the MITR reactor safety system, and involved multiple Technical Specification changes.
  - The NRC concluded these changes fell short of a "material alteration" to the MITR facility.
- Alterations proposed for MURR's Part 2 LAR—essentially, affixing stand-alone hot cells to the existing facility—involve a smaller degree of "alteration" than in the MITR example; and, likewise, would not necessitate the issuance of a construction permit.

Presentation 2
Licensing Approach

Key Considerations – Construction Permit

Additional "Hot Cell" Installation Is Not a "Material Alteration"

- Over the years, MURR (like other research reactors) has installed additional hot cells at its existing facility.
  - The NRC has not previously required a construction permit for such installations.
  - Some installations have been directly observed by the NRC, and did not require so much as a license amendment, much less a construction permit. (*See, e.g.,* MURR License Renewal SER at 10-4 to 10-7)
- Even for hot cells requiring changes to MURR's TS (*e.g.*, Amendment No. 37 in March 2016), the NRC has approved such installations and associated systems without the need for a construction permit. (ML16032A424)

Presentation 2
Licensing Approach

"Class 104 License" vs. "Class 103 License"

Presentation 2
Licensing Approach

Key Considerations – Class 104 vs. Class 103 License

- As noted earlier, the NRC is empowered to issue a single license for multiple activities. *See* AEA § 161.h; 10 C.F.R. § 50.52.
- The "class" is associated with the "license," not each individual activity. *e.g.*, 10 C.F.R. § 50.21 ("A class 104 *license* will be issued . . . for any *one or more* of the following [activities].")
- Because MURR's Part 2 LAR will seek amendment of its existing license to authorize both production and utilization activities, the appropriate consideration for determining the class of "license" is the cost of owning and operating (10 C.F.R. § 50.22) the "one or more" (*i.e.*, all) facilities authorized by the license.

BREAK

Presentation 3
Accident Analyses

- Nuclear Criticality Safety Program
- Chemical Accidents
- Emergency Planning
- Integrated Safety Analysis Methodology
- Maximum Hypothetical Accident

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- The MURR Nuclear Criticality Safety (NCS) Program is being developed as outlined in NUREG-1537 ISG, Section 6b.3.
- The following documents provide the guidance for the program:
  - ANSI/ANS-8.1, “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactor”
  - ANSI/ANS-8.3, “Criticality Accident Alarm System”
  - ANSI/ANS-8.7, “Nuclear Criticality Safety in the Storage of Fissile Materials”
  - ANSI/ANS-8.10, “Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement”
  - ANSI/ANS-8.17, “Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors”
  - ANSI/ANS-8.19, “Administrative Practices for Nuclear Criticality Safety”

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- ANSI/ANS-8.20, “Nuclear Criticality Safety Training”
- ANSI/ANS-8.21, “Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors”
- ANSI/ANS-8.22, “Nuclear Criticality Safety Based on Limiting and Controlling Parameters”
- ANSI/ANS-8.23, “Nuclear Criticality Accident Emergency Planning and Response”
- ANSI/ANS-8.24, “Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations”
- ANSI/ANS-8.26, “Criticality Safety Engineer Training and Qualification Program”
- 10 CFR 70, “Domestic Licensing of Special Nuclear Material”
- NUREG-1513, “Integrated Safety Analysis Guidance Document”
- NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Applications”

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- Regulatory Guide 3.71, “Nuclear Criticality Safety Standards for Fuels and Material Facilities”

- Fissile material will be in one of two forms: UO_2 pellets prior to processing and U_3O_8 powder during and after processing.
- UO_2 pellets - will be removed from the target rods to be processed:
  - 11 Target Rods contain less than 700 grams of U-235 total – less than a “*critical mass of special nuclear material (SNM)*” per 10 CFR 70.4
- U_3O_8 powder - two permanent storage locations after processing [defined as Target Residue (TR)]:
  - Short-term – Processing Hot Cell HC-13C (held for decay for 17 to 20 weeks)
  - Long-term – Waste Storage and Handling Hot Cell HC-14B (held for a period of time prior to shipment to receipt site)

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- Nuclear Criticality Safety Evaluations:
  - Fresh (unirradiated) Target Rod storage
  - Fresh/Irradiated Target Rods in the reactor pool (discussed in LAR Part 1)
  - Irradiated Target Rod movement (11 rods)
    - Pool-to-Hot Cell Transfer Cask
    - Reaction Vessel
  - TR inventory in hot cell HC-13C (+ 11 rods)
  - TR movement from hot cell HC-13C to hot cell HC-14B
  - TR inventory in hot cell HC-14B

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- Nuclear Criticality Safety Controls:
  - The hierarchy used for establishing criticality control of fissile material operations:
    1) Passive design features, including favorable geometry;
    2) Active engineered controls;
    3) Enhanced administrative controls; and
    4) Simple administrative.

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- Criticality control for hot cell HC-13C:
  - Neutron absorbing material built into storage rack
  - Storage rack has a defined number of storage positions – fixed geometry
  - Two-person verification on movement of any can containing TR
  - Criticality calculation performed with storage rack fully moderated and reflected and an additional mass of U-235 placed adjacent to the storage rack
  - Results in a K_{eff} of less than 0.9
- Criticality control for hot cell HC-14B:
  - Storage rack has a defined number of storage positions – fixed geometry
  - Two-person verification on movement of any capsule containing TR
  - Criticality calculation performed with storage rack fully moderated and reflected and an additional mass of U-235 (entire row) placed on top of rack
  - Results in a K_{eff} significantly less than 0.9

Presentation 3
Accident Analyses

Nuclear Criticality Safety Program

- MURR hired criticality consultant to support Mo-99 Project.
- 1st visit by consultant - MURR provided details of project, discussed measures to prevent an inadvertent criticality accident, and outlined the program.
- Received draft Nuclear Criticality Safety Program document from consultant which MURR staff is currently reviewing and providing feedback.
- Final Nuclear Criticality Safety Program document will be reviewed by the consultant prior to submittal of LAR Part 2.

Presentation 3
Accident Analyses

Chemical Accidents

Presentation 3
Accident Analyses

Chemical Accidents

- Chlorine gas is used in the SGE process.
- The quantity that will be maintained in the reactor containment building will be small – lecture bottle size (1 pound).
- The cabinet that the bottle will be housed in will be ventilated.
- All materials that will be in contact with chlorine gas will be made of corrosive resistant material, primarily Hastelloy.
- Chlorine monitors will be located in the immediate vicinity of the Hot Cells.
- Procedures will be in-place for evacuation of the area should a monitor alarm.
- Consequences of a chlorine leak will be minimal.

Presentation 3
Accident Analyses

Chemical Accidents

- Helium, nitrogen and oxygen gases are also used in the SGE process.
- Controls/monitors will be consistent with industry practices.
- Procedures will be in-place should a monitor alarm.
- Further discussion during the closed session.

Presentation 3
Accident Analyses

Emergency Planning

Presentation 3
Accident Analyses

Emergency Planning

- MURR's Emergency Plan (EP) follows the guidance of Regulatory Guide 2.6, "Emergency Planning for Research and Test Reactors," and ANSI/ANS-15.16, "Emergency Planning for Research and Test Reactors."
- MURR EP was reviewed during license renewal and the NRC found it complies with the regulations and is consistent with the applicable guidance (Safety Evaluation Report – January 2017).
- MURR has also reviewed NUREG-1520, Revision 1, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," and NUREG-0849, "Standard Review Plan for Review and Evaluation of Emergency Plans for Research and Test Reactors," for applicability.

Presentation 3
Accident Analyses

Emergency Planning

- Based on the review of the EP and NUREG-0849 and NUREG-1520, MURR does not anticipate making any changes to the MURR EP. The dose consequences of the LAR Part 2 Maximum Hypothetical Accident will be within 10 CFR 20 limits.
- Emergence Plan Implementing Procedures will be revised to support LAR Part 2.

Presentation 3
Accident Analyses

Integrated Safety Analysis Methodology

Presentation 3
Accident Analyses

Integrated Safety Analysis Methodology

- MURR is using the Integrated Safety Analysis (ISA) Methodologies:
  - as described in 10 CFR Part 70 Subpart H;
  - as described in NUREG-1513, “Integrated Safety Analysis Guidance Document;”
  - as described in NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Applications;”
  - application of the radiological and chemical consequences and likelihood criteria contained in the performance requirements of 10 CFR 70.61;
  - designation of items relied on for safety (IROFS); and
  - the establishment of management measures.

Presentation 3
Accident Analyses

Integrated Safety Analysis Methodology

- Processes that are being analyzed:
  - Operations with SNM: Unirradiated, irradiated and processed
  - Radiochemical Operations
  - Operations with Hazardous Chemicals
- Accident-initiating Events:
  - Loss of electrical power;
  - External events (meteorological, seismic, fire and flood);
  - Critical equipment malfunction;
  - Operator error;
  - Facility fire; and
  - Any other event that could be related to unique operations within the facility.

Presentation 3
Accident Analyses

Integrated Safety Analysis Methodology

- MURR hired ISA consultant (ABS Group) to support Mo-99 Project.
- 1st visit by consultant - trained MURR staff on ISA methodologies.
- 2nd visit by consultant - discussion of accident scenarios and development of a draft ISA document which MURR staff is currently completing.
- Final ISA document will be reviewed by the consultant prior to submittal of LAR Part 2.
- MURR is using the Maximum Hypothetical Accident (MHA) scenario for the worst-case radiological release accident (discussed next) and the ISA methodologies for all other accident scenarios.

Presentation 3
Accident Analyses

Maximum Hypothetical Accident

Presentation 3
Accident Analyses

Maximum Hypothetical Accident

- The source term for the Maximum Hypothetical Accident (MHA) is the entire fission product activity of 11 target rods at 6 hours after End of Irradiation (EOI+6) and 480 hours of full power operation.

Isotope	Curies	Isotope	Curies	Isotope	Curies
I-130	2	Kr-83m	540	Xe-131m	31
I-131	5,394	Kr-85	2	Xe-133	14,204
I-132	9,529	Kr-85m	1,118	Xe-133m	452
I-133	13,322	Kr-87	231	Xe-135	5,927
I-134	516	Kr-88	1,971	Xe-135m	1,262
I-135	7,878				
Total:	36,641	Total:	3,862	Total:	21,876

Presentation 3
Accident Analyses

Maximum Hypothetical Accident

- How the total inventory is released into the hot cell is immaterial to the analysis.
- The fission product inventory is contained within the hot cell and its ventilation system.
- A fraction of the fission product inventory is released into the reactor containment building.
- The reactor containment building provides a second barrier against a release to the public.
- Doses to individuals in the restricted and unrestricted areas are with 10 CFR 20 limits.

Public Comment

Closing Remarks and Adjourn

Lunch