FRIB Project History

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)



Last decade: The U.S. Department of Energy's (DOE) Office of Science determines that the Facility for Rare Isotope Beams (FRIB) is a high priority for the future of U.S. nuclear science research as documented in several reports, including:

- Facilities for the Future of Science, A Twenty-Year Outlook, Department of Energy, Office of Science, December 2003
- Four Years Later: An Interim Report on Facilities for the Future of Science, A Twenty-Year Outlook, Department of Energy, Office of Science, August 2007
- The Frontiers of Nuclear Science, A Long Range Plan, Department of Energy/National Science Foundation Nuclear Science Advisory Committee, December 2007

December 2006: National Research Council of the National Academies publishes *Scientific Opportunities with Rare-Isotope Facility in the United States*, concluding the science addressed by a rare-isotope facility should be a high priority for the United States.





May 20, 2008: DOE conducts a competition through a Funding Opportunity Announcement for the establishment of a rare isotope beam facility for nuclear structure and astrophysics research.

December 11, 2008: DOE concludes after performing an environmental critique that the physical environmental impacts identified could be successfully managed to avoid or minimize impact. DOE selects Michigan State University (MSU) at completion of a Merit Review Panel process.





June 8, 2009: DOE and MSU sign a Cooperative Agreement for establishment of the FRIB.

October 27, 2009: The National Environmental Policy Act process begins, a required step prior to final design and construction of the FRIB.









Facility for Rare Isotope Beams

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

Mission

The U.S. Department of Energy (DOE) has a mission to advance our basic understanding of science. Scientific research at a Facility for Rare Isotope Beams (FRIB) holds the promise to vastly expand our understanding of nuclear astrophysics and nuclear structure. DOE determined that the establishment of the FRIB is a high priority for the future of U.S. nuclear science research. The FRIB, located on the Michigan State University (MSU) campus in East Lansing, establishes a highly sophisticated research laboratory that would produce intense beams of rare isotopes.

Design

The FRIB would provide a safe and secure facility enabling scientists to study the nuclear reactions that power stars and generate the elements found on earth; explore the structure of the nuclei of atoms, which form the core of all matter and the forces that bind them together; test current theories about the fundamental nature of matter; and play a role in developing new nuclear medicines and other societal applications of rare isotopes. The FRIB would be designed to limit its environmental impact.

Environmental Impact Limits for FRIB

Target Receptor	Limit	
Radiation Dose - Worker	Standard ¹ : 5,000 mrem/yr MSU ALARA Goal ³ : <500 mrem/year	
Radiation Dose - Public	Standard ¹ : 100 mrem/yr and \leq 2 mrem/(any one hour) MSU ALARA Goal ³ : < 10 mrem/year and \leq 2 mrem/(any one hour)	
Air - maximum exposure to nearest receptor	Standard ¹ : 10 mrem/yr MSU ALARA Goal ³ : < 1 mrem/year	
Groundwater ⁴ (in situ, no decay reduction factor)	H-3 Drinking Water Standard ² : 20 pCi/ml	Na-22 Drinking Water Standard ² : 0.4 pCi/ml
Sump Water ⁵	H-3 Standard ² : 10,000 pCi/ml	Na-22 Standard ¹ : 60 pCi/ml

Notes:

¹ Standard refers to 10 CFR 20 (U.S. Nuclear Regulatory Commission).

² Standard refers to 40 CFR 141 (U.S. Environmental Protection Agency).

³Note: Some conservative self imposed limits are used to provide flexibility in the design, commissioning, and operation of the FRIB and accommodate future upgrades or changes in mission. The as low as reasonably achievable (ALARA) goals represent action levels for the FRIB and MSU where actions are taken to reduce the exposures to maintain operations within the ALARA goal. The radiation ALARA goal for workers and the public is based on using 10 percent of the regulatory limit and is applicable for any MSU facility. The effluent limits for air releases are applicable to the integrated release from all MSU effluent generators. Therefore, the limit and ALARAgoal must account for all releases from MSU. The FRIB limit is an integral part of the overall MSU release limits and not a stand-alone value.

⁴ Groundwater is being evaluated using drinking water limits to assure that there are no negative impacts for water that may migrate to the underground aquifer. ⁵ Sump water is being evaluated using limits for release to the sanitary sewer.

Safety and Regulatory Compliance

MSU holds the necessary licenses, permits and registrations required for the construction and operation of the FRIB and has managed these responsibly in the operation of the National Superconducting Cyclotron Laboratory (NSCL). NSCL maintains, as would the FRIB, the highest level of standards for health and safety management systems, environmental management systems, and quality management systems as also evident by its recognition as a Clean Corporate Citizen.











Existing MSU Applicable Licenses, Permits, and Registrations

License, Permit, or Registration	Regulatory Agency/Standard
Resource Conservation and Recovery Act (RCRA) - Chemical Waste Treatment, Storage, and Disposal (TSD) Permit	State of Michigan, Department of Environmental Quality, Waste Management Division — MDEQ Rule 299.9501-299.9713
Clean Air Act - National Emission Standards for Hazardous Air Pollutants (NESHAPS - Renewable Operation Permit [ROP])	State of Michigan, Department of Environmental Quality, Waste Management Division — MDEQ Rule 336.1211
Clean Water Act - National Pollutant Discharge Elimination System (NPDES) Storm Water Permits	State of Michigan, Department of Environmental Quality, Water Division — MDEQ Rule 323.2161 <i>et seq</i>
Radiation Producing Machines Registration	State of Michigan, Department of Community Health, Radiation Safety Section Michigan Ionizing Radiation Rules for Radiation Producing Machines
NRC Broad Scope License for Radioactive Materials	NRC 10 CFR 1 - 199 as applicable and NUREG 1556
Local Requirements	MSU Board of Trustees
Community Right to Know Act - Notifications and Plans	State of Michigan, Department of Environmental Quality / U.S. EPA Michigan Executive Order — 40 CFR 350 - 372
Sanitary Hookup	City of East Lansing
Drinking Water Dispensing Permit	State of Michigan, Department of Environmental Quality Water Bureau — MDEQ Rule 325 1001-325 1023

The State of Michigan, the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), the U.S. Department of Labor (DOL), and U.S. Nuclear Regulatory Commission (NRC) would have regulatory authority for the FRIB construction and operation. Required permits have been obtained. Permits requiring amendment are noted by the blue shade.







Proposed FRIB Site and Design

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Alternative Configurations









From NSCL to FRIB

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)











Establishment of FRIB

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

National Superconducting Cyclotron Laboratory (NSCL)

(today – approximately 2017):

- National user facility operated by Michigan State University (MSU) and funded by the U.S. National Science Foundation (NFS) through a Cooperative Agreement
- 700 users from around the world
- 300 employees
- Approximately \$20 million annually in NSF funding
- Coupled superconducting cyclotrons accelerate and smash atomic nuclei in basic nuclear science experiments
- Rare isotope beams made from primary beams with 0.5 kW – 1 kW power
- Regulated by State of Michigan, the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), U. S. Department of Labor (DOL), and U.S. Nuclear Regulatory Commission (NRC)
- International Organization for Standardization (ISO) 9001-registered Quality Management System
- ISO 14001-registered Environmental Management System
- Occupational Health and Safety Assessment Series (OHSAS) 18001-registered Integrated Safety Management System
- · Best-in-class safety record

Facility for Rare Isotope Beams (FRIB)

(anticipated 2017):



- National user facility operated by MSU and funded by the U.S. Department of Energy (DOE) through a Cooperative Agreement
- Up to 1,000 users from around the world
- Approximately 400 employees
- Approximately \$50 million annually in DOE funding
- Superconducting linear accelerator accelerates and smashes atomic nuclei in basic nuclear science experiments
- Rare isotope beams made from primary beams with 0.5 kW – 400 kW power
- Regulated by State of Michigan, ER, DOT, DOL, and NRC
- Same ISO and OHSAS registrations as for NSCL









Facility for Rare Isotope Beams Research Goals

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)



• Effects of symmetry violations are amplified in certain nuclei



Societal applications and benefits

• Bio-medicine, energy, material sciences, and national security







Periodic Table of the Elements and Chart of Nuclides

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)







MICHIGAN STATE

UNIVERSITY

What is an Environmental Assessment?

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

An environmental assessment (EA) is a National Environmental Policy Act (NEPA) document describing the environmental impacts that would result from implementation of a proposed action and alternatives.

Notice of Intent for EA You Scoping Process* Pre-approval ne <u>EA</u> Process Draft EA Public Comment on Pre-approval Draft EA* Preliminary Final EA Draft FONSI **Public Comment** on Draft FONSI Final EA and FONSI * Opportunities for public participation, including public meetings

Why Is an EA Being Prepared?

NEPA requires Federal agencies to prepare NEPA documents for major Federal actions that could have significant impacts on the human environment. Major Federal actions refers to actions that the Federal government has some level of control or responsibility for. Under NEPA, human environment includes the natural and physical environment (such as air, water, and biological resources) and the relationship of people with that environment (such as health, safety, and jobs). NEPA documents look at both short-term and long-term effects and consider possible mitigation measures, if applicable.

Depending on the potential to impact the environment, an environmental impact statement (EIS) or an EA is prepared or a categorical exclusion determination is made. The U.S. Department of Energy (DOE) believes significant impacts associated with construction and operation of the Facility for Rare Isotope Beams (FRIB) are unlikely and thus determined it should prepare an EA. The EA will either corroborate DOE's belief or conclude that significant impacts are likely and that it should therefore prepare an EIS.

Are Here The EA Process

An EA is prepared in a series of steps, normally: gathering government and public comments to define the issues that should be analyzed in the EA (known as "scoping"); preparing the pre-approval draft EA; receiving and addressing public comments on the draft EA; preparing a final EA, and preparing a finding of no significant impact (FONSI), if warranted, or preparing an EIS.

DOE tailored the FRIB EA process to include enhanced opportunities for public involvement.

Scoping (Public Input)

Scoping during the EA process is usually an internal Federal agency planning process used to establish the alternatives and type of analysis to be performed.

DOE tailored the FRIB EA process to include publication of a Notice of Intent (NOI) in the *Federal Register* to let the public know that it is considering an action and will prepare an EA. NOIs describe the proposed action and may provide background information on issues and potential impacts. During the scoping period, the public can provide comments on the proposed action, alternatives, issues, and environmental impacts to be analyzed in the EA. Scoping may involve public meetings and other means to obtain public comments on the EA.

The NOI for the FRIB EA was published on October 27, 2009, and announced a 45-day comment period and today's public meeting.

Pre-approval Draft EA (Public Input)

Preparation of the pre-approval draft EA is the next step in the process. The draft EA presents, analyzes, and compares the potential environmental impacts for the proposed action and alternatives, taking into account the scoping comments received. It also provides information on possible mitigation actions to avoid or reduce adverse impacts. The draft EA is made available for public review and comment.

The pre-approval draft FRIB EA is scheduled for spring 2010 with a 30-day comment period and another public meeting.

Preliminary Final EA

Upon completion of the public comment period and analysis of the input received on the pre-approval draft EA, it is revised accordingly and reviewed internally by DOE.

Draft FONSI (Public Input)

After preparation of the preliminary final EA, the Federal agency normally prepares a FONSI, assuming that the EA justifies a conclusion that there are no significant environmental impacts associated with the proposed action. The FONSI explains the agency's basis for this determination and describes any commitments for mitigating potential environmental impacts.

DOE tailored the FRIB EA process to include preparation of a draft FONSI. The draft FONSI is distributed for public comment, currently scheduled for summer 2010, with a 30-day comment period.

Final EA and FONSI

Based on public input, and if a determination of no significant impacts can be supported, the EA and FONSI are finalized and published. Approval of the FONSI concludes the EA process.

The final EA and FONSI are scheduled for fall 2010.





