Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

Scoping Report

December 2009

U.S. DEPARTMENT OF ENERGY | Office of Science

Rev. 0

MICHIGAN STATE UNIVERSITY

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1.0 INTRODUCTION

1.1 Background

On October 27, 2009, the U.S. Department of Energy (DOE) issued a notice of intent (NOI) in the *Federal Register* (74 FR 55221) to prepare an environmental assessment (EA) as shown at Appendix A. As indicated in the NOI, the proposed Federal action requiring the EA is to fund the construction and operation of the Facility for Rare Isotope Beams (FRIB) on the Michigan State University (MSU) campus located in East Lansing, Michigan.

DOE has a mission to advance our basic understanding of science and research at the proposed FRIB holds the promise to vastly expand our understanding of nuclear astrophysics and nuclear structure. The FRIB establishes a highly sophisticated research laboratory that would produce intense beams of rare isotopes. These beams enable 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.

1.2 Public Scoping Process

DOE is preparing the FRIB EA pursuant to the National Environmental Policy Act (NEPA) as amended (42 USC 4321 et seq.), and in accordance with the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508) and DOE's implementing regulations (10 CFR Part 1021, as amended). The public scoping process is an integral component of NEPA compliance and ensures consideration of the full range of issues and alternatives that should be evaluated and helps identify the potential for significant environmental impacts.

The NOI to prepare the FRIB EA marked the beginning of the 45-day public comment period (October 27 through December 11, 2009), known as scoping, and announced the date, time, and location of the public scoping meeting, as well as the communication mechanisms to submit comments: e-mail, mail, scoping meeting, toll-free fax, and Web page. Additionally, DOE prepared individual letters to 24 local, state, and congressional representatives; collectively, DOE and MSU also e-mailed a postcard providing the NOI information to approximately 4,490 stakeholders as presented at Appendix B. The vast majority of these stakeholders are comprised of MSU faculty, staff, and students.

A stakeholder database was also developed that includes a portion of these stakeholders, which include relevant local, state, and Federal agencies/representatives, as well as non-governmental organizations and associations. MSU also developed a Web page dedicated to public involvement on the FRIB EA at http://www.frib.msu.edu/nepa, which announced the meeting and allows interested stakeholders to be added to the mailing list, submit comments, and download project materials.

The scoping meeting was announced in local newspapers (see Appendix C) prior to meeting date as shown in Table 1-1, in addition to local efforts made by MSU. The DOE Office of Science Communications Director also published a press release.

Table 1-1. FRIB EA Scoping Meeting Advertisements in Local Publications

PUBLICATION	ADVERTISEMENT DATE
Lansing State Journal	Tuesday, October 27, 2009 Saturday, November 7, 2009
The State News	Tuesday, October 27, 2009 Tuesday, November 3, 2009 Wednesday, November 11, 2009
City Pulse	Wednesday, October 28, 2009 Wednesday, November 4, 2009

Prior to the public scoping meeting, MSU held an educational open house providing the approximately 35 attendees the opportunity to view informational materials (see Appendix D), talk informally with subject matter experts from MSU and DOE, and tour the National Superconducting Cyclotron Laboratory (NSCL). DOE hosted a similar open house before the scoping meeting as shown in Table 1-2.

Table 1-2. FRIB EA Public Scoping Meeting Schedule

MEETING VENUE	MEETING DATE AND TIME
Educational Open House National Superconducting Cyclotron Laboratory 1 Cyclotron Road East Lansing, Michigan 48824-1321	**November 11, 2009** 4:00 ─ 6:00 p.m.
Scoping Meeting Biomedical and Physical Sciences Building* Room 1410 * Adjacent to NSCL	6:30 ─ 7:00 p.m. Oral comment sign up and open house 7:00 ─ 10:00 p.m. Presentation and recording oral comments

Meeting attendees who wished to provide oral comments were requested to sign up and all attendees were provided a meeting packet, which contained fact sheets and a written comment form to guide them in fully participating in the NEPA process (see Appendix E). Written comments were accepted onsite and attendees could also sign up to be on the project mailing list and request documents.

The moderator, Mr. Tom Emery, called the meeting to order and Dr. J. Ian Gray, Vice President of MSU's Office of Research and Graduate Studies and Dr. Eugene Henry, Acting Associate Director of Science for Nuclear Physics in DOE's Office of Science provided welcoming statements. Mr. Peter Siebach, the NEPA Compliance Officer for DOE's Office of Science, presented an overview of the FRIB EA and DOE's approach to meeting its obligations under

NEPA. There was an opportunity to ask questions but none were posed. Most of the meeting time was devoted to the formal comment period, which was facilitated by the moderator who kept the process flowing to ensure that everyone who wanted to speak was given the opportunity to do so. To ensure accuracy, the oral comments were recorded by a court reporter.

2.0 ISSUE CATEGORIES

As advertised, written comments could be submitted by e-mail, mail, toll-free fax, Web page, or handed in at the scoping meeting. A court reported provided a transcript of the oral comments given at the scoping meeting. All comments, both written and oral, received during the scoping period, which ended on December 11, 2009, were given equal consideration in developing the issue categories. Comments received after the comment period were considered to the extent practical in preparing this report. Comments were grouped by similar insights and concerns into issue categories. The identification and categorization of individual comments is subjective, however every effort was made to ensure that all public input was carefully considered and placed in the most appropriate issue category possible, given the spirit and context of each comment.

Approximately 35 individuals attended the scoping meeting and 11 provided oral comments. In addition, 21 comment documents were received as noted by the individuals identified in Table 2-1.

Table 2-1. Commentors by Submission Method

SUBMISSION METHOD	COMMENTORS
E-mail	Colin Cronin Debbie De Leon Sandy Draggoo David Hollister Stanley "Skip" Pruss Eric Schertzing Governor Jennifer Granholm Dave Waymire
Mail	George Bruchmann Colin Cronin Gerald Richards Eric Schertzing Randall Talifarro
Scoping Meeting (includes commentors providing oral and/or written comments)	Tony Baltimore Wayne Cass Tim Daman Timothy Dempsey Kyle Dysarz Kali Fox Melissa Horste Philip Kao The Honorable Carl Levin Rob Maleczka Ken Nichols Shannon Nicley

SUBMISSION METHOD	COMMENTORS
	Roy Saper The Honorable Debbie Stabenow
Web Page	Philip Kraushaar The Honorable Mark Meadows Ananda Jenkins

The comment documents and transcript were analyzed yielding 112 comments categorized by subject as shown in Table 2-2.

Table 2-2. Issue Categories Summary

ISSUE CATEGORY	NUMBER OF COMMENTS RECEIVED	DEFINITION
Alternatives	29	➢ Statements of support for the facility at the proposed location. ➢ Statements of opposition to the facility at the proposed location. ➢ Suggestions for alternative locations.
Design/Construction/ Operation/Decommission	29	➢ Design components including safety features and energy efficiency. ➢ Construction components including construction management and standards, quality assurance, and environmentally friendly practices. ➢ Operation components including management and safety assurance. ➢ Decommission including demolition, reuse, and potential contamination.
Human Health and Safety	3	Environmental, safety, and health of workers and the surrounding community.
Infrastructure	3	Physical infrastructure to support the new facilities and business infrastructure to accommodate related housing and office space requirements.
NEPA Process	4	NEPA procedures and public outreach activities.
Regulatory Compliance	10	Local, state, and Federal policy and regulation compliance and sustained environmental stewardship through certifications and permits.
Socioeconomics	33	Related to job creation, quality of life, and opportunities for economic and/or educational growth and scientific discovery.

ISSUE CATEGORY	NUMBER OF COMMENTS RECEIVED	DEFINITION
Other	1	Requests for information.

Although the insights and issues raised during the scoping period will be considered in the preparation of the FRIB EA, some of the issues will either be analyzed in less detail or will not be analyzed at all, depending on their relevance to the proposed action and the anticipated impacts.

3.0 SUMMARY OF COMMENTS

In general, the comments received during the scoping period expressed strong support for the proposed FRIB being constructed and operated on the MSU campus. Many commentors pointed out the stellar safety record of the national user NSCL and acknowledged its achievement of International Organization for Standardization (ISO) and Occupational Health and Safety Assessment Series (OHSAS) certificates of registration regarding environmental management, and health and safety management systems. Commentors also offered praise and support of MSU as being a leader in sustainability and education initiatives that demonstrate environmental stewardship. Several commentors highlighted MSU's "green" culture and share their faith that MSU would uphold one of its core commitments of remaining "green" throughout the construction and operation of the FRIB.

The majority of commentors welcome the economic opportunities associated with the construction and operation of the FRIB. Commentors pointed out the obvious economic boost the FRIB would bring to the local and regional economy but also expressed pride in having cutting-edge research capabilities that would draw top scientists and graduate students and afford them the opportunity to make discoveries that would benefit humanity in areas such as health science and national security. Further, many shared the view that MSU has the expertise and capability to supervise a construction project of this magnitude and could ensure compliance with all applicable construction regulations and practices that would lead to environmentally friendly and safe operations.

The following represents the range of comments verbatim that were heard or received by issue category.

Alternatives

- *I am writing to express my strong support for the Facility for Rare Isotope Beams (FRIB), funded by the Department of Energy, Office of Nuclear Physics and operated by Michigan State University (MSU).*
- *I know I speak for the vast majority of the regional business, academic, labor, governmental, and community leaders when I enthusiastically support the continual development of the Facility for Rare Isotope Beams by Michigan State University*

- *The MSU FRIB team have an off campus site, originally proposed for RIA, that would eliminate many of these concerns.*

- *I'm in support of the construction of this project. I favor the folded alternative as it makes better use of available space and minimizes the project footprint.*

Design/Construction/Operation/Decommission

- *Particularly because of MSU's strong track record in managing the NSCL, we have every confidence that MSU will operate the FRIB in the same, safe, professional and efficient manner that they have operated the NSCL since 1963.*

- *…look at securing the construction site, especially given its close location to the undergraduate dorms.*

- *Given the tight budget constraints of the project, the temptation to minimize the wall thickness, will generate another environmental hazard which is the production of tritium in the ground water outside the tunnel walls.*

- *The university has high standards for protecting and enhancing the environment and actively promotes "green" practices on campus. University staff, including public safety personnel, has an excellent track record and experience overseeing highly sensitive labs and facilities. With plenty of experience behind them, university officials enjoy the confidence of the community that the FRIB will be constructed and used in the safest possible manner.*

- *…is confident in MSU's ability to establish and operate the FRIB safely, with a minimal environmental impact. By way of example, MSU's National Superconducting Cyclotron Laboratory has been recognized by the Michigan Department of Environmental Quality as a Clean Corporate Citizen for its demonstrated environmental stewardship and strong environmental ethic.*

- *Michigan State University handles major construction projects worth tens of millions every year and has the ability to supervise a major project of this size.*

- *…I'm not so sure I'm interested in the heavy equipment.*

- *I admire and I am impressed with the level of success that MSU has displayed in all of its major addition to the campus building landscape.*

- *Prior operation can not be used to justify an exception since the current operation is at orders of magnitude lower energy. No one at NSCL has real operating experience at an unsecured site at these energies.*

- *Also, I have environmental concerns about the residual low level radioactive waste site that will be created when the facility is eventually decommissioned. As you know, the concrete and rebar that form the linac tunnel will be activated during operations of the accelerator and will basically constitute low level waste, again, in the middle of a heavily populated area.*

Human Health and Safety

- *We believe this project will proceed with great attention and consideration afforded to the safety and wellbeing of the employees that work onsite and the community at large.*

- *The proposed location has a zero radius protective area in the event of an accidental release of radioactive materials (gaseous form or fine particulate). The general public, most importantly students, can walk right up to the buildings that will house the facility, as they can currently.*

- *However, the question of how you will train the public and future students to the hazard the facility represents on campus will be problematic...I know that we had specific training to deal with emergencies related to the release of radioactive materials from accelerator operations. You will need to do this for the MSU campus community.*

Infrastructure

- *In addition to noise, vibration is something that's important as well as fluctuations, safety in utilities, particularly water and electricity because they obviously affect ongoing experiments on campus.*

- *Meridian Township and the surrounding area have ample infrastructure and exiting office space to house the ancillary businesses expected to result from this project.*

- *Hundreds of platted lots are available for new home construction to accommodate the expected influx of people associated with the project.*

NEPA Process

- *The process that you have outlined tonight is one of the most detailed and thorough that I've ever seen for a NEPA process, especially this early comment period. This is really unique, so I commend you for doing that.*

- *Several divisions have reviewed the project information that has been provided to date, and all have indicated that the environmental impacts of this project are expected to be small. Thus, we believe that the DOE's intent to prepare an EA is the appropriate course to take in accordance with the National Environmental Policy Act.*

- *I would like to go on the record as saying I will oppose any action by the DOE that does not include a full environmental impact statement process for this project.*

Regulatory Compliance

- *MSU has routinely been recognized for its environmental stewardship and the NSCL itself has achieved the ISO 14001 and OHSAS 18001 standard registrations.*

- *The organization and activities on the MSU campus abide by all state and university requirements to ensure that contractors, vendors, employees and subcontractors comply with environmental regulations.*

Socioeconomics

- *This facility is critical for brining jobs and cutting edge technology to Michigan.*

- *This project will be a critical economic engine for our community, region, and state for many years to come. The investment and employment opportunities are significant, particularly given the current upheaval in the Michigan economy.*

- *This project ensures Michigan students, from high school through graduate school, are exposed to the most advanced nuclear research in the world, encouraging their further study in this vital area.*

- *Already, top scientists and researchers from around the world are applying for jobs at MSU, in anticipation of the opening of the FRIB.*

- *The FRIB project is a great addition to the Michigan State University's current Cyclotron Laboratory and will have a significant positive economic impact on the entire greater Lansing area as indicated by the Anderson Economic Group's study.*

- *I have come to believe that this project has the potential to transform Michigan from the epicenter of the Rust Belt, to a power house of innovation, entrepreneurship, and vitality.*

- *This new facility will add to our vitality through construction jobs, long term employment and new tax revenue.*

- *Not only does this have benefits to the science community in researching nuclear physics, not only does this cement the university's status as a world-class institution, but really, this will provide a vehicle for economic development in Michigan.*

- *…the members that I represented are going to continue to work and build this new facility with the same care and skill that the National Superconductor Laboratory was handled.*

- *We students realize that from the start of this project that not only would our learning institution become a world leader in the field of nuclear science, but that it would also bring an expected $1 billion worth of economic activity to our state. Something that not a single Michigan resident would ever consider a bad thing.*

- *FRIB also gives our graduate students the opportunity to benefit from the experience of top nuclear scientists who will come to MSU to run experiments and take permanent jobs. Many graduate students will try to return as well for continuing research or to take permanent jobs as young assistant professors and staff scientists. Students and top researchers will be drawn here not just because the physics is cutting edge but because the people and overall lab atmosphere here are great.*

- *When you look at what we're trying to do locally to transform ourselves from an old economy region to a new economy focused on high-tech job growth, this is really the type of project and initiative that is a marquee effort for our region.*

- *Building upon MSU's 154-year history, the FRIB will increase our connectivity with leaps across a multitude of government and educational institutions across the work advancing knowledge, transforming lives, allowing us to make important contributions to the work that have yet to be discovered.*

- *We all believe that this university will continue to rally together to make sure that this project's success and existence will be just as green, in to more green, than ever before. And in the end, this project and process will truly be something that we all can benefit from and be proud of.*

Other

- *Please include a scoping summary report to the public via the project website after the close of the scoping period.*

4.0 CONCLUSION

The scoping process summarized in this report will help guide DOE in the development of the FRIB EA. Overwhelmingly, the comments expressed support for the construction of the proposed FRIB on the MSU campus primarily because of the confidence in MSU's proven track record over time managing the building of state-of-the-art facilities in a safe and environmentally conscious manner. Further, that confidence extends to operating the FRIB based on MSU's campus-wide "Be Spartan Green" campaign and being recognized for its strong environmental stewardship and ethics in operating the NSCL. And although the majority of the commentors are eager for the economic boost of such a construction project concerns were expressed regarding the safety of students during construction due to the heavy equipment necessary and the proximity of the site to undergraduate dorms. Another concern was the noise and vibrations and potential disruption of water and electricity and its effects to ongoing experiments being conducted on campus.

Other concerns were raised regarding operations and decommissioning of the FRIB due to the risks associated with radiation. Safety of the community, and especially the student population, was voiced in the event of an accidental release of radioactive material and also raised the issue of appropriate training in the event of such an emergency. It was also pointed out that those involved with operating the NSCL do not have operating experience at an unsecured site at the energy levels anticipated for the FRIB. Another concern was the threat of tritium being released to groundwater if the concrete walls were not the proper thickness and the disposition of low-level radioactive waste once the FRIB was decommissioned.

The next opportunity for the public to comment on the FRIB will be spring 2010, when the pre-decisional draft FRIB EA is expected to be available. Announcements will be made when it is published along with information on a public meeting and the communication mechanisms available to submit comments during the planned 30-day comment period.

APPENDIX A
NOTICE OF INTENT

Access at: *http://www.gpoaccess.gov/nara/index.html.*

John Q. Easton,

Director, Institute of Education Sciences.

[FR Doc. E9–25838 Filed 10–26–09; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

Notice of Intent To Prepare an Environmental Assessment, To Open a Public Scoping Period, and To Conduct a Public Scoping Meeting

AGENCY: Office of Science, Department of Energy.

ACTION: Notice of Intent to Prepare an Environmental Assessment, to open a public scoping period, and to conduct a public scoping meeting for the funding of the construction and operation of the Facility for Rare Isotope Beams at Michigan State University, East Lansing, Michigan.

SUMMARY: The Department of Energy (DOE) announces its intent to prepare an Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA) and to hold a public scoping meeting on the proposed Federal action to fund the construction and operation of the Facility for Rare Isotope Beams (FRIB) on the campus of Michigan State University (MSU) in East Lansing, Michigan. FRIB's design is composed of buildings and/or building additions for a heavy ion/proton accelerator, ancillary laboratories, and support facilities. Construction/operation would occur adjacent to the existing National Superconducting Cyclotron Laboratory (NSCL), which would ultimately be subsumed into FRIB. The EA will identify and assess potential environmental impacts from the Proposed Action and a range of reasonable alternatives so DOE can determine whether to prepare an environmental impact statement (EIS) or issue a finding of no significant impact (FONSI). DOE is also opening a 45-day scoping period to allow the public the opportunity to voice any concerns it might have and to make recommendations about the analytical approach and alternatives. During the scoping period, a public meeting will be held. If at any point during the preparation of the EA DOE determines that it is necessary to prepare an EIS, this scoping process will serve as the scoping process that would normally follow a Notice of Intent to prepare an EIS.

DATES: The public scoping period starts with the publication of this Notice in the **Federal Register** and will continue until December 11, 2009. DOE will consider all comments received or postmarked by that date in defining the scope of the EA. Comments received or postmarked after that date will be considered to the extent practicable.

DOE invites public comment on the scope of this EA during a public scoping meeting from 6:30 p.m. to 10 p.m. on November 11, 2009 in room 1400 of the Biomedical and Physical Sciences Building (BPS) on the campus of Michigan State University, in East Lansing, Michigan. The scoping meeting will be preceded by an educational open house to be held from 4 p.m. to 6 p.m. at the NSCL, which is adjacent to BPS.

ADDRESSES: Written comments or suggestions on the scope of the EA may be submitted by mail to: FRIB Comments, U.S. Department of Energy, Office of Science, Chicago Office (STS), 9800 South Cass Avenue, Argonne, Illinois 60439; by toll free fax to 1–888–676–3672; by e-mail to *frib.comments@ch.doe.gov;* or through the EA Web site at *http://www.frib.msu.edu/NEPA/.*

The Pre-approval Draft EA is expected to be completed in the Spring of 2010. Advance requests for copies can also be made at this time via the methods above. In making your request, please specify whether you would like a paper copy, a compact disc, or notification of its availability on the Internet.

FOR FURTHER INFORMATION CONTACT: For further information on the proposed project, contact Mr. James Hawkins, FRIB Program Manager, U.S. Department of Energy, SC–26.2/Germantown Building, 1000 Independence Avenue, SW., Washington, DC 20585–1290, by telephone at 301–903–3613, or via e-mail at *James.Hawkins@science.doe.gov;* or Dr. Thomas Glasmacher, FRIB Project Manager, Facility for Rare Isotope Beams, Michigan State University, East Lansing, MI 48824–1321, by telephone at 517–908–7750, or via e-mail at *glasmacher@frib.msu.edu.* The FRIB project is described in detail at the FRIB Web site, *http://www.frib.msu.edu/.*

For general information concerning DOE's NEPA process, contact: Peter Siebach, NEPA Compliance Officer, U.S. Department of Energy, Office of Science-Chicago Office (STS), 9800 South Cass Avenue, Argonne, Illinois 60439, by telephone at 603–252–2007, or via e-mail at *Peter.Siebach@ch.doe.gov.* This Notice of Intent and general information on the DOE NEPA process are available at *http://www.gc.energy.gov/NEPA/.*

SUPPLEMENTARY INFORMATION:

Background

DOE published a ''funding opportunity announcement'' on May 20, 2008 seeking applications for the design and establishment of a particle acceleration facility—the FRIB—as a National User Facility. The FRIB would take about a decade to design and build and would cost an estimated $550 million, including cost sharing from MSU. MSU would also make other, non-monetary contributions. The research conducted at FRIB would involve experimentation with intense beams of rare isotopes—short-lived nuclei not normally found on earth—that will enable researchers to address pressing questions in nuclear structure and nuclear astrophysics. Two applications were received. The results of an independent merit review process, as well as an environmental critique, i.e., a comparison of environmental information provided in the applications, were considered by DOE and on December 11, 2008, MSU was selected to design and establish the FRIB. A cooperative agreement with DOE was signed on June 8, 2009, establishing terms and conditions for the work to be performed and ensuring DOE's substantial ongoing involvement in the project.

Purpose and Need for Action

DOE has a mission to advance our basic understanding of science. Scientific research at a 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 establishes a highly sophisticated research laboratory that would produce intense beams of rare isotopes. These beams enable 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 concept has undergone numerous studies and assessments within DOE and by independent parties such as the National Research Council of the National Academy of Sciences. These studies—in addition to the joint DOE/National Science Foundation (NSF) Nuclear Science Advisory Committee (NSAC) 2007 Long Range Plan—concluded that such a facility is

a vital part of the U.S. nuclear science portfolio, complements existing and planned international efforts, and will provide capabilities unmatched elsewhere.

Proposed Action and Alternatives

DOE and MSU propose to construct and operate the FRIB on approximately 10 acres on its East Lansing, Michigan campus. Its design is composed of buildings and/or building additions for a heavy ion/proton accelerator and ancillary laboratories, support facilities such as a cryomodule, and offices. Construction/operations would occur on campus, adjacent to the existing NSCL, which would ultimately be subsumed into FRIB. The function and scope of operations of FRIB would be similar to NSCL, but FRIB would have substantially more power. The existing NSCL research program relies on a 200 MeV/u coupled cyclotron driver accelerator with 1–2 kW beam power. FRIB would be capable of 200 MeV/u energy for all species, higher energies for lighter ions up to 600 MeV/u for protons with up to 400 kW beam power. A 12 MeV/u reaccelerator is also planned for the facility. Upgrade is possible, but not currently planned.

Most of the structures that would house the accelerator would be thick-walled, reinforced concrete structures. The heavy ion linear accelerator (linac) would be located in a tunnel below grade. A trench (varying between 30 and 75 feet below grade up to 1,800 feet long) would be excavated for the accelerator, necessitating that Bogue Street be closed between Wilson Road and East Shaw Lane two years and portions of East Shaw Lane possibly to be closed for a number of months. The high energy end of the accelerator would join with the existing NSCL building.

The ground where FRIB would be located has been previously disturbed. Like the NSCL, the FRIB would be licensed by the Nuclear Regulatory Commission (NRC). Operation would result in low levels of activation of air and groundwater, which MSU would manage in accordance with NRC license requirements and Environmental Protection Agency regulations. Radiation doses to workers and members of the public from operation of the FRIB would be limited to well below NRC radiation protection standards.

As required by NEPA, the EA will evaluate a No Action alternative to serve as a basis for comparison with the action alternatives. Under the No Action alternative, a FRIB would not be constructed and operated at MSU, although other use of the site could not be ruled out.

Preliminary Identification of Environmental Issues

In the EA, DOE will examine public health and safety effects and environmental impacts from the construction and operation of the proposed FRIB at MSU. This notice is to inform the public of the proposed project and to solicit comments and suggestions for consideration in the preparation of the EA. To help the public frame its comments, this notice contains a preliminary list of potential environmental issues that DOE has tentatively identified for analysis. It is not intended to be comprehensive, nor to imply any predetermination of impacts. These issues include:

1. Impacts from construction accidents;
2. Impacts to both workers and the public from potential exposure to radiation and other hazards under routine operations and credible accident scenarios including natural disasters (e.g., floods, hurricanes, tornadoes, and seismic events);
3. Transportation related impacts;
4. Impacts on surface and groundwater and on water use and quality;
5. Impacts on air and soil;
6. Socioeconomic impacts;
7. Disproportionately high and adverse impacts on minority and low income populations;
8. Impacts on land-use plans, policies and controls, and visual resources;
9. Pollution prevention and waste management practices and activities;
10. Unavoidable adverse impacts and irreversible and irretrievable commitments of resources;
11. Cumulative environmental effects of past, present, and reasonably foreseeable future actions;
12. Status of compliance with all applicable Federal, state and local statutes and regulations, international agreements, and required Federal and State environmental permits, consultations, and notifications; and
13. Impacts of intentional destructive acts, including sabotage and terrorism.

Since the proposed site is adjacent to a currently operating accelerator facility and would involve digging and construction in previously disturbed areas now occupied primarily by parking lots and roads, impacts in several areas are expected to be minor. These impact areas will therefore not be evaluated in detail:

- Impacts on protected, threatened, endangered, or sensitive species of animals or plants, or their critical habitats;
- Impacts on cultural or historic resources; and
- Impacts on floodplains and wetlands.

Scoping Process

DOE invites Federal agencies, State, local and Tribal governments, the general public and international community to participate in the scoping process both to refine the environmental issues to be analyzed and to identify the reasonable range of alternatives. Both oral and written comments will be considered and given equal weight by DOE. The public scoping period starts with the publication of this Notice in the **Federal Register** and will continue until December 11, 2009. DOE will consider all comments received or postmarked by then in defining the scope of the EA. Comments received or postmarked after that date will be considered to the extent practicable.

The scoping meeting will be held at the location, date, and times indicated above under the **DATES** section. It will provide interested parties the opportunity to ask questions about the project and comment on the EA scope. A facilitator will establish procedures needed to ensure that everyone who wishes to speak has the opportunity to do so. Should any speaker desire to provide further information that cannot be presented within the designated time, such additional information may be submitted in writing by the date listed in the **DATES** section. Both oral and written comments will be considered and given equal weight by DOE.

The scoping meeting will be preceded by an educational open house, to be held at the location, date, and times indicated above under the **DATES** section. During the open house, members of the public can register to provide oral comments at the scoping meeting, provide written comments, view FRIB informational materials, engage project staff, and tour the existing NSCL.

The Pre-approval Draft EA is planned to be issued for state and public review by the Spring of 2010. Persons submitting comments during the scoping process will receive a copy. Others who would like to receive a copy of the draft EA when it is issued should notify DOE per the **ADDRESSES** section above.

If at any time during preparation of the EA DOE determines that potentially significant environmental impacts might occur with the implementation of the Proposed Action and that an EIS would be needed, DOE will issue a Notice of Intent to prepare an EIS in the **Federal**

Register. In that case, this scoping process will serve as the scoping process that normally would follow a Notice of Intent to prepare an EIS. Accordingly, DOE will consider any comments on the scope of the EA received during this scoping process in preparing such an EIS.

Issued in Washington, DC on October 20, 2009.

Jehanne Gillo,

Director, Facilities and Project Management Division, Office of Nuclear Physics.

[FR Doc. E9–25847 Filed 10–26–09; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Northern New Mexico

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: This notice announces a meeting of the Environmental Management Site-Specific Advisory Board (EM SSAB), Northern New Mexico. The Federal Advisory Committee Act (Pub. L. 92–463, 86 Stat. 770) requires that public notice of this meeting be announced in the **Federal Register**.

DATES: Wednesday, November 18, 2009, 1 p.m.–8 p.m.

ADDRESSES: Holiday Inn Santa Fe, 4048 Cerillos Road, Santa Fe, New Mexico.

FOR FURTHER INFORMATION CONTACT: Menice Santistevan, Northern New Mexico Citizens' Advisory Board (NNMCAB), 1660 Old Pecos Trail, Suite B, Santa Fe, NM 87505. Phone (505) 995–0393; Fax (505) 989–1752 or e-mail: *msantistevan@doeal.gov.*

SUPPLEMENTARY INFORMATION:

Purpose of the Board: The purpose of the Board is to make recommendations to DOE in the areas of environmental restoration, waste management, and related activities.

Tentative Agenda

1 p.m. Call to Order by Co-Deputy Designated Federal Officers, Ed Worth and Lee Bishop.

Establishment of a Quorum, Lorelei Novak:

- Roll Call;
- Excused Absences.

Welcome and Introductions, Ralph Phelps.

Approval of Agenda.

Approval of September 30, 2009 Meeting Minutes.

1:15 p.m. Old Business:

- Written reports;
- Other items.

1:30 p.m. New Business.

1:45 p.m. Co-Deputy Designated Federal Officers' Report, Ed Worth and Lee Bishop.

2:15 p.m. NNMCAB Annual Evaluation Report, Pam Henline.

2:45 p.m. Break.

3 p.m. Matters From Board Members.

3:30 p.m. Presentation on Los Alamos National Laboratory Groundwater Monitoring System (Existing and New Wells), Danny Katzman.

5 p.m. Dinner Break.

6 p.m. Public Comment Period.

6:15 p.m. Consideration and Action on Recommendation(s).

7:00 p.m. End of Year Report, Michael Graham.

7:45 p.m. Meeting Feedback.

8 p.m. Adjourn, Ed Worth and Lee Bishop.

Public Participation: The EM SSAB, Northern New Mexico, welcomes the attendance of the public at its advisory committee meetings and will make every effort to accommodate persons with physical disabilities or special needs. If you require special accommodations due to a disability, please contact Menice Santistevan at least seven days in advance of the meeting at the telephone number listed above. Written statements may be filed with the Board either before or after the meeting. Individuals who wish to make oral statements pertaining to agenda items should contact Menice Santistevan at the address or telephone number listed above. Requests must be received five days prior to the meeting and reasonable provision will be made to include the presentation in the agenda. The Deputy Designated Federal Officer is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Individuals wishing to make public comment will be provided a maximum of five minutes to present their comments.

Minutes: Minutes will be available by writing or calling Menice Santistevan at the address or phone number listed above. Minutes and other Board documents are on the Internet at: *http://www.nnmcab.org/.*

Issued at Washington, DC on October 20, 2009.

Rachel Samuel,

Deputy Committee Management Officer.

[FR Doc. E9–25842 Filed 10–26–09; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Oak Ridge Reservation

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: This notice announces a meeting of the Environmental Management Site-Specific Advisory Board (EM SSAB), Oak Ridge Reservation. The Federal Advisory Committee Act (Pub. L. 92–463, 86 Stat. 770) requires that public notice of this meeting be announced in the **Federal Register**.

DATES: Wednesday, November18, 2009, 6 p.m.

ADDRESSES: DOE Information Center, 475 Oak Ridge Turnpike, Oak Ridge, Tennessee.

FOR FURTHER INFORMATION CONTACT: Patricia J. Halsey, Federal Coordinator, Department of Energy Oak Ridge Operations Office, P.O. Box 2001, EM–90, Oak Ridge, TN 37831. Phone (865) 576–4025; Fax (865) 576–2347 or e-mail: *halseypj@oro.doe.gov* or check the Web site at *http://www.oakridge.doe.gov/em/ssab.*

SUPPLEMENTARY INFORMATION:

Purpose of the Board: The purpose of the Board is to make recommendations to DOE in the areas of environmental restoration, waste management, and related activities.

Tentative Agenda: The main meeting presentation will be on Mercury Remediation Strategy and Activities.

Public Participation: The EM SSAB, Oak Ridge, welcomes the attendance of the public at its advisory committee meetings and will make every effort to accommodate persons with physical disabilities or special needs. If you require special accommodations due to a disability, please contact Pat Halsey at least seven days in advance of the meeting at the phone number listed above. Written statements may be filed with the Board either before or after the meeting. Individuals who wish to make oral statements pertaining to the agenda item should contact Pat Halsey at the address or telephone number listed above. Requests must be received five days prior to the meeting and reasonable provision will be made to include the presentation in the agenda. The Deputy Designated Federal Officer is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Individuals wishing to make public comment will be provided a maximum of five minutes to present their comments.

APPENDIX B
SCOPING MEETING ANNOUCEMENT

FRIB EA SCOPING MEETING

A Notice of Intent (NOI) was published in the *Federal Register* on October 27, 2009, announcing the U.S. Department of Energy's (DOE's) intention of preparing an environmental assessment (EA) to fund the construction and operation of the Facility for Rare Isotope Beams (FRIB) at Michigan State University (MSU). DOE determined that the establishment of the FRIB is a high priority for the future of U.S. nuclear science research. The FRIB establishes a highly sophisticated research laboratory that would produce intense beams of rare isotopes. These beams enable 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 public is invited to participate in the open exchange of information and submission of comments on the proposed scope and content of the FRIB EA beginning at **6:30 p.m.** on **November 11, 2009**, in the Biomedical and Physical Sciences Building (BPS) on the MSU campus in East Lansing, Michigan. This meeting will be preceded by an educational open house at **4:00 p.m.** to be held at the National Superconducting Cyclotron Laboratory, which is adjacent to BPS.

Opportunities to Comment

The scoping period is October 27 through December 11, 2009. All comments, both oral and written, received during this period will be given equal consideration during the development of the EA. Comments may be submitted at the scoping meeting or by:

U.S. MAIL: FRIB Comments, U.S. Department of Energy (STS), Chicago Office, 9800 South Cass Avenue, Argonne, Illinois 60439; **E-MAIL:** frib.comments@ch.doe.gov; **ONLINE:** http://www.frib.msu.edu/NEPA/; **TOLL-FREE FAX:** 1-888-676-3672.

Meeting Schedule — Wednesday, November 11, 2009

Educational Open House	4:00 p.m. to 6:00 p.m.	National Superconducting Cyclotron Laboratory (NSCL)
Scoping Meeting	6:30 to 10:00 p.m.	Biomedical and Physical Sciences Building (BPS) — Room 1410

Free parking available — please visit http://www.frib.msu.edu/NEPA/ for further details.

APPENDIX C
SCOPING MEETING ADVERTISEMENT

The U.S. Department of Energy Invites the Public to Comment on the Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

November 11, 2009

EDUCATIONAL OPEN HOUSE
4:00 p.m. to 6:00 p.m.
National Superconducting Cyclotron Lab. (NSCL)

SCOPING MEETING
6:30 to 10:00 p.m.
Biomedical and Physical Sciences Bldg. (BPS)
Free Parking – For details visit
http://www.frib.msu.edu/NEPA/

The public is invited to participate in the open exchange of information and submission of comments on the proposed scope and content of the FRIB EA beginning at **6:30 p.m.** on **November 11, 2009**, in the BPS on the MSU campus in East Lansing. This meeting will be preceded by an educational open house at **4:00 p.m.** to be held at the NSCL, which is adjacent to BPS.

The scoping period is Oct. 27 through Dec. 11, 2009. All comments, both oral and written, received during this period will be given equal consideration during the development of the EA. Comments may be submitted at the scoping meeting or by:

U.S. MAIL: FRIB Comments,
U.S. Department of Energy (STS),
Chicago Office, 9800 South Cass Avenue,
Argonne, IL 60439
E-MAIL: frib.comments@ch.doe.gov
ONLINE: http://www.frib.msu.edu/NEPA/
TOLL-FREE FAX: 1-888-676-3672

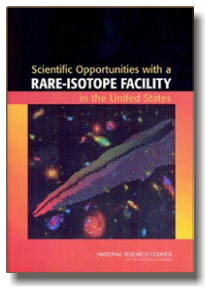
APPENDIX D
SCOPING MEETING POSTERS

FRIB Project History

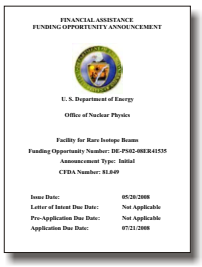
Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

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.

U.S. DEPARTMENT OF ENERGY | Office of Science

FRIB

MICHIGAN STATE UNIVERSITY

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 ≤2 mrem/(any one hour) MSU ALARA Goal[3]: < 10 mrem/year and ≤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).

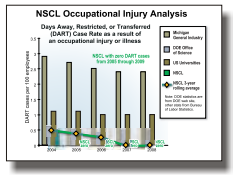
[3] Note: Some conservative self imposed limits are used to provide flexibility in the design, commissioning, and operation of the FRIB and accommodate future upgrades or changes in mission. The as low as reasonably achievable (ALARA) goals represent action levels for the FRIB and MSU where actions are 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 ALARA goal 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.



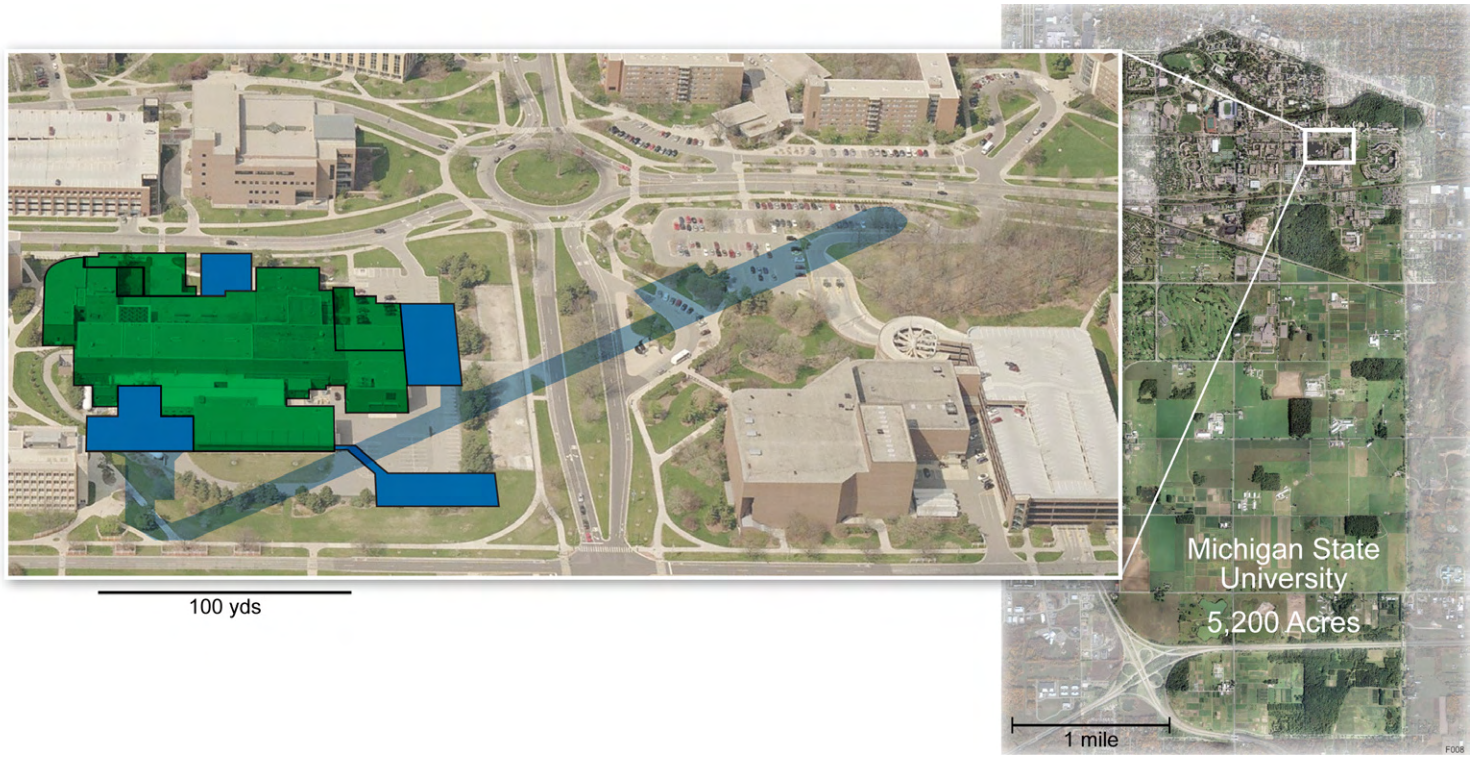
Existing MSU Applicable Licenses, Permits, and Registrations

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 *et seq*
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

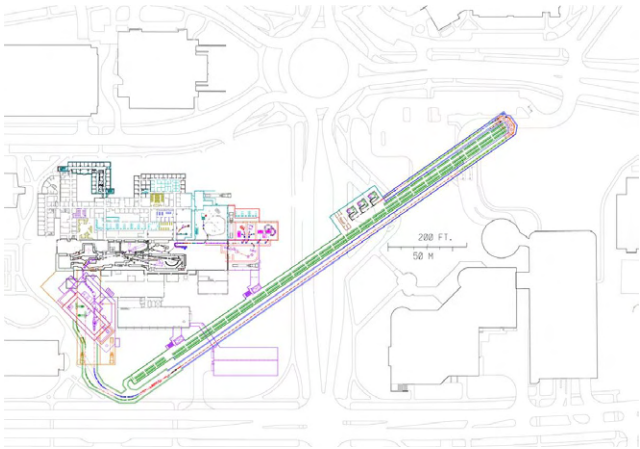
The State of Michigan, the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), the U.S. Department of Labor (DOL), and U.S. Nuclear Regulatory Commission (NRC) would have regulatory authority for the FRIB construction and operation. Required permits have been obtained.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

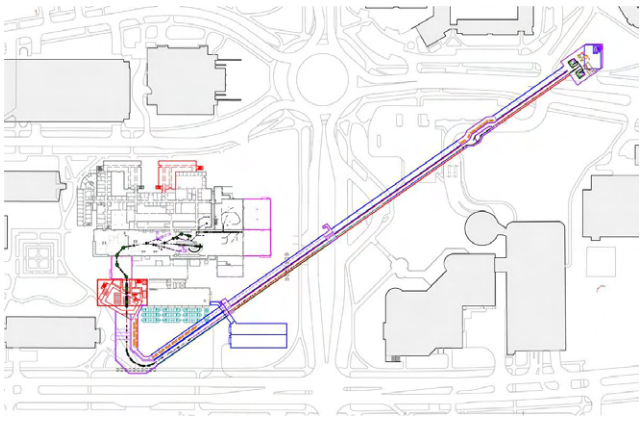
Proposed FRIB Site and Design

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)



Alternative Configurations





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From NSCL to FRIB

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

1958 Michigan State University (MSU) hires first accelerator expert

1961 National Science Foundation (NSF) approves sector foscused K50 cyclotron

1965 Research with K50; single turn extration

1975 NSF approves superconducting cyclotron magnet prototype

1977 NSF approves K500 cyclotron

1978 Nuclear Science Advisory Committee (NSAC) recommends national user facility at MSU

1982 Research with stable beams from K500

1989 Research with stable beams from K1200

1990 Research with fast rare isotope beams from A1200

1996 NSF approves coupled cyclotron facility (CCF)

2001 Research with fast rare isotope beams from CCF

2002 Infrastructure for Superconducting Radio-Frequency (SRF) linear accelerator research and development

2005 Research with trapped rare isotope beams

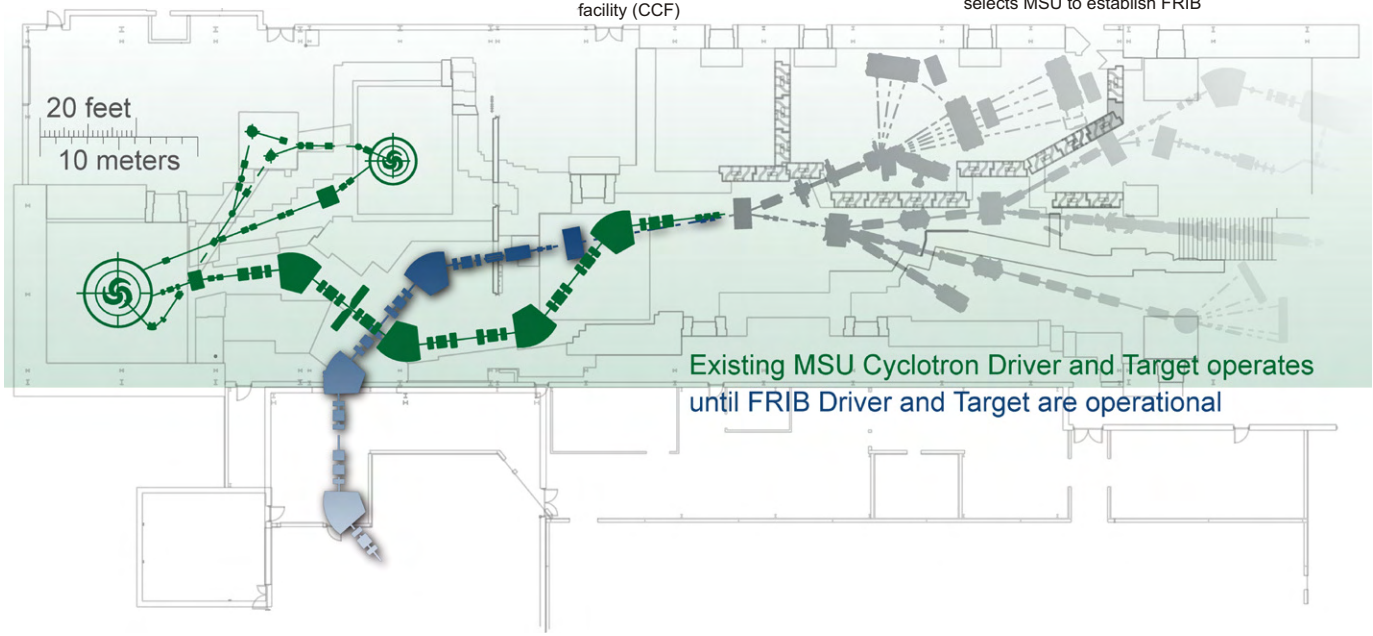
2006 MSU funds ReA3 reaccelerator project

2008 U.S. Department of Energy (DOE) selects MSU to establish FRIB

2010 Research with reaccelerated rare isotope beams from ReA3

2017 FRIB operational

National Superconducting Cyclotron Laboratory (NSCL) → **FRIB**



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Establishment of FRIB

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

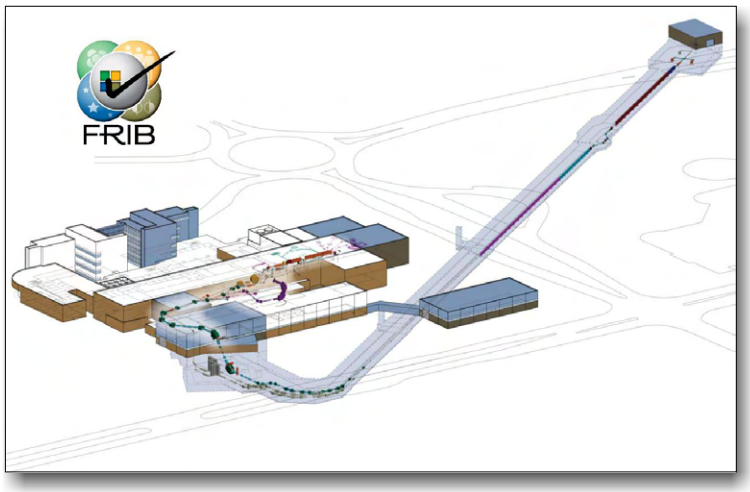
National Superconducting Cyclotron Laboratory (NSCL)

(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)

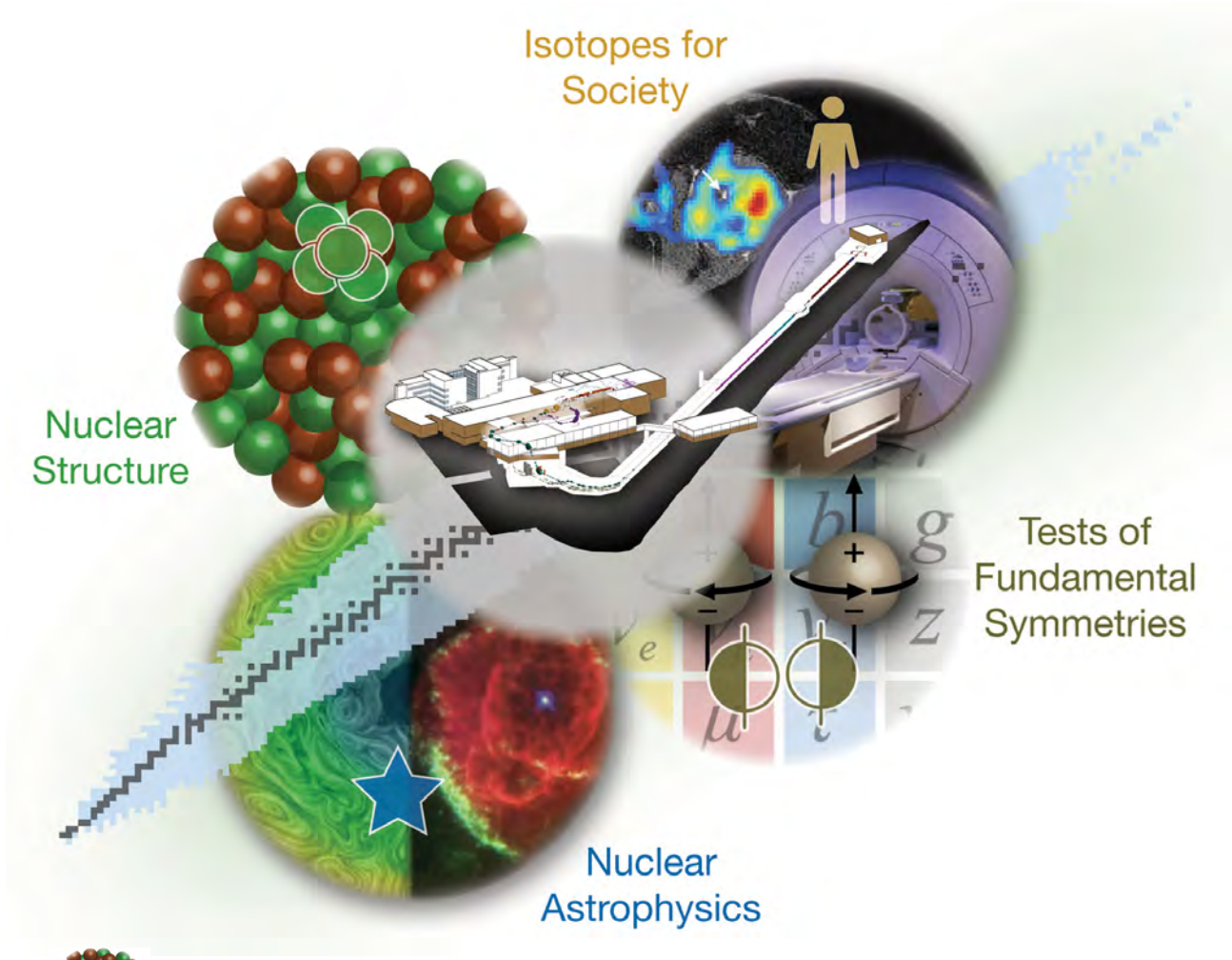
(anticipated 2017):

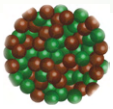


- National user facility operated by MSU and funded by the U.S. Department of Energy (DOE) through a Cooperative Agreement
- Up to 1,000 users from around the world
- Approximately 400 employees
- Approximately $50 million annually in DOE funding
- Superconducting linear accelerator accelerates and smashes 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, EPA, DOT, DOL, and NRC
- Same ISO and OHSAS registrations as for NSCL

Facility for Rare Isotope Beams Research Goals

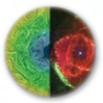
Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)





Properties of nucleonic matter

- Classical domain of nuclear science
- Many-body quantum problem: intellectual overlap to mesoscopic science - how to understand the world from simple building blocks

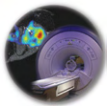


Nuclear processes in the universe

- Energy generation in stars, (explosive) nucleo-synthesis
- Properties of neutron stars, Equation-of-State (EOS) of asymmetric nuclear matter

Test of fundamental symmetries

- Effects of symmetry violations are amplified in certain nuclei



Societal applications and benefits

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

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Periodic Table of the Elements and Chart of Nuclides

Facility for Rare Isotope Beams Environmental Assessment (FRIB EA)

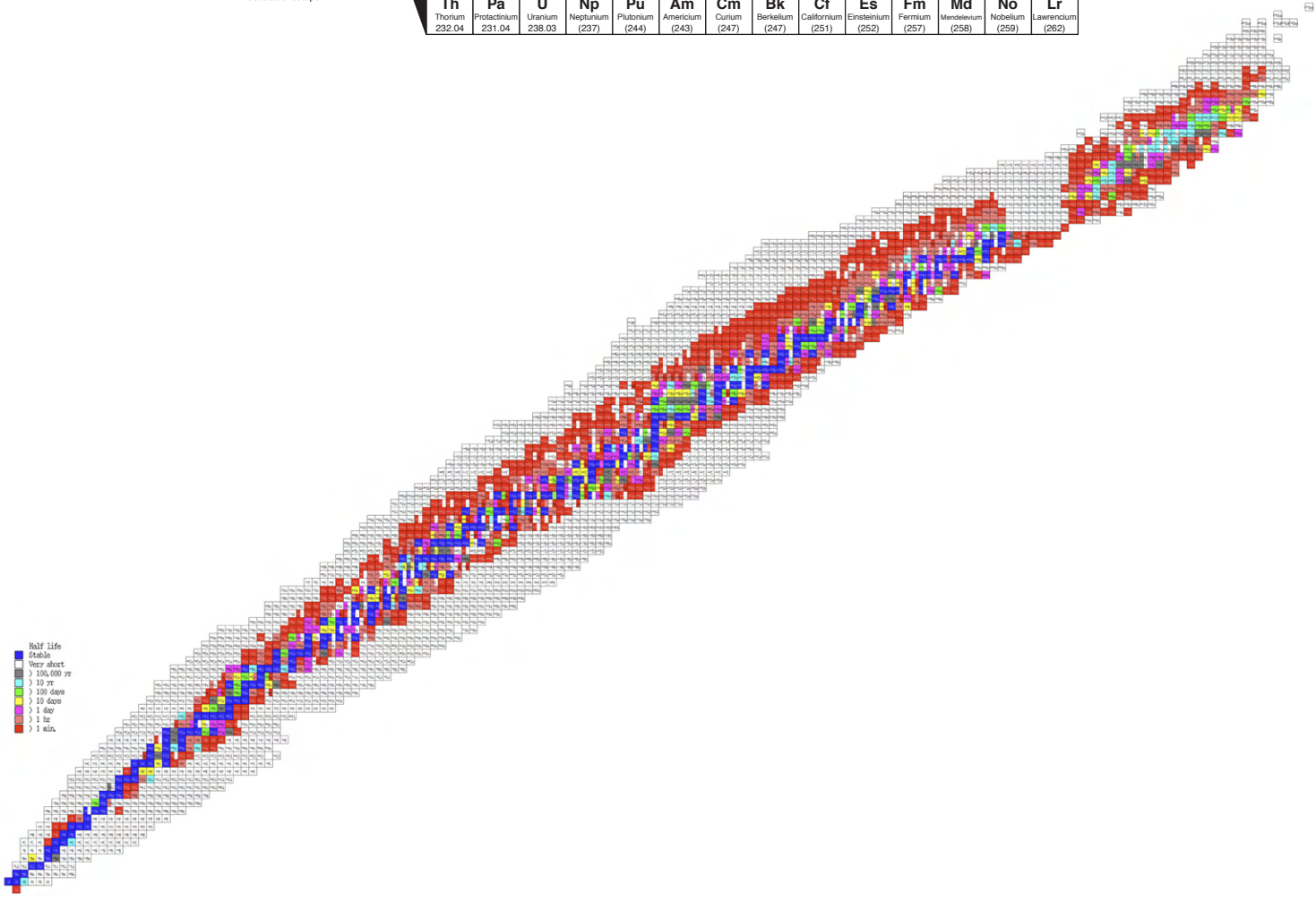
	1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 H Hydrogen 1.01	2 2A																2 He Helium 4.00
2	3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
3	11 Na Sodium 22.99	12 Mg Magnesium 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
4	19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
6	55 Cs Cesium 132.91	56 Ba Barium 137.33	57 La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (269)	109 Mt Meitnerium (268)									

Key

11 — Atomic number
Na — Element symbol
Sodium — Element name
22.99 — Average atomic mass*

* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97
90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)



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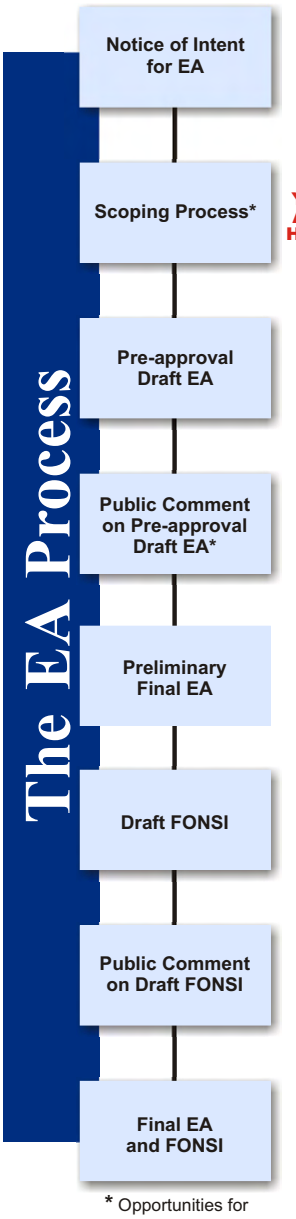
What is an Environmental Assessment?

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.



* 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.

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.

U.S. DEPARTMENT OF ENERGY | Office of Science
FRIB
MICHIGAN STATE UNIVERSITY

APPENDIX E
SCOPING MEETING WRITTEN MATERIALS

Scoping Meeting Objectives and Agenda

SCOPING MEETING OBJECTIVES

The objectives of the Facility for Rare Isotope Beams Environmental Assessment (FRIB EA) scoping meeting are to:

- inform stakeholders about the proposed action to build the FRIB on the campus of Michigan State University (MSU); and
- solicit relevant, focused input from stakeholders on the scope of the FRIB EA, including identification of a range of reasonable alternatives and environmental issues to be analyzed.

SCOPING PROCESS

To encourage meaningful public involvement, the U.S. Department of Energy (DOE) is sponsoring a public meeting in the vicinity of the proposed action for the construction and operation of the FRIB. The purpose of this meeting is to provide participants the opportunity to meet officials from the DOE Office of Science (SC) and MSU, who are working cooperatively to prepare the EA, as well as design the FRIB to ensure it meets DOE's mission requirements and allows the United States to maintain its leadership in the fields of nuclear astrophysics, nuclear structure, and fundamental symmetries. The results of the scoping meeting will be a better understanding among members of the public of the proposed action, input on the scope of the FRIB EA, and a better understanding within DOE of public preferences and/or concerns.

A court reporter will transcribe the comments provided during the formal comment phase. Comments obtained at this scoping meeting, as well as oral and written comments obtained from other communication mechanisms, will be given equal consideration in defining the scope of the FRIB EA.

Scoping Meeting Agenda

Registration: 6:30 p.m.
- Receive registration packet
- Sign-up to provide comments
- View exhibits, review information materials, and speak with subject matter experts

Presentation: 7:00 p.m.
- Welcome and introductions
- FRIB project
- Questions and answers

Formal Comment Period: 8:00 p.m. – 10:00 p.m.
- Participants provide comments
- Concluding remarks
- Comments captured by a court reporter

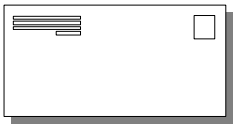
NOTE: Times are approximate and are subject to change based on meeting attendance levels.

OVER→

Opportunities for Public Comment

The U.S. Department of Energy (DOE) and Michigan State University (MSU) are fully committed to providing the public access to information about its activities and opportunities for involvement in preparing the Facility for Rare Isotope Beams Environmental Assessment (FRIB EA). Accordingly, DOE is soliciting written and oral comments on the proposed scope and issues that should be addressed in the FRIB EA.

A variety of methods listed below are available for providing comment. All comments received by close of business December 11, 2009, both written and oral, will be equally considered when developing the draft FRIB EA. Late comments will be considered to the extent practicable.



FRIB Comments
U.S. Department of Energy (STS)
9800 South Cass Avenue
Argonne, IL 60439

Web site: http://www.frib.msu.edu/NEPA/

E-mail: frib.comments@ch.doe.gov

Written comments may be submitted by faxing to our 24-hour toll-free number: 1-888-676-3672

Participants in the public meetings will have access to the following tools to assist them in submitting written and oral comments:

Project Staff:	To answer questions and discuss issues
Comment Forms:	To prepare and submit written comments
Court Reporter:	To record oral comments

Facility for Rare Isotope Beams Environmental Assessment

PURPOSE AND NEED

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 establishes a highly sophisticated research laboratory that would produce intense beams of rare isotopes. These beams enable 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 concept has undergone numerous studies and assessments within DOE and by independent parties such as the National Research Council of the National Academy of Sciences. These studies—in addition to the joint DOE and National Science Foundation, Nuclear Science Advisory Committee 2007 Long Range Plan—concluded that such a facility is a vital part of the U.S. nuclear science portfolio, complements existing and planned international efforts, and will provide capabilities unmatched elsewhere.

PROPOSED ACTION AND ALTERNATIVES

A Notice of Intent (NOI) was published in the *Federal Register* on October 27, 2009, announcing DOE's intention of preparing an environmental assessment (EA) to evaluate the potential environmental impacts of the proposal to construct and operate the FRIB on approximately 10 acres on the Michigan State University (MSU) campus in East Lansing. Its design is comprised of buildings and/or building additions for a heavy ion/proton accelerator and ancillary laboratories, support facilities such as a cryomodule, and offices. Construction would occur on campus, adjacent to the existing National Superconducting Cyclotron Laboratory (NSCL), which would ultimately be subsumed into FRIB. The function, scope, and licensing of operations of FRIB would be similar to NSCL, but FRIB would have substantially more power.

Most of the structures that would house the accelerator would be thick-walled, reinforced concrete structures. The heavy ion linear accelerator (linac) would be located in a tunnel below grade. A trench (varying between 30 and 75 feet below grade up to 1,800 feet long) would be excavated for the accelerator, necessitating that Bogue Street be closed between Wilson Road and East Shaw Lane two years and portions of East Shaw Lane possibly to be closed for a number of months. The high-energy end of the accelerator would join with the existing NSCL building.

The National Environmental Policy Act (NEPA) requires that Federal agencies consider a range of reasonable alternatives for implementing a proposed action. The FRIB EA will analyze the following preliminary alternatives; however, public input during the scoping period may result in the addition of other alternatives:

- No action alternative (i.e., maintain current research capability at NSCL and do not proceed with the proposed FRIB). NEPA requires agencies to consider a no action alternative.
- Build and operate the proposed FRIB at MSU. Two configurations are under consideration: a straight linac and a folded linac.

PRELIMINARY IDENTIFICATION OF ENVIRONMENTAL ISSUES

In the EA, DOE will examine public health and safety effects and environmental impacts from the construction and operation of the proposed FRIB at MSU. DOE has tentatively identified a list of potential environmental issues for

analysis. It is not intended to be comprehensive or to imply any predetermination of impacts but serves as a starting point for the public when considering their comments. These issues include:

- impacts from construction accidents;
- impacts to both workers and the public from potential exposure to radiation and other hazards under routine operations and credible accident scenarios including natural disasters (e.g., floods, hurricanes, tornadoes, and seismic events);
- transportation-related impacts;
- impacts on surface and groundwater and on water use and quality;
- impacts on air and soil;
- socioeconomic impacts;
- disproportionately high and adverse impacts on minority and low income populations;
- impacts on land-use plans, policies and controls, and visual resources;
- pollution prevention and waste management practices and activities;
- unavoidable adverse impacts, and irreversible and irretrievable commitments of resources;
- cumulative environmental effects of past, present, and reasonably foreseeable future actions;
- status of compliance with all applicable Federal, state and local statutes and regulations, international agreements, and required Federal and state environmental permits, consultations, and notifications; and
- impacts of intentional destructive acts, including sabotage and terrorism.

Because the proposed site is adjacent to a currently operating accelerator facility and would involve digging and construction in previously disturbed areas now occupied primarily by parking lots and roads, impacts in several areas are expected to be minor. These impact areas will therefore not be evaluated in detail:

- impacts on protected, threatened, endangered, or sensitive species of animals or plants, or their critical habitats;
- impacts on cultural or historic resources; and
- impacts on floodplains and wetlands.

DECISIONS TO BE MADE

Environmental consequences are of great importance to DOE in this endeavor and will be an integral part of the decision-making process. If at any time during preparation of the EA DOE determines that potentially significant environmental impacts might occur with the implementation of the proposed action and that an environmental impact statement (EIS) would be needed, DOE will issue an NOI in the *Federal Register*.

No decisions will be made in the EA itself; however, the decision whether to build the FRIB will be made based on the analyses, as well as public comment. Should the analysis indicate no significant environmental impacts DOE will issue a finding of no significant impact (FONSI).

PUBLIC INVOLVEMENT

DOE is currently soliciting public input on the scope of the FRIB EA and holding a public meeting to facilitate public participation. In addition to providing oral comments or submitting written comments at the meeting, the following communication mechanisms are available. All comments, both oral and written, received during the scoping period (October 27 through December 11, 2009), will be given equal consideration.

U.S. MAIL: FRIB Comments
U.S. Department of Energy (STS)
9800 South Cass Avenue
Argonne, IL 60439

E-MAIL: frib.comments@ch.doe.gov
ONLINE: http://www.frib.msu.edu/NEPA
TOLL-FREE FAX: 1-888-676-3672


Journey
Into the Heart of Matter
The Department of Energy's Office of Science Office of Nuclear Physics

Nuclear physics is a quest to understand the origin, evolution and structure of the matter of the universe that leads to stars, the Earth and us.

Introduction

Through research, nuclear physicists are leading us on a journey of discovery into the nucleus of the atom — the very heart of matter. The goal is a roadmap of matter that will help unlock the secrets of how the universe is put together.

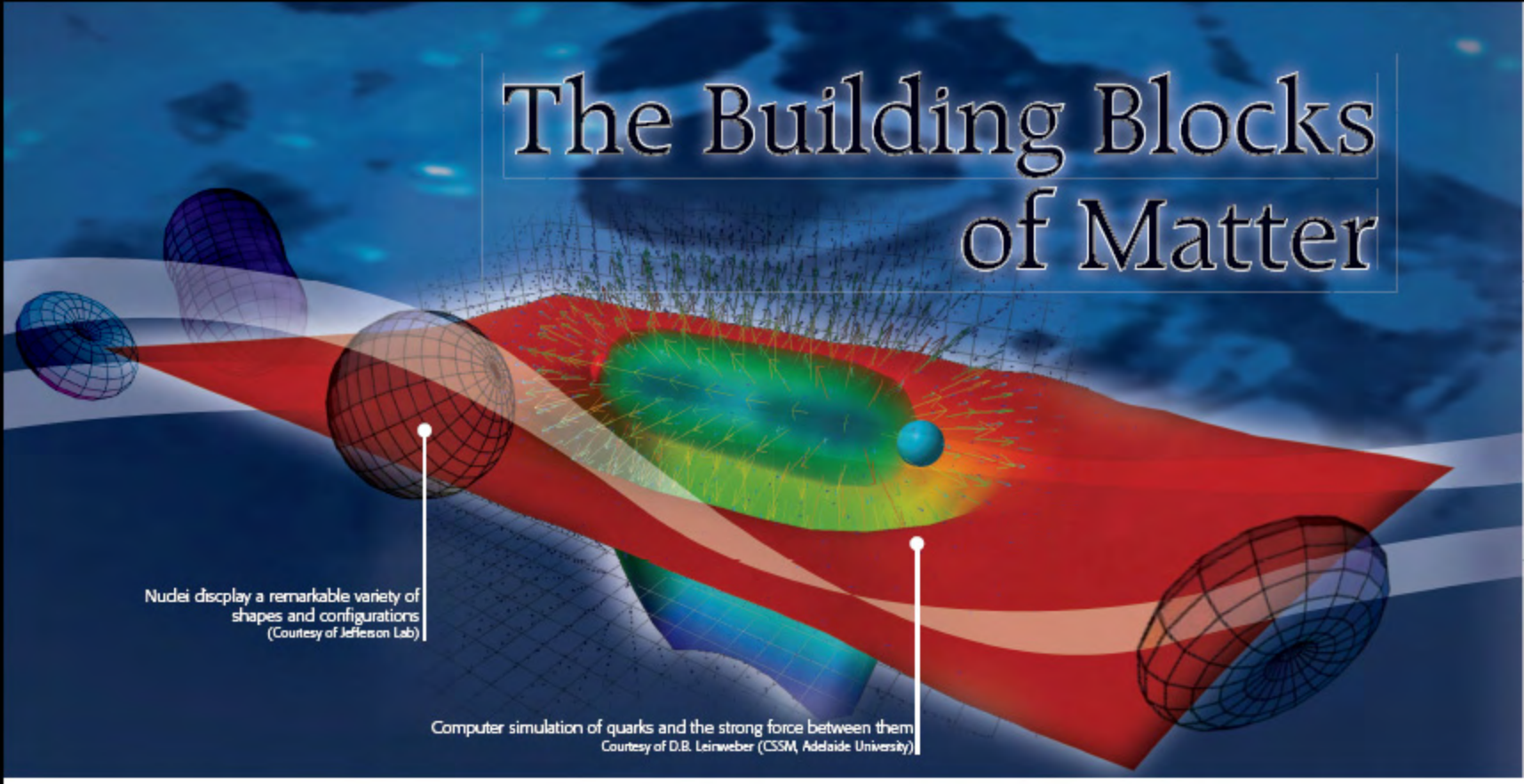
The Office of Nuclear Physics in the Department of Energy's (DOE's) Office of Science supports the experimental and theoretical research needed to create this roadmap. This quest requires a broad approach to different, but related, scientific frontiers: improving our understanding of the building blocks of matter; discovering the origins of nuclei; and identifying the forces that transform matter. Stewardship of the field is shared with the National Science Foundation's (NSF's) Nuclear Physics Program. DOE and NSF fund almost all basic research in nuclear physics.

Funding for nuclear physics provides leading-edge instrumentation, world-class facilities, and training and support for the people involved in these pursuits. The result is a vast array of information that is helping us understand the universe at ever-deeper levels.

Forefront nuclear physics research provides solid foundations for other fields: the accumulation of new results and the intellectual training of new generations of scientists foster important advances in medicine, chemistry and other sciences.

Join us on our journey into the heart of matter and learn how nuclear physicists are creating a roadmap of the evolution and structure matter that will benefit our nation for generations.

The Building Blocks of Matter



Nuclei display a remarkable variety of shapes and configurations
(Courtesy of Jefferson Lab)

Computer simulation of quarks and the strong force between them
Courtesy of D.B. Leinweber (CSSM, Adelaide University)

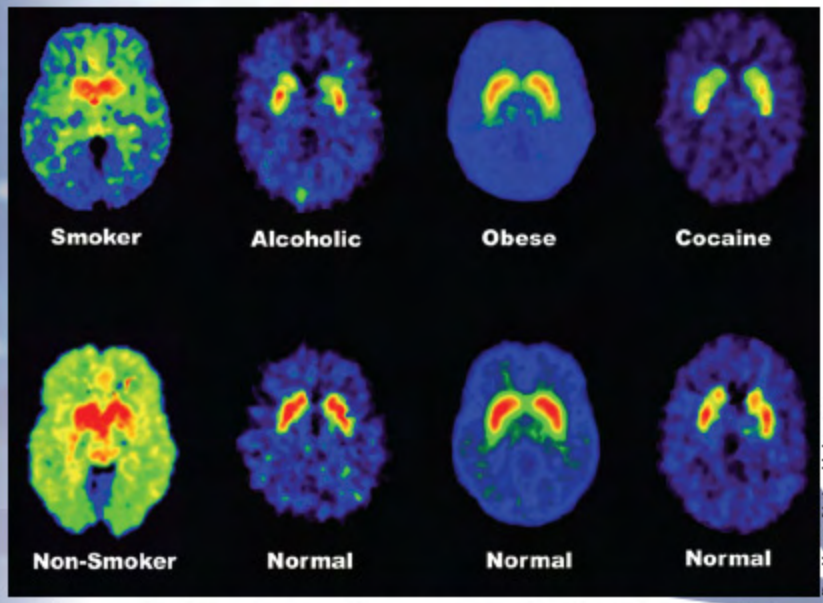
A Journey in Space

Nearly all of what we see in the universe, from people to stars, gets its mass from nuclei. As we zoom into smaller and smaller dimensions, from human hearts to cells, from molecules to atoms, we reach the nucleus at the center of an atom surrounded by a cloud of electrons. If an atom were the size of a football stadium, its nucleus would be about the size of a marble. Despite its tiny dimensions, the nucleus accounts for 99.9% of an atom's mass.

The microscopes that scientists use for peering into a nucleus are accelerators that bounce energetic particles or other nuclei from the nucleus, breaking pieces off of it or adding energy to it. The detectors used to look at these collisions reveal that nuclei are turbulent, active environments. Protons and neutrons swirl around each other at up to half the speed of light in a cosmic dance that gives rise to a remarkable range and diversity of shapes and configurations.

For example, nuclei containing up to some 100 protons and 150 neutrons have been found, but one extraordinary puzzle is that a nucleus with 250 constituents is about the same size as one special case containing just 11. To study such diverse behavior, nuclear physicists are using accelerators to create "designer nuclei." Finding simple, reproducible patterns among the many complex behaviors of both designer and ordinary nuclei will allow us to better understand how and why certain chemical elements are found on Earth and in stars.

Going one level deeper, nuclear physicists are looking at the building blocks of protons and neutrons: quarks and gluons. The theory of Quantum Chromodynamics, or QCD, describes how quarks exchange gluons, much the way children toss a ball back and forth. According to QCD, this exchange of gluons binds quarks together via the strong force. This force is so strong that when pried even a little



Brookhaven National Laboratory

As a by-product of building and using accelerators, pioneering nuclear physicists have also developed new tools to peer inside the human body. Using radiotracers and positron emission tomography (PET) scanners developed by nuclear physicists, biochemical clues have been identified for a range of addictive behaviors including smoking, alcoholism, overeating, and drug abuse. The PET scans reveal that people with addictions have fewer receptors for one of the brain's "pleasure" chemicals and may be attempting to compensate for a blunted pleasure response by taking drugs.

Nuclear Physics Applications

The precise knowledge of nuclear materials and nuclear reactions gained through basic research in nuclear physics has yielded many benefits for society, including:

- radiation therapy for eradicating cancer while shielding healthy tissues from harm
- medical imaging technologies such as X-ray, MRI and PET
- the potential for abundant nuclear power and safer ways to dispose of nuclear waste
- radiation detectors for screening cargo and protecting our national security

apart, quarks experience many tons of force pulling them together again.

As a result, protons and neutrons are hot, bubbling cauldrons of activity. Quarks and gluons jiggle around inside at nearly light-speed, and extra gluons and quark/anti-quark pairs may even pop into existence one moment only to disappear the next. It is this flurry of activity, fueled by the energy of the gluons, that generates nearly all the mass of protons and neutrons and thus ultimately of all the matter we see. One of the most bewildering questions nuclear physicists are trying to answer is how the basic properties of protons and neutrons like mass, shape and spin come about from this flood of gluons, quark/anti-quark pairs and a few ever-present quarks.

Scientists are also investigating how the strong force that glues quarks and gluons together influences nuclear properties. A small fraction of that force leaks out beyond the edges of protons and neutrons and binds them together to form nuclei. Thus, the very same force that makes a proton or a neutron also generates nuclei. We are only beginning to understand how this "leakage" occurs and how it results in the impressive variety of nuclei found in nature.

Nuclear physicists study the building blocks of nuclei that make up 99.9% of the mass of our everyday world.

The Origin of Nuclei

A Journey Through Time

When you examine the matter surrounding us, you are seeing material distilled in the hearts of stars. Tracing the origin of the carbon in your blood or the calcium in your bones is a journey through time.

More than 15 billion years ago, the Big Bang produced a scorching-hot fireball of the most basic particles. A few millionths of a second later, just as hot water vapor condenses to liquid, some of the simplest components of the matter we see today — protons and neutrons — formed as the primordial fireball expanded and cooled. For the first time since this unique event, nuclear physicists are now recreating in the laboratory the matter that existed in that first fraction of a second of the universe's life to learn how it condensed into protons and neutrons.

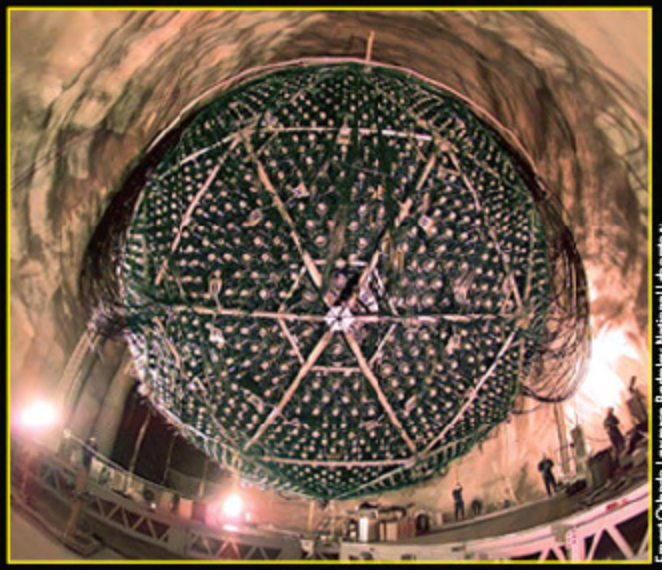
One of the greatest mysteries scientists are exploring is why the pure energy of the Big Bang did not turn into equal amounts of matter and antimatter. Antimatter is extremely rare in nature. Experiments in nuclear physics are helping to reveal secrets of the forces that acted during the universe's earliest moments to find out why.

In the minutes following the Big Bang, the first, simplest nuclei formed. Gravity exerted its sway on the swirling gas of atoms and formed clumps of hydrogen atoms, which compressed, heated and started to fuse and glow. A new light shone in the formerly dark universe, powered by the energy of nuclear reactions. As the stars evolved, these nuclear reactions produced heavier and heavier nuclei.

Relatively small stars like our sun burn steadily for billions of years, creating the conditions needed for life. Nuclear physics experiments can detect not only the light from the surface of our sun but also ghost-

NASA/IR-Caltech/O. Krause (Steward Observatory)

Using tools like the NSCL at Michigan State University, ATLAS at Argonne National Laboratory and HRIBF at Oak Ridge National Laboratory nuclear physicists are deciphering the processes by which supernova explosions create elements.



Ernest Orlando Lawrence Berkeley National Laboratory

Neutrinos are produced in vast numbers in some nuclear reactions, such as those that occur in the processes that light the stars and in the nuclear power plants that light our cities. But neutrinos rarely interact with other matter. They can pass through the entire Earth without interacting with a single atom. Neutrinos get even stranger: they can morph into one of three different types and back again. These properties make neutrinos notoriously difficult to study — and fascinating. The Sudbury Neutrino Detector, located over one mile underground (pictured above), provided the first direct evidence that neutrinos change as they travel from the core of the sun to the Earth.

like neutrinos that emerge from the fiery nuclear reactions at its core. These experiments are confirming our picture of the sun. They have also revealed that neutrinos change their nature during their 93-million-mile journey to Earth. This "oscillation" from one neutrino type to another demonstrates that neutrinos have mass. While that mass is tiny, there are so many neutrinos in the cosmos that their total mass may outweigh that of the visible stars.

Large stars burn up quickly and can end their lives in catastrophic explosions. Supernovas, which briefly shine brighter than an entire galaxy of stars, may be the source of over half the elements heavier than iron and may create additional short-lived nuclei, such as those containing extra neutrons. Fingerprints of these unusual nuclei can be seen in the chemical distribution of the elements on Earth.

However, this story can only be partly told: simulated supernovas in today's computer models fail to explode at all. What does nature know about the properties of neutrinos and nuclei that we do not? Through nuclear physics research, scientists are aiming to find out.

Massive detectors enable nuclear physicists to study the processes that allowed matter to form after the Big Bang and learn about the origin of nuclei and the ultimate fate of stars.

Changing Matter

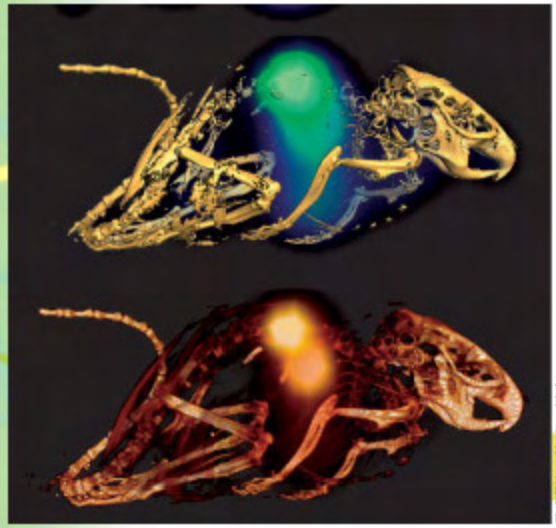
A Journey to the Extremes

What happens when you boil water? Bend metal? Burn wood? Throughout human history, scientific thinkers have asked questions about what happens when you change matter. Even babies act as scientists, pushing and pulling on everything around them to learn how things work. Such experimentation is essential to our survival and often helps us gain control of our world.

In experiments using powerful particle accelerators, nuclear physicists poke and prod nuclei by colliding atoms or subatomic particles to discover what happens when these packets of particles are heated to extreme temperatures under extreme pressure. These experiments are allowing scientists to change things in a predictable way, so they can see what happens as conditions like temperature and density vary, observe at what point significant changes occur, and determine how to control the transitions. It's much like being able to watch the evolution of the universe on "videotape" — rewinding, fast-forwarding and freeze-framing to better understand what transpired.

Nuclear physicists are also probing matter at larger scales to see nuclei we have never seen before, how nuclei transform themselves from one type to another, how long they live, and how to detect such a change has taken place.

Future facilities will allow scientists to create the neutron-rich exotic nuclei that may be formed in supernovas to understand how elements are produced in the universe. They are also aiming to create nuclei with exotic species of quarks. Most nuclei in nature are primarily made of "up" and "down" quarks. Nuclear physicists are creating nuclei



Oak Ridge National Lab

The knowledge of unstable nuclei is allowing the collaboration of Oak Ridge National Lab, Jefferson Lab and Johns Hopkins University to develop a small-animal imager that collects metabolic and structural images of mice as they move freely within a very small space. Scientists are developing a similar system for medical imaging of children, eliminating the need for sedation.

with a third species of quark, "strange" quarks, to probe how the force that holds the nucleus together changes when different building blocks are used to make nuclei.

Today's experiments are only just beginning to allow nuclear physicists to examine the properties of these exotic nuclei, and tomorrow offers even more exciting possibilities. New advances in accelerator technology pioneered by this scientific community have made it possible to plan new facilities that can cook up fresh batches of star-stuff. This will help us understand, for example, why the sun burns as brightly as it does and how long it's likely to continue. It may also help us discover which nuclei might be used as tiny specialists to journey into our bodies to diagnose disease and vanish once their job is done.

Accelerators allow nuclear physicists to study matter under different conditions to learn how its building blocks interact and combine to form more complex particles and materials, helping scientists search for new ways to benefit society.

Nuclear Science Education

Profiles in Nuclear Physics

Jennifer Thomas, a Naval Officer with HSL-49, the Helicopter Anti-Submarine Squadron Light, served in 2005 aboard the USS Ingraham, deployed with Expeditionary Strike Group One in support of the Global War on Terrorism. She is an Aircraft Commander flying SH-60B Seahawk helicopters. Her leadership, reasoning skills and hands-on technical experience were developed while studying for her master's degree in instrumentation from the State University of New York at Stonybrook. That experience enabled her to build large detector systems for nuclear physics experiments at Brookhaven National Lab and prepared her for a successful career in the Navy.

Investing in Our Nation's Future

Nuclear science is a key component of the Nation's research capabilities. In addition to providing fundamental insights into the origin, evolution and structure of matter, nuclear scientists create knowledge and devices that are directly applicable to the nation's energy resources, security safeguards, health needs, environmental protection and economic vitality. Students with nuclear science training become the skilled workforce necessary for the many industries that apply nuclear science and related technologies.

Research and development for homeland security is an important application of nuclear science. Detection systems based on the very same technologies developed in nuclear physics experiments are providing important techniques for efficiently and unobtrusively screening transport containers at our nation's borders. These methods draw heavily on nuclear science expertise in detector development, experimental simulation, source design and analysis.

Declining oil reserves and mounting concerns about greenhouse gases and global warming are making nuclear power more attractive as a reliable source of energy for the future. Nuclear science faculty educate and train nuclear power engineers. Responsible stewardship of the Nation's nuclear power industry relies on a capably trained nuclear science workforce.

The growing field of nuclear medicine has its origin in nuclear science. Applications developed in the last 50 years include beams of ionizing radiation, magnetic resonance imaging, and radionuclides for medical imaging. These techniques, for example, enable the early detection of cancer and detailed studies of how the brain and heart function.

David Fields began his career in experimental nuclear physics, gaining experience in detection and sensor hardware and analysis of complex data. He has worked at Lawrence Livermore National Laboratory and the Defense Advanced Research Projects Agency (DARPA), managing research programs focusing on weapons, weapons physics, non-lethal systems, land mine detection, sensors, and communications. As an independent government contractor, he now supports defense, intelligence, and homeland security organizations. His undergraduate research in nuclear physics at Tennessee Technological University was supported by the DOE. Fields has a Ph.D. in physics from Michigan State University, and he credits his Ph.D. training with enhancing his ability to grasp complex physical concepts in diverse disciplines and to parse problems and projects.

Roland Henry is pioneering new MRI techniques to study brain structure and function at the Center for Molecular and Functional Imaging in the University of California, San Francisco Radiology Department. These studies include neurological disorders like brain tumors, Multiple Sclerosis, and Amyotrophic Lateral Sclerosis (ALS), as well as normal and abnormal development of the neonatal brain. As an associate professor, he is also teaching and training a new generation of biomedical engineers in the Graduate Program in Bioengineering at UC's Berkeley and San Francisco campuses. His skill at extracting signals from large backgrounds was developed by taking some of the first measurements of highly elongated heavy nuclei using efficient gamma-ray detectors at Argonne National Lab. He is the second person originally from Belize to received a Ph.D. in physics (1992).

Ani Aprahamian is the Chair of the Department of Physics at the University of Notre Dame and the Director of the Institute for Structure and Nuclear Astrophysics. She is investigating how the properties of nuclei can affect the distributions of the "star stuff" that we are all made of. She is presently measuring the half-lives of the most neutron-rich nuclei made in the laboratory. These measurements provide crucial historical information about our universe. At the same time, Aprahamian and her graduate students are investigating the role long-lived states (isomers) in nuclear reactions have on neutron stars. These studies lead to a wide range of potential applications – from medicine to energy storage to basic nuclear science. Aprahamian earned her Ph.D. from Clark University.

Diagnostic techniques with roots in nuclear science become even more important as our society ages.

Students in nuclear science gain a broad range of skills that are invaluable to the workforce, including problem solving, mining of data from large data sets, working in teams, advanced theoretical modeling and mathematical skills, and computer simulation of complex systems. Over two-thirds of nuclear science graduates find employment outside of academia, representing a significant transfer of knowledge to meet society's needs.

Advanced education in nuclear science has contributed to America's prosperity and technological advances for more than half a century. A robust educational system supporting and training the best U.S. scientists and engineers and attracting outstanding students and scientists from other nations is essential for producing a world-class workforce.

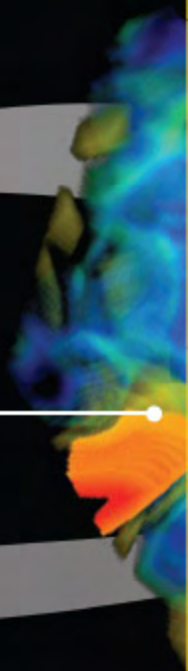
Nuclear scientists fill a variety of roles in government and industry in careers ranging from finance to medical physics.

The Department of Energy's Office of Nuclear Physics is the primary funding agency for the quest to understand the origin, evolution and structure of the matter in the universe leading to the stars, the Earth and us.

The Department of Energy's Office of Nuclear Physics supports national labs and university research groups and provides research tools utilized by the national and international research community. These trailblazers are adding to the knowledge base of humankind, developing new technologies, training the next generation of scientists, and improving the science literacy of the general public.

From the question of how it all began, to what the far future holds, from dissecting things we can observe in the universe, to searching for things unseen, nuclear physicists are testing the boundaries of our knowledge. The only way to find out where these experiments might lead is to keep moving forward with the endeavor to explore and understand the heart of matter.

For more information, visit: www.science.doe.gov/feature/NP.htm



Computer simulation of fluctuations in the strong force
Coutesy: Brookhaven National Lab

This brochure was collaboratively prepared by participants from Argonne National Lab, Brookhaven National Lab, Jefferson Lab, Lawrence Berkeley National Lab, Oak Ridge National Lab, Massachusetts Institute of Technology, Michigan State University, National Science Foundation and the University of Maryland using funds from the Office of Nuclear Physics.

Glossary of Technical Terms

absorber: Any material that stops ionizing radiation. Lead, concrete, and steel attenuate gamma rays. A thin sheet of paper or metal will stop or absorb alpha particles and most beta particles.

accelerator: Device used to increase the energy of particles, which then collide with other particles. Major types are linear accelerators and circular accelerators. The name refers to the path taken by the accelerated particle.

atom: A particle of matter indivisible by chemical means. It is the fundamental building block of molecules. It consists of a positively charged nucleus and orbiting electrons. The number of electrons is the same as the number of protons in the nucleus.

atomic number: *Z*, the total number of protons found in a nucleus.

beta particle (beta radiation, beta ray): An electron of either positive charge (e^+ or b+) or negative charge (e, e^- or b-) emitted by an atomic nucleus or neutron in the process of a transformation. Beta particles are more penetrating than alpha particles but less than gamma rays or x-rays. Electron capture is a form of beta decay.

Big Bang: Beginning of the universe; a transition from conditions of unimaginable density and temperature to conditions of lower density and temperature.

cryogenic: The branches of physics and engineering that involve the study of very low temperatures, how to produce them, and how materials behave at those temperatures. Cryogenic cooling of devices and material is usually achieved via the use of liquid nitrogen, liquid helium, or a cryocompressor (which uses high pressure helium lines).

cyclotron: Circular accelerator in which the particle is bent in traveling through a magnetic field, and an oscillating potential difference causes the particles to gain energy.

decay (radioactive): The change of one radioactive nuclide into a different nuclide by the spontaneous emission of radiation such as alpha, beta, or gamma rays, or by electron capture. The end product is a less energetic, more stable nucleus. Each decay process has a definite half-life.

detector: A device or series of devices to used to measure nuclear particles and radiations.

dose: A general term denoting the effect of absorption of a quantity of radiation or energy absorbed.

electron: An elementary particle with a unit electrical charge and a mass 1/1837 that of the proton. Electrons surround an atom's positively charged nucleus and determine that atom's chemical properties.

electron capture: A radioactive decay process in which an orbital electron is captured by and merges with the nucleus. The mass number is unchanged, but the atomic number is decreased by one.

electronvolt (eV): A unit of energy equal to the kinetic energy (or energy of motion) an electron gains when being accelerated through a potential difference on 1 volt. Another unit of energy is the joule and 1 joule equals 6.2415E18 eV. One joule is roughly the energy needed to lift 1 kg (2.2 pounds) on the surface of the earth by 0.1 meter (4 inches). **keV:** One thousand electronvolts. **MeV:** One million electronvolts.

gamma ray: A highly penetrating type of nuclear radiation, similar to x-radiation, except that it comes from within the nucleus of an atom, and, in general, has a shorter wavelength.

half-life: The time in which half the (large number of) atoms of a particular radioactive nuclide disintegrate. The half-life is a characteristic property of each radioactive isotope.

ion: An atomic particle that is electrically charged, either negatively or positively.

isotope: Isotopes of a given element have the same atomic number (same number of protons in their nuclei) but different mass numbers (different number of neutrons in their nuclei). ^{238}U and ^{235}U are isotopes of uranium.

linac: Another name for a linear accelerator.

linear accelerator: Particle accelerator laid out in a straight line. FRIB will have a linear accelerator. An alternative considered is a folded linear accelerator.

mass number: The total number of protons and neutrons in the nucleus**:** $A=Z+N$. This is also the total nucleon number of the

nuclear reaction: A reaction involving an atomic nucleus. It is usually initiated by bombarding a target nucleus with a radiation, called a projectile. The interaction of the radiation with the nucleus may cause the emission of other radiations, called ejectiles.

neutron: One of the basic particles that make up a nucleus. A neutron and a proton have about the same mass, but the neutron has no electrical charge.

neutron number: The total number of neutrons in the nucleus, N.

nucleon: A constituent of the nucleus; that is, a proton or a neutron.

nucleus: The core of the atom, where most of its mass and all of its positive charge is concentrated. Except for ^{1}H, the nucleus consists of a combination of protons and neutrons.

nuclide: Any species of atom that exists for a measurable length of time. A nuclide can be distinguished by its atomic mass, atomic number, and energy state.

proton: One of the basic particles that makes up an atom. The proton is found in the nucleus and has a positive electrical charge equal to the negative charge of an electron and a mass similar to that of a neutron**:** a hydrogen nucleus.

proton number: The total number of protons in the nucleus, Z.

radioactive waste: Materials that are radioactive and for which there is no further use.

radioactivity: The spontaneous decay or disintegration of an unstable atomic nucleus accompanied by the emission of radiation.

shielding: A protective barrier, usually a dense material, that reduces the passage of radiation from radioactive materials to the surroundings by absorbing it.

source: A radioactive material that produces radiation for experimental or industrial use.

stable: Strictly speaking, a nuclide that is not radioactive. The definition is often relaxed to include very long-lived nuclides that are naturally occurring.

superconductivity: occurs in certain materials at very low temperatures. When superconductive, a material has an electrical resistance of exactly zero and no interior magnetic field.

symmetry: Invariance of equations of motion under changes in condition.

target nuclide: The initial nucleus in a nuclear reaction on which a projectile is incident. It is used in the context of a nuclear reaction where the projectile interacts with a target nucleus, producing a product nucleus and an ejectile.

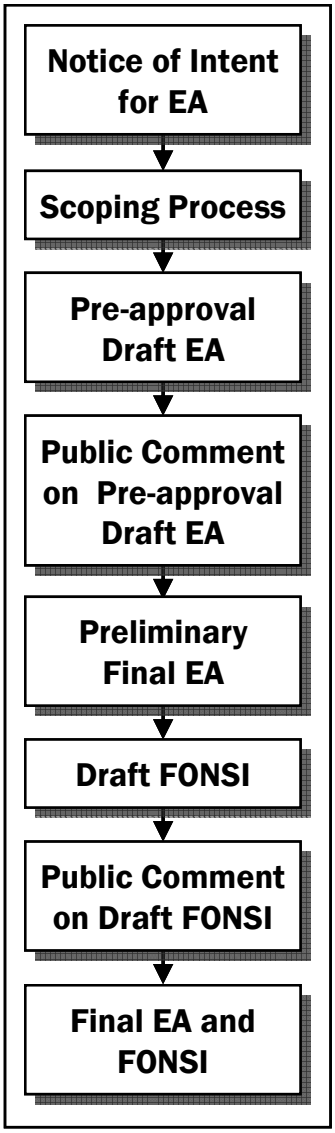
x-ray: Electromagnetic radiation with wavelengths between ultraviolet and gamma rays.

FRIB, NEPA, and You

The U.S. Department of Energy (DOE) has prepared this fact sheet to encourage and help you to participate in the DOE National Environmental Policy Act (NEPA) process for the Facility for Rare Isotope Beams (FRIB) at Michigan State University (MSU). DOE has determined that it must prepare an environmental assessment (EA) to ascertain whether project construction or operation have the potential to significantly affect the environment. This fact sheet describes the planned NEPA activities, focusing on opportunities for your involvement.

HOW CAN I BE INVOLVED IN THE PREPARATION OF THE FRIB EA?

DOE takes a graded approach in designing public participation processes. The following process was designed specifically with public interest in the FRIB in mind.



✓ **Notice of Intent (NOI).** On October 27, 2009, DOE published an NOI to prepare an EA in the *Federal Register* and subsequently made announcements in the local media. The NOI states the need for action and provides preliminary information on the EA scope. The NOI serves as the beginning of the scoping process.

TIP: The NOI explains how you can participate in the scoping process.

✓ **Scoping Process.** DOE requests your comments on the scope on the FRIB EA. What alternatives should be evaluated? What potential environmental impacts should be analyzed? The FRIB scoping process will last through December 11, 2009. A public meeting will be held on November 11, 2009.

TIP: During the scoping process, tell DOE what EA information you would like.

- **Pre-approval Draft EA.** DOE will consider scoping comments in preparing a Draft EA. The Draft EA will analyze the potential environmental impacts of the FRIB, and will provide for a comparison with project alternatives, one of which is always a "no action" alternative. It will also discuss ways to avoid or reduce potential adverse impacts. It is expected to be completed in the spring of 2010.
- **Public Comment Period on the Draft EA.** DOE will send e-mails and letters to those on its mailing list and issue a public announcement opening a 30-day public comment period. DOE will also present details regarding how to comment on the Draft EA, either in writing or orally at a public meeting yet to be scheduled.

TIP: If you did not sign up during scoping to receive a copy of the Draft EA, the public announcement will advise you about how to obtain one. http://www.frib.msu.edu/nepa can also keep you up-to-date.

- **Preliminary Final EA.** DOE will consider all timely public comments on the Draft EA in preparing the Final EA. The Final EA will address those comments. It is scheduled to be completed in the summer of 2010.
- **Draft Finding of No Significant Impact (FONSI).** Unless the Draft EA reveals the potential for significant environmental impacts, DOE will prepare a Draft FONSI, which will discuss the basis for such a finding and describe any commitments for mitigating potential environmental impacts. Such a determination will be made late in the summer of 2010. If a FONSI can not be supported, DOE would prepare an environmental impact statement.
- **Public Comment on Draft FONSI.** If a Draft FONSI is prepared, DOE will make the appropriate public announcements and open a 30-day public comment period.
- **Final EA and FONSI.** In the absence of new evidence of significant impacts during the public comment period, DOE will finalize the EA and FONSI. At this time, MSU will be authorized to proceed with FRIB.

NEPA Background

WHAT IS NEPA?

The National Environmental Policy Act (NEPA) is a Federal law that serves as the Nation's basic charter for environmental protection. It requires that all Federal agencies consider the potential environmental impacts of proposed actions which are subject to their control and responsibility and which have the potential to significantly effect the environment. NEPA promotes better agency decision making by ensuring that high quality environmental information is available to agency officials and the public before the agency decides whether and how to undertake a major Federal action. Through the NEPA process, you have an opportunity to learn about government agencies' proposed actions and to provide timely information and comments.

To implement NEPA, all Federal agencies follow procedures issued by the President's Council on Environmental Quality in the Code of Federal Regulations (40 CFR Parts 1500-1508). DOE also follows its own supplementary procedures, found in 10 CFR Part 1021.

HOW DOES NEPA WORK?

Early in its planning process for a proposed action, DOE considers how to comply with the NEPA. The appropriate level of review depends on the significance (i.e., the context and intensity) of the potential environmental impacts associated with the proposed action. There are three levels of NEPA review:

- **Environmental Impact Statement (EIS).** For major Federal actions that may significantly affect the quality of the human environment, NEPA requires preparation of an EIS. An EIS is a detailed analysis of the potential environmental impacts of a proposed action and the range of reasonable alternatives. Public participation is an important part of the EIS process.
- **Environmental Assessment (EA).** When the need for an EIS is unclear, an agency may prepare an EA to determine whether to prepare an EIS or to issue a Finding of No Significant Impact (FONSI). An EA is a brief analysis. DOE's procedures normally provide notification and comment opportunities for host states and tribes only. DOE also may provide notification and comment opportunities for other interested people. DOE considers any comments received, makes revisions as appropriate, and issues the EA and FONSI. If at any point during preparation of the EA DOE determines that significant impacts would be likely, an EIS is prepared
- **Categorical Exclusion.** DOE's NEPA regulations list classes of actions that normally do not require an EIS or an EA because, individually or cumulatively, they do not have the potential for significant environmental impacts. Examples are information gathering activities and property transfers when the use is unchanged.

WHAT KINDS OF POTENTIAL ENVIRONMENTAL IMPACTS DO NEPA DOCUMENTS EXPLORE?

EAs and EISs present coordinated analyses of a broad range of potential environmental impacts, including those to: human health, air, water, soil, biological resources, and historical/cultural resources.

DOE Encourages Public Participation

DOE is committed to open communication and providing public access to pertinent information and opportunities for involvement throughout the NEPA process. Accordingly, DOE encourages your participation because it helps shape the scope and issues addressed in the FRIB EA.

The scoping period ends Dec. 11, 2009. All comments, both oral and written, received during this period will be given equal consideration during the development of the EA. Comments may be submitted at the scoping meeting or by:

U.S. MAIL: FRIB Comments
U.S. Department of Energy (STS)
9800 South Cass Avenue
Argonne, IL 60439

E-MAIL: frib.comments@ch.doe.gov
ONLINE: http://www.frib.msu.edu/NEPA
TOLL-FREE FAX: 1-888-676-3672

For specific information on the FRIB EA visit http://www.frib.msu.edu/NEPA/ or contact the NEPA Compliance Officer, Peter Siebach at (630)-252-2007 or peter.siebach@ch.doe.gov. For further information on NEPA visit: http://www.eh.doe.gov/NEPA or http://ceq.hss.doe.gov/nepa/nepanet.htm

FRIB EA Scoping Comment Form

Please provide the following information:

Name: _____

Title: _____

Organization: _____

Address: _____

_____

City: _____ State: _____ Zip Code: _____

E-mail Address: _____ _____

Comments: _____

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(Continued on back for your convenience)

THANK YOU FOR PARTICIPATING

Please return this form to the registration table. It may also be mailed or faxed as follows:

U.S. MAIL

FRIB Comments
U.S. Department of Energy (STS)
Chicago Office
9800 South Cass Avenue
Argonne, IL 60439

TOLL-FREE FAX

1-888-676-3672