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DOE Nuclear Safety Research and Development Program - 15413

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ABSTRACT

A corporate Nuclear Safety Research and Development (NSR&D) Program has been established by the U.S. Department of Energy (DOE), managed by the Office of Nuclear Safety in DOE's Office of Environment, Health, Safety and Security (EHSS). Among the objectives of the program are the identification, support, and dissemination of the results of R&D to address cross-cutting nuclear safety issues relevant to the design, construction, and operation of DOE civilian and defense nuclear facilities. Most of the projects supported by the NSR&D Program are selected from responses to an annual Call for Proposals, which is distributed to the National Nuclear Security Administration (NNSA) and DOE Program Offices, and to the contractors operating DOE and NNSA nuclear facilities. Additional NSR&D projects have been initiated by the Office of Nuclear Safety to support the Office's mission of developing DOE nuclear safety policy. The Office of Nuclear Safety continues to work closely with NNSA and DOE program offices to expand the number and scope of NSR&D projects, and to look for opportunities to collaborate with other organizations to identify and study nuclear safety issues relevant to DOE's nuclear facilities.

INTRODUCTION

In order to foster the integration and support of research, analysis, and testing in nuclear safety technologies, the U.S. Department of Energy (DOE) established its corporate Nuclear Safety Research and Development (NSR&D) Program, managed by the Office of Nuclear Safety in DOE's Office of Environment, Health, Safety and Security (EHSS). The objectives of the program include the identification, support, and dissemination of the results of R&D to address cross-cutting nuclear safety issues relevant to the design, construction, and operation of DOE civilian and defense nuclear facilities. This paper discusses the DOE NSR&D Program's background and establishment, current projects and near-term objectives, and the Office of Nuclear Safety's plans for enhancing and expanding the Program's activities.

BACKGROUND

DOE's Offices of Environmental Management (EM), Nuclear Energy (NE), and Science (SC), and the NNSA are responsible for the operation, by their contractors, of a wide range of both civilian and defense-related nuclear facilities at national laboratories, nuclear security sites, and industrial facilities. Those nuclear facilities range from non-power reactors, such as the Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL), to radioactive waste storage and processing facilities, such as those at the Savannah River Site (SRS), to facilities for the testing, processing, and storage of special nuclear material (SNM), such as the Plutonium Facility (PF-4) at Los Alamos National Laboratory (LANL). EM, NE, SC, and NNSA are also

responsible for safety oversight of their nuclear facilities; consequently, each Office has historically conducted its own nuclear safety R&D programs to support its mission. However, inter-Office coordination of R&D projects and communication of results was inconsistent, and the ability to investigate cross-cutting safety issues that could affect multiple Offices' nuclear facilities was limited.

To provide a corporate-level focus on research related to nuclear safety at DOE facilities, the NSR&D Program was formally established in 2011. As noted above, the program is managed by the Office of Nuclear Safety, which is the DOE organization responsible for the development of nuclear safety policy. The corporate NSR&D Program includes participation of all of the Offices responsible for civilian and defense nuclear facilities. The emphasis of the program is on broad-based nuclear safety issues; specific research areas and their application to DOE nuclear safety are discussed below. The following sections cover the establishment the NSR&D Program, the processes of soliciting and selecting research proposals, and an overview of the projects that have been undertaken.

ESTABLISHMENT AND ORGANIZATION OF THE NSR&D PROGRAM

The initial phase in the establishment of the NSR&D Program was to develop a Program Operating Plan [1], setting out the objectives and processes of the Program, and the roles and responsibilities of the Offices participating in it. Management of the Program was assigned to the Office of Nuclear Safety, in the Office of Health, Safety and Security (HSS).[a] The positions of Program Manager and Project Manager were established; the Program Manager is responsible for overall program leadership and coordination with participating Offices, while the Project Manager is responsible for oversight of R&D projects supported by the Program. The Nuclear Safety R&D Committee, chaired by the NSR&D Program Manager and further comprising one representative from each participating Program Office and one representative from the staff of the Chief of Nuclear Safety (CNS)[b] for each Office, was also established to provide advice and assistance in development and operation of the Program. A formal charter for the NSR&D Committee was developed and approved by HSS, EM, SC, NE, and NNSA senior management and their respective CNS/CDNS.

The Program Operating Plan established the objectives of the NSR&D Program, including:

- Establishment of an enduring Departmental commitment and capability to utilize NSR&D in preventing and/or reducing the hazards and risks posed by DOE and NNSA nuclear facilities, operations, nuclear explosives, and environmental restoration activities;

- Fostering a Departmental culture that embraces NSR&D as a standard business practice for affecting continuous improvement in nuclear facility safety consistent with Integrated Safety Management (ISM) principles; and

[a] HSS became the Office of Environment, Health, Safety and Security (EHSS) in 2014.
[b] The NNSA Chief of Nuclear Safety is referred to as the Chief of Defense Nuclear Safety (CDNS).

- Optimization of NSR&D resources in resolving existing and emerging nuclear facility safety concerns.

Another key responsibility of the Program, to improve inter-Office coordination and communication, is the development of an Annual Report on DOE Nuclear Safety R&D. This report covers both the activities of the NSR&D Program and nuclear safety research relevant to DOE facilities and operations, funded separately by NNSA and DOE Program Offices.

The Operation Plan also discussed the means by which the Program would identify and support R&D projects. This process will be described in the next section.

This initial phase of the establishment of the NSR&D Program was complete by the middle of 2012, and the Program commenced operations shortly thereafter.

OPERATION OF THE NSR&D PROGRAM

As described in the NSR&D Program Operating Plan, the primary method for identifying prospective NSR&D projects is through a DOE-wide Call for Proposals. In addition, other projects may be identified separately by Office of Nuclear Safety management or staff, or by DOE or NNSA senior management.

As discussed above, DOE nuclear facilities and operations include a wide range of types and missions. The focus of the project identification process is to help ensure that NSR&D projects supported by the corporate program address nuclear safety issues common to multiple facilities and programmatic missions. In this regard, it may be instructive to compare the DOE NSR&D Program to the research programs sponsored by the U.S. Nuclear Regulatory Commission's (NRC's) Office of Nuclear Regulatory Research (RES). RES's mission is to undertake research to support the NRC's regulatory responsibilities, e.g., developing the technical bases underlying its regulatory requirements and the acceptable methods for NRC licensees (or license applicants) to satisfy those requirements. However, the NRC does not own or operate nuclear facilities, and research to support or improve facility or operational safety is generally the responsibility of the facility owner or licensee, or the broader nuclear industry, as appropriate.

In DOE's case, nuclear safety R&D projects may be undertaken to support the development of new or improved technical bases for the safety requirements and guidance that DOE establishes for the contractors who operate the Department's facilities. However, as the owner of its nuclear facilities, DOE also has a responsibility to conduct R&D to improve facility and operational safety. These considerations are important in determining which projects should be supported by the corporate NSR&D Program.

Development of a DOE-wide Call for Proposals began upon formal establishment of the NSR&D Program, in mid-2012; it was distributed in early 2013 to the participating NNSA and DOE Program Offices and to DOE nuclear facility contractors. Twenty-three proposals were submitted for consideration. Evaluation of the proposals was performed by the NSR&D Committee. Based on the project evaluation criteria and available funding, three projects were selected for funding:

- Development and manufacture of an ergonomically-sound glovebox glove
- Development and testing of a ceramic HEPA filter
- Development of an in-place testing instrument for nuclear material containers

The third project has been completed and the final report is currently being reviewed. The first projects are currently in progress, with completion expected in 2015.

The second Department-wide call for proposals was distributed in January 2014. A significant addition to the proposal submission process was a requirement to obtain an endorsement from either the DOE or NNSA field/site office overseeing the submitting facility or from the DOE Headquarters (HQ) Office responsible for operation of the facility. In the event that multiple proposals were submitted via one field/site or HQ office, the endorsement was required to include a prioritized ranking of the proposals. Thirty-two proposals were submitted, an increase of nearly 40% over 2013. The NSR&D Committee once again evaluated the proposed research projects, and four were selected for support, again consistent with available funding, which was approximately 50% greater than in fiscal year (FY) 2013. Those four projects are:

- Study of HEPA filter degradation due to aging
- Development and validation of methodology to model flow in ventilation systems commonly found in nuclear facilities
- Computational capability to substantiate DOE-Handbook-3010 data
- Stochastic modeling of radioactive material releases

These projects were initiated in September or October 2014, and are scheduled to be completed in 2015.

The third call for proposals, for FY 2015, is currently being developed, and is scheduled for distribution in late 2014. The anticipated funding for FY 2015 again represents an increase of approximately 50% over that provided in FY 2014.

In addition to the projects undertaken as a result of the calls for proposals, the Office of Nuclear Safety has initiated three projects involving the preparation of technical reports addressing the following cross-cutting nuclear safety issues:

- Calculations of atmospheric dispersion at onsite locations for DOE nuclear facilities
- Relationship between DOE nuclear facility safety objectives and accident analysis dose consequences
- Spray release modeling

Draft reports have been developed for the first two of these projects, and are currently under review. The third project began in mid-2014 and is scheduled for completion in 2015.

As noted above, the NSR&D Program is also responsible for an Annual Report on Nuclear Safety Research and Development. The first such report [2] was completed in December 2014. The second annual report is currently being developed, for distribution in late 2015.

The NSR&D Committee reviews the proposal submission and evaluation process after the completion of each year's cycle. As a result, adjustments are made in the proposal review criteria and other elements of the process, such as the requirement for endorsements discussed above.

The NSR&D Program also maintains contacts with nuclear safety R&D-related organizations outside of DOE, including the NRC and the NSR&D Subgroup of the Safety Analysis Working Group (SAWG) of the Energy Facilities Contractors Group (EFCOG). Opportunities for additional collaborations, e.g., with the Electric Power Research Institute (EPRI), are also being explored.

Overall, experience with the NSR&D Program indicates that it is operating consistent with its Operating Plan, and the basic processes that the Program has put in place are sound. Expansion of the Program, consistent with available funding and Departmental needs, is expected to continue .

CONCLUSIONS

DOE has established a corporate NSR&D Program to facilitate the identification, performance, and dissemination of information related to research associated with the safety of the Department's civilian and defense-related nuclear facilities and operations. The program is managed by the Office of Nuclear Safety, in cooperation with NNSA and DOE Program Offices responsible for the operation and oversight of those nuclear facilities. Program funding has grown by more than a factor of two over the three years that it has been in operation, and there has been an enthusiastic and growing response to the solicitation of proposals for NSR&D projects. The Office of Nuclear Safety continues to work closely with NNSA and DOE Program Offices to expand the number and scope of NSR&D projects, and to look for opportunities to collaborate with other organizations to identify and study nuclear safety issues relevant to DOE's nuclear facilities.

REFERENCES

1. Department of Energy Office of Nuclear Safety, "Nuclear Safety Research and Development Program Operating Plan" (2012), available at http://energy.gov/ea/downloads/nuclear-safety-research-and-development-program-operating-plan

2. Department of Energy Office of Nuclear Safety, “Nuclear Safety Research and Development Annual Report,” NSRD-2014-TD-02 (2014), available at http://energy.gov/ehss/downloads/nuclear-safety-research-and-development-annual-report-december-2014-0