Environmental Review Form for Argonne National Laboratory

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Created By:	Woodford, John B.

Creator

Badge:	**51790**	Name:	**Woodford, John B.**
Cost Center:	**254**	Division:	**WSH**
Job Title:	**Safety Specialist 5**	Employee Type:	**Regular Full-Time Exempt**
Building:	**208**	Lab Extension:	**2-0910**

General Information

Project/Activity Title: Reduction of Severe Accident Uncertainties (ROSAU) Project

ASO NEPA Tracking No.: Type of Funding:

B & R Code: Identifying Number: NSEFY20-01

SPP Proposal Number: 2019-19072 CRADA Proposal Number:

Work Project Number: ANL Accounting Number: (Item 3a in Field Work Proposal)

Other (explain):

List appropriate NEPA Owners:

Division: NSE NEPA Owner:

Financial Plans

To select a Financial Plan, click the magnifying glass icon to open a search window.

Cost Center: Project: Phase: Task:

Description of Proposed Action

This project is planned to focus on addressing two of the knowledge gaps in severe accident analysis and management identified in the aftermath of the Fukushima Daiichi accident; specifically, i) characterizing the extent of core melt spreading under flooded cavity conditions,and ii) the effect of metal content in melt on molten core/concrete interaction and in-core and ex-core debris coolability. A five-year experimental program is anticipated. The program would consist of two types of experiments, designed to address the two knowledge gaps identified above: 1) simulant core melt would be produced and injected into a ~10-square meter spreading sector up to 7.25 m long containing water. Melt masses may be as high as ~300 kg. Melt composition, flow rate, temperature, and depth are the key parameters to be varied during the test program. Fission product simulants may be included in the melts. A dry test may be performed as a baseline. Six large-scale tests are planned during the course of the program. 2) simulant core melts would be produced with varying amounts of metal (steel and/or zirconium alloy) and allowed to ablate concrete under top-flooding conditions. Decay heat will be simulated using Joule or inductive heating of the melts. Melt masses will be ~100 kg, and metal content will range up to 30%. In addition, coolant purity may be varied; for example, to simulate sea water that may be used for emergency cooling in plants located on a seacoast. Following the tests, the fracture strength of the solidified corium will be determined. Five tests are planned in this category. Note that these are similar to those carried out as part of the previous molten core/concrete interaction (MCCI) experiments (cf. ASO-CX-283), albeit on a somewhat smaller scale and including examination of a different set of experimental parameters. In all cases, the core melts would be produced using depleted uranium oxide (U_3O_8), zirconium metal, chromium (VI) oxide, concrete oxides and metal thereof, all in granular form. Initial heating is accomplished via the redox reaction between zirconium and chromium (VI) oxide, which will rapidly raise the temperature to ~2300 degrees C. Depleted uranium provides the correct behavior for the core melt while reducing the radioactivity by 25% compared to natural uranium. Following each experiment, the test apparatus would be disassembled to document the post-test debris configuration and perform any further characterization. The quenched melt and other components will ultimately be disposed of as low-level radioactive waste, although they will be retained long enough to facilitate the post-test characterization activities. Proposed ancillary tasks related to the test include preparation of the spreading sector and the concrete molds, which may be performed in the Building 206 high bay; preparation of the melt mixture, performed in a walk-in hood in Building 315; and loading the test apparatus, performed in Building 315 Cell 4. If it becomes necessary to evaluate new melt mixture formulations, either in response to a project sponsor request or if process improvements are required, small amounts of the new mixture would be prepared and tested in Building 315 Cell 4. The water used in the experiment is to be captured in tanks in Cell 4 and reused, if possible. Once it is no longer required it would be allowed to evaporate, and any solid residue would be disposed of as low-level radioactive waste.

Description of Affected Environment

Building 315, Cell 4 and Cell 6; Building 206, B133 and the high bay. The Melt Attack Coolability Experiment (MACE) is a permitted radiological emission unit in Building 315. Testing would take place in Cell 4, one of the old Zero Power Reactor test chambers, with HEPA-filtered exhaust and 3-4 foot thick walls. Cell 6 is a more conventional laboratory space with a walk-in hood for operations with the loose melt mix. The walk-in hood has HEPA-filtered exhaust. Depending on the difficulty of the operation, the walk-in hood may be moved to Cell 4 before the bulk of the ROSAU work is planned to take place. Building 206 Room B133 is a radiological laboratory. The Building 206 high bay is a standard high bay space with a scrubber system and burn stall designed for passivation of radioactively-contaminated alkali metals. This proposed work is a follow-on activity to related work in the test area that was covered under ASO-CX-283. A hazards analysis showed that the Cell 4 test chamber would survive a steam explosion caused by interaction between water and a melt massing over 2000 kg, so the proposed tests will not challenge that. In addition, the longer-duration tests are to be performed under inert cover gas purges to ensure that explosive mixtures of hydrogen will not develop during reactions between the water and the molten simulant.

Potential Environmental Effects

- Attach explanation for each "yes" response near bottom of form.
- **See Instructions for Completing Environmental Review Form.**

Section A (Complete For All Projects)			**Yes**	**No**	**Explanation**
1.	Project evaluated for Pollution Prevention and Waste Minimization opportunities and details provided under items 2, 4, 6, 7, 8, 16, and 20 below, as applicable		(•)	( )	Waste would be minimized by reusing moste test components, by using the minimum amount of melt mixture appropriate for the desired results, and by capturing and reusing the quench water.
2.	Air Pollutant Emissions		(•)	( )	Particulate emissions (sparks and smoke) are expected to take place during the test. As noted above, emissions are to be filtered twice in a quench tank before exiting the test chamber and exhausting through HEPA filters, precluding significant air emissions outside Cell 4. The proposed thermite mixture would contain depleted uranium oxide and chromium (VI) oxide in granular form. As noted above, all work with open containers of these materials are to take place only in areas with HEPA-filtered ventilation, precluding release of material outside the work area.
3.	Noise		(•)	( )	The reaction and water quenching can be quite loud. However, no personnel would be allowed in Cell 4 during a test, and the thick chamber walls prevent significant noise levels outside of the test chamber.
4.	Chemical/Oil Storage/Use		(•)	( )	The proposed melt constituents include depleted uranium oxide, zirconium metal, chromium (VI) oxide, concrete oxides (calcium oxide, magnesium oxide, aluminum oxide, iron oxide), and some of the metal constituents (Mg, Al, Fe), all in granular form.
5.	Pesticide Use		( )	(•)	
6.	**Toxic Substances Control Act (TSCA) Substances**				
	6a.	Polychlorinated Biphenyls (PCBs)	( )	(•)	
	6b.	Asbestos or Asbestos Containing Materials	( )	(•)	
	6c.	Other TSCA Regulated Substances	( )	(•)	
	6d.	Import or Export of Chemical Substances	( )	(•)	
7.	Biohazards		( )	(•)	
	Effluent/Wastewater (If yes, see question #12 and				

8.	contact Peter Lynch (HSE) at 2-4582 or lynch@anl.gov)	( )	(•)	
9.	**Waste Management**			
	9a. Construction or Demolition Waste	( )	(•)	
	9b. Hazardous Waste	(•)	( )	Chromium (VI) oxide is a suspect human carcinogen and RCRA waste. Although the majority of waste from handling it would be mixed waste (see below), it is possible that items may be contaminated only with chromium (VI) oxide. These items will be disposed of as RCRA hazardous waste.
	9c. Radioactive Mixed Waste	(•)	( )	Unreacted melt mixes would be both radioactive (depleted uranium oxide) and hazardous (carcinogenic). Only the amount of melt mix needed is to be prepared, but approximately 5 cubic feet of mixed waste per test is expected. The planned mixed waste would largely consist of contaminated personal protective equipment; work on this material must be performed in anticontamination coveralls with gloves and respirators, and the coveralls & gloves are to be disposed of after use as mixed waste.
	9d. Radioactive Waste	(•)	( )	The final product is expected to be radioactive due to the presence of depleted uranium oxide, but based on the intensity of radiation it would be treated as low-level waste (LLW) when disposed of. It would not be considered to be mixed waste because all of the chromium (VI) oxide would react with zirconium metal to form Cr metal and/or chromium (III) oxide, neither of which are carcinogenic. To verify this, TCLP tests have been done in previous experiments to confirm the lack of hexavalent chromium in the leachate from the final product before its disposal.
	9e. Asbestos Waste	( )	(•)	
	9f. Biological Waste	( )	(•)	
	9g. No Path to Disposal Waste	( )	(•)	
	9h. Nano-material Waste	( )	(•)	
10.	Radiation	(•)	( )	Depleted uranium (DU) and its compounds are radioactive. However, DU is considerably less radioactive than natural uranium. All significant operations involving the use of DU/DU compounds, in melt mixes and elsewhere, would take place with Health Physics support. All operations involving the use of DU/DU compounds in dispersible forms would take place in areas with HEPA-filtered ventilation, to prevent release of radioactive material into the environment. All radioactive materials are to be stored in appropriately controlled areas under the applicable Argonne procedures.
11.	Threatened Violation of ES&H Regulations or Permit Requirement	( )	(•)	
12.	New or Modified Federal or State Permits	( )	(•)	
13.	Siting, Construction, or Major Modification of Facility to Recover, Treat, Store, or Dispose of Waste	( )	(•)	
14.	Public Controversy	( )	(•)	
15.	Historic Structures and Objects	( )	(•)	
16.	Disturbance of Pre-existing Contamination	( )	(•)	
17.	Energy Efficiency, Resource Conserving, and Sustainable Design Features	( )	(•)	
Section B (For Projects that Occur Outdoors)		**Yes**	**No**	
18.	Threatened or Endangered Species, Critical Habitats, and/or other Protected Species	( )	( )	

19.	Wetlands	○	○	
20.	Floodplain	○	○	
21.	Landscaping	○	○	
22.	Navigable Air Space	○	○	
23.	Clearing or Excavation	○	○	
24.	Archaeological Resources	○	○	
25.	Underground Injection	○	○	
26.	Underground Storage Tanks	○	○	
27.	Public Utilities or Services	○	○	
28.	Depletion of a Non-Renewable Resource	○	○	
Section C (For Projects Outside of ANL)		**Yes**	**No**	
29.	Prime, Unique, or Locally Important Farmland	○	○	
30.	Special Sources of Groundwater (such as sole source aquifer)	○	○	
31.	Coastal Zones	○	○	
32.	Areas with Special National Designations (such as National Forests, Parks, or Trails)	○	○	
33.	Action of a State Agency in a State with NEPA-type Law	○	○	
34.	Class I Air Quality Control Region	○	○	

Categorical Exclusion

ANL NEPA Reviewer Use Only

○ My approval is the final approval necessary

◉ This form requires additional approval from DOE

To be Completed by DOE/ASO

Section D	Yes	No
Are there any extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal?	○	◉
Is the project connected to other actions with potentially significant impacts or related to other proposed action with cumulatively significant impacts?	○	◉
If yes, is a categorical exclusion determination precluded by 40 CFR 1506.1 or 10 CFR 1021.211?	○	○
Can the project or activity be categorically excluded from preparation of an Environment Assessment or Environmental Impact Statement under Subpart D of the DOE NEPA Regulations?	◉	○
If yes, indicate the class or classes of action from Appendix A or B of Subpart D under which the project may be excluded: This project may be excluded under the following Categorical Exclusion: 10 CFR Part 1021, Subpart D, Appendix B, Category B3.6 Small-scale research and development, laboratory operations, and pilot projects		
If no, indicate the NEPA recommendation and class(es) of action from Appendix C or D to Subpart D to Part 1021 of 10 CFR.		

Attachments

File Description:

Comments

None

Add Approver

Approver Name	Approver Badge	Reason	Delete
Farmer, Mitchell T.	30139	Principal Investigator	

Notifications

The approval notification email will be copied to the people listed below.

Badge	Name	Division	Delete

ASO-CX Number

ASO-CX- 368

Comments:

This Categorical Exclusion is tracked as ASO-CX-368.

Approval

Approver	Action	Date Routed	Action Date	Approval Reason / Comments	Approval Type
Woodford, John B.	APPROVED	2020-01-14	2020-01-14 13:44:17.0	Creator :	PRIMARY
Woodford, John B.	APPROVED	2020-01-14	2020-01-14 13:44:17.0	Project Manager :	PRIMARY
Farmer, Mitchell T.	APPROVED	2020-01-14	2020-01-14 15:00:50.0	Principal Investigator :	PRIMARY
Riel, Roberta T.	APPROVED	2020-01-14	2020-01-15 07:06:51.0	NEPA Owner Approval for Argonne Environmental Review :	PRIMARY
Ptak, Jill S.	APPROVED	2020-01-15	2020-01-15 10:28:45.0	ANL NEPA Reviewer :	PRIMARY
Hellman, Karen B.	APPROVED	2020-01-15	2020-01-15 11:10:05.0	ANL-985 Review and Approval :	PRIMARY
Dunn, Michael W. for Kearns, Paul K.	APPROVED	2020-01-15	2020-01-15 14:03:07.0	ANL-985 ANL COO Review and Approval :	DELEGATE
Joshi, Kaushik N.	APPROVED	2020-01-15	2020-02-03 15:14:58.0	ANL-985 DOE-ASO Review and Approval : **This Categorical Exclusion is tracked as ASO-CX-368.**	PRIMARY
Siebach, Peter Rudolf	APPROVED	2020-02-03	2020-02-05 09:02:45.0	ANL-985 DOE NEPA Compliance Officer Review and Approval :	PRIMARY