SECTION A. Project Title: Investigative Teardown of Flood Damaged Stranded Electric Vehicle Batteries

SECTION B. Project Description and Purpose:

Revision 2:

This revision is to continue to support NHTSA conducting an investigative teardown of 10 flood damaged EVs. INL will work to move and tear down the EVs at INL and will provide the facility, logistics and hardware along with ensuring all safety protocols are met. During tear-down of the vehicles, all fluids will be removed and captured to be submitted to WGS for final disposal. During the disassembly of the battery, the battery will be discharged to determine the charge left in the battery after immersion to further evaluate the effects of immersion. This will leave the battery with zero energy. Batteries in this state can be handled and recycled as industrial waste. If the battery reacts during immersion or post immersion, it will be evaluated to verify no stranded energy is left. The battery components will be turned over to WGS for final disposal. Ownership of the remainder of the vehicle will be transferred to Property Reutilization for final disposition. The equipment that will be purchased will be an Atlas 9KOHX 9000 lbs., a powered Hydraulic Vehicle Lift and a Powerline Vantage ELT-3300 EV battery lift table and will be turned over to NSTR for their use.

The final setup will utilize standard vertical round storage tanks for holding water before the tests. It is believed that the water can be reused for multiple tests but cannot be confirmed until after the first test. The pump and filter equipment will be housed in a utility trailer, with PVC piping connecting the storage tanks and the immersion tank. Power will be derived from propane powered generators, with a larger diesel generator for backup and for the contingency of rapidly refilling the immersion tank if needed. A 30’ x 30’ pole barn style building will be erected over an existing concrete pad in the lay-down area of NSTR near where the immersion system will be set up. This will be used for the teardown and analysis of the vehicle batteries. The coordinates for the location of the setup is **43.689953, -112.673784.**

Figure 1. Location of test location in retrospect to other site facilities.

Figure 2. Image of location of the Immersion Test Area Test Pad

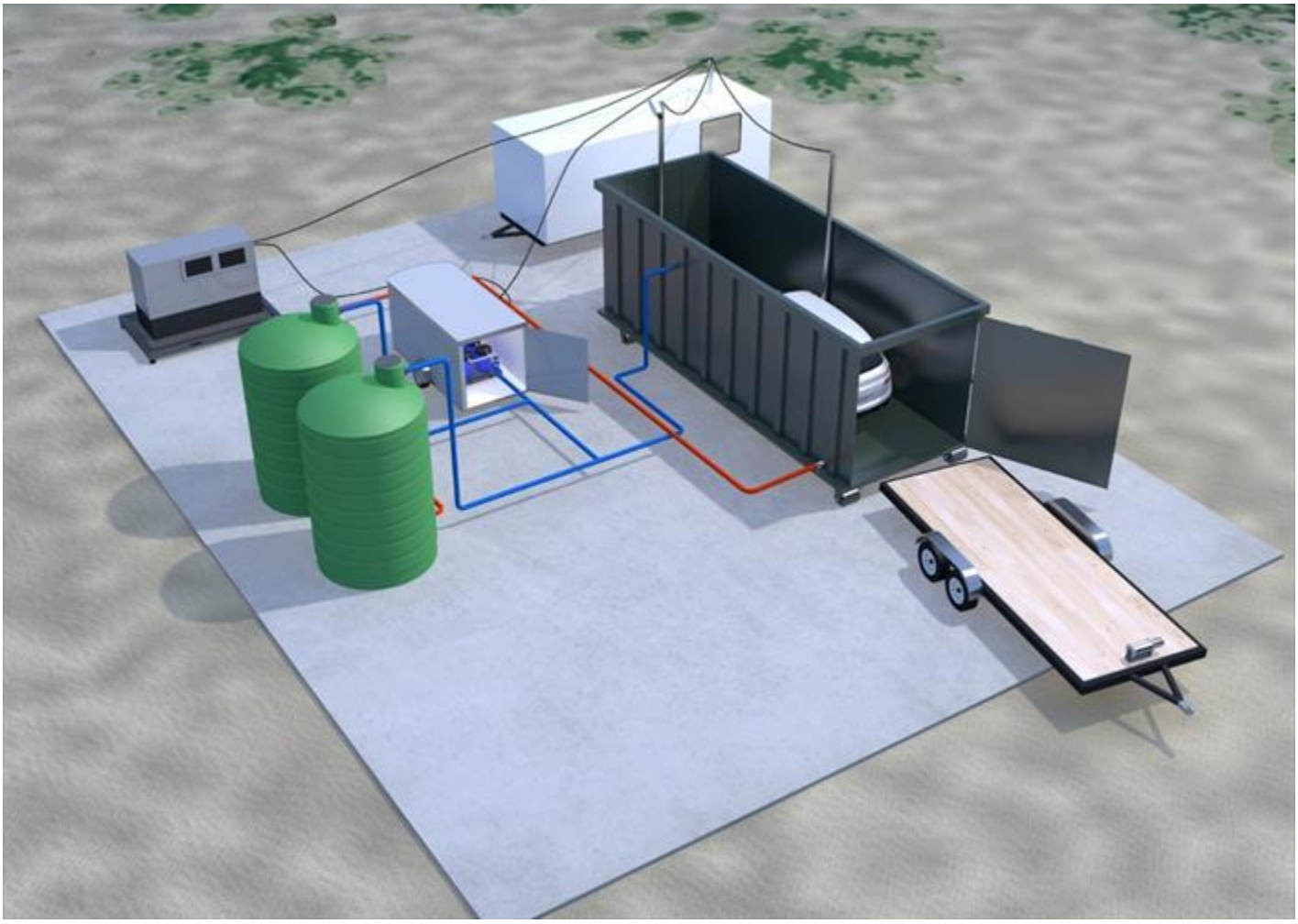

Figure 3: Updated setup of the immersion testing.

The expected waste generated will be:

1) Automotive Lithium-ion battery packs up to 1200lbs. per vehicle. Packs will be in a discharged state and recycled by INL WGS. Packs may experience significant damage during immersion but will be inert.

2) Electric vehicles minus the battery pack, approximately 10 total, will be transferred to Property Redistribution for auction or transfer to other groups for training use (INL-FD, NSTR, NHLS).

3) Approximately 5000 gallons per EV test of water at a nominal salinity of ~37PPT. Per WGS personnel, water will be sampled and then used for dust abatement or discharged to the sanitary wastewater system at MFC or Central Facilities Area.

Hazardous (Note: All volumes are approximate). The types of fluids reflects a cross section of the fluids that will be encountered in a range of EVs. Additions and deviations of fluides from this list will be dealt with on a case-by-case basis in consultation with WGS.

- Windshield washer fluid, various types, 1 gallon per vehicle, will be captured and returned to WGS for disposal.
- Brake Fluid, DOT type 4 (example: BASF Hydraulan 404), 24 oz. per vehicle. Remove and return to WGS for disposal.
- Coolant, 1 gallon per vehicle, Ethylene glycol 50/50 mix, will be captured and returned to WGS for disposal.
- Geabox fluid, 80 oz. per vehicle, (example: EDF2 [part number 1616951-00-A] ATF or similar), capture and return to WGS for disposal.
- Air conditioning refrigerant, R134A or R1234yf, 40 oz per vehicle, will be pumped out and returned to WGS for disposal.
- Air conditioning oil, (example: POE ND-11 oil), 10 oz per vehicle, will be drained as much as possible after refrigerant is recovered and returned to WGS for disposal.
- Small quantities of silicone sealant, < 10 lbs. per year, capture used sealant and dispose of in trash

- PPE, wipes
- Use of nitrile gloves, < 2lbs. per year, dispose of through WGS
- Use of latex gloves, < 2lbs. per year, dispose of through WGS
- Use of shop towels for incidental cleanup, < 3lbs. per year, capture and turn over to WGS for disposal.
- Use of non-prescription safety glasses, < 20 pairs per year, dispose in common trash.

Revision 1:

Work to be completed at NSTR (Proposed work will occur on the concrete pad, approximately in the middle of the first laydown yard of the NSTR off of T25.)

Unknown stranded energy in electric vehicles (EV) is a big concern for consumers, first responders, emergency responders, etc. Stranded energy is the energy left in an EV with an unknown state of safety after a crash, water immersion, or any other abnormal event. A potentially damaged battery with an unknown state of safety might go into a thermal runaway without proper monitoring, diagnostics, controls, and handling—thereby leading to potential loss of life and property damage. Therefore, it is imperative to develop standard guidelines, diagnostic methods, and tools to handle stranded energy appropriately and minimize safety risks from immediately after an EV accident/submersion event to final disposal or re-entry to the road.

EVs immersed in seawater due to storm-surge and the energy stranded within them has recently been identified as a big concern for 1st and 2nd responders. EV battery packs may catch on fire depending on the extent of saltwater immersion. The exact mechanisms of how high-voltage batteries immersed in seawater catch on fire are largely unknown. Several immersion tests exist and are used in various countries; however, how these tests compare with real world events is also yet to be discovered. INL is performing an investigative teardown of actual flood-damaged EV battery packs, e.g., EVs damaged during Hurricane Ian in Florida which could provide essential insights on better understanding the root cause of battery fire and offer guidelines and pathways to handle the suspected EV/battery packs safely.

As a follow-up work of the investigative teardown, INL will perform up to 10 full-scale EV immersion tests in a controlled manner with appropriate instrumentation to better understand how different water immersion scenarios affect battery packs' safety in electric vehicles. The knowledge obtained from these tests would directly feed into properly diagnosing, handling, and hazard mitigation strategies for flood-damaged electric cars. Timeline: This will be a multi-year project. In FY23 to FY24, we will build the test setup and perform immersion testing on one EV. Additionally, up to 9 tests will be performed in FY24 to FY25. The work will take place at National Security Test Range (NSTR) which is located approximately 7 miles north of MFC to the west of T-25 (You can find the NSTR on iMaps). The NSTR has a few possible test locations in the range. Exact placement of the test article has not been finalized yet, but the test will take place at an approved location on the range. Test locations are gravel pads. Currently, the only structure that may be used is an 80’x100’ tension temporary structure.

The following waste will be generated:

Industrial

- Universal: Lithium-ion battery, up to 1200lbs/EV test. The EVs will be removed from INL by Munro & Associates (https://leandesign.com) and recycled at their facility after post-mortem/teardown analysis. SNT is performing a similar activity as part of Phase I of this project, i.e., SNT is moving 10 Florida flood damaged EVs from Florida to their facility at OKC and helping INL perform an investigative teardown.
- Approximately 5000 gallons per EV test of water at a maximum salinity of ~39 PPT. Will be reused to the extent possible. Final disposal will be as dust abatement.

Per a research of battery chemistry, there is no indication of RCRA heavy metals in the battery matrix. The only possibility for any RCRA metals in the water would come from the cars themselves (e.g., Circuitry, computer chips, wheel weights, bearings, etc.). It is highly unlikely those will have any significant contribution of RCRA metals to the water for one vehicle. Multiple vehicles would increase that likelihood.

- DE (diatomaceous earth), Sand, and cartridge type water filter elements. Approximately 30-40 lbs. per year. Dry and dispose of it in INL landfill.
- PPE, wipes: Possible incidental use of nitrile glove and safety glasses. Small quantities of silicone sealant (Approximately 10 lbs. per year)
- Radioactive: None
- Low level: None
- Mixed: None
- TRU: None

Samples will be collected: Water samples will be taken to verify water is safe for disposal after the first few tests. Samples will not be retained.

Vehicles will be observed in a safe location for a minimum of 2 days and up to 30 days depending on reaction during immersion. If the vehicle reacts vigorously during immersion, a short observation period is indicated. If the vehicle shows little sign of reaction or none, a longer observation period will be required. Vehicles will be removed by SNT to their facility in Oklahoma for postmortem analysis. Once the analysis is complete, batteries will be recycled by SNT.

During immersion, any reaction and gas evolution should be muted by the water. During the observation period after the vehicle is removed from the tank, there is the possibility of a fire that would emit smoke and combustion gases.

The project will purchase 2 each 30-yard dumpsters. The dumpsters will be modified to hold water without leaking. One will be used as the immersion tank and one as a storage/transfer tank. INL will purchase the parts and assemble a pump/filtration skid. The tanks will be modified to connect to the filter skid to provide filtration of the water to maintain clarity and transfer water from the holding tank to the immersion tank. Modifications to the immersion tank will allow INL personnel to role the test vehicles in and out eliminating the need and hazards associated with lifting them via a gantry. Along with the immersion and holding tanks, the project will also acquire an instrumentation trailer and portable generator(s). The trailer will provide a secure location for data recording equipment and shelter for test personnel. Equipment will be kept in place during the winter months of 2023 – 2024. Further testing is expected during the summer of 2024. After all testing is complete, the dumpsters will be transferred to waste management for their use. The trailer will be transferred to NSTR for their use or excessed. The pump skid and all other accessories will be excessed.

After sampling to ensure environmental compliance, it is anticipated the water can be discharged to the sanitary wastewater system at MFC or Central Facilities Area.

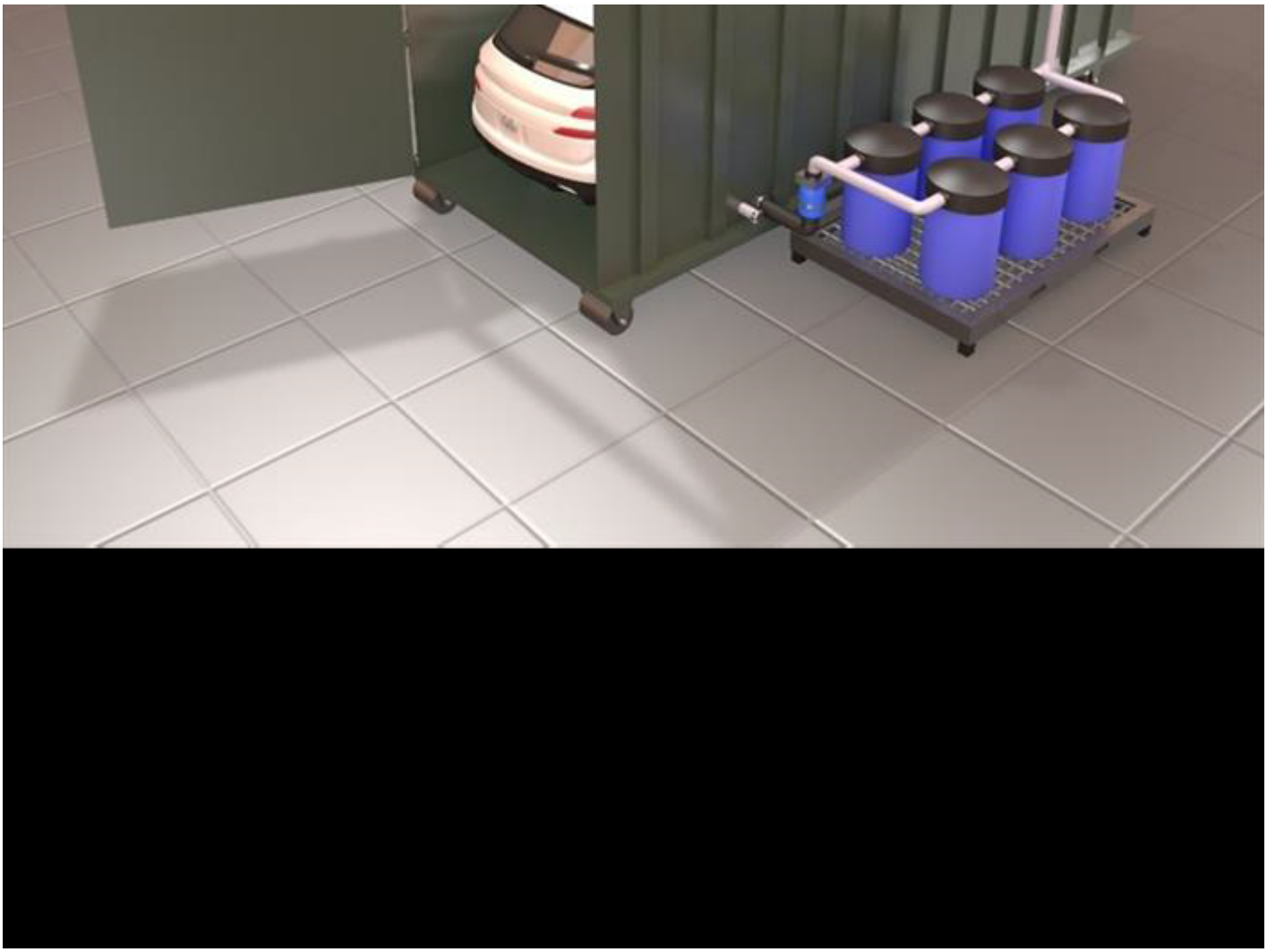

Figure 4. Showing an early iteration of immersion test set up.

Original ECP:

Unknown stranded energy in electric vehicles (EV) is a big concern for consumers, first responders, emergency responders, etc. Stranded energy is the energy left in an EV with an unknown state of safety after a crash, saltwater submersion, or any other abnormal event. A potentially damaged battery with an unknown state of safety might go into a thermal runaway without proper monitoring, diagnostics, controls, and handling—thereby leading to potential loss of life and property damage. Therefore, it is imperative to develop standard guidelines, diagnostic methods, and tools to handle stranded energy appropriately and minimize safety risks from immediately after an EV accident/submersion event to final disposal or re-entry to the road. Storm-surged seawater submersed EVs, and the energy stranded within them have recently been identified as a big concern for 1st and 2nd responders. EV battery packs may catch on fire depending on the extent of saltwater submersions. The exact mechanisms of how saltwater submersed high-voltage batteries catch on fire are largely unknown. Several immersion tests exist and are used in various countries; however, how these tests compare with real world events is also yet to be discovered. Investigative teardown of actual flood damaged EV battery packs, e.g., from Florida Ian Hurricane damage EVs, could provide essential insights on better understanding the root cause of battery fire and offer guidelines and pathways to handle the suspected EV/battery packs safely.

The goal of this agreement is to:

i) Collect relevant information from saltwater submerged EVs (up to 10 EVs) in Florida that could guide the 1st and 2nd responders on the efficient and safe handling of these EVs.

ii) Support NHTSA conducting an investigative teardown of 10 flood damaged EVs INL will work with a subcontractor to move and tear down the EVs at the subcontractor's facility. The subcontractor has been finalized, and a formal contract will be placed upon completing the SPP contract with the sponsor (NHTSA). A team of INL researchers will travel to the subcontractor facility, guide them throughout the teardown process, and collect relevant data. The subcontractor will perform the hands-on teardown. Data analysis, discussion, and report writing will be performed at IF-685 C100 lab and INL researcher's office spaces.

Waste includes conventional Li ion battery and Vehicle body The subcontractor will take care of the waste generated during and after the teardown at their facility. The subcontractor has an in-house battery recycling facility. The vehicle body will be auctioned off at the subcontractor facility or donated to interested fire departments for educational/training purpose. There will not be any emission to the air at any INL facility as the teardown will be performed at the subcontractor facility. The subcontractor facility is equipped to handle any emission during the teardown. There will not be any discharge to the sewer.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

During immersion, any reaction and gas evolution should be muted by the water. During the observation period after the vehicle is removed from the tank, there is the possibility of a fire that would emit smoke and combustion gases. Modifications to the immersion tank will allow INL personnel to role the test vehicles in and out eliminating the need and hazards associated with lifting them via a gantry. Along with the immersion and holding tanks, the project will also acquire an instrumentation trailer and portable generator(s). The trailer will provide a secure location for data recording equipment and shelter for test personnel. Equipment will be kept in place during the winter months of 2023 – 2024. Further testing is expected during the summer of 2024. After all testing is complete, the dumpsters will be transferred to waste management for their use. The trailer will be transferred to NSTR for their use or excessed. The pump skid and all other accessories will be excessed.

Discharging to Surface-, Storm-, or Ground Water

Approximately 5000 gallons per EV test of water at a maximum salinity of ~39 PPT. Will be reused to the extent possible. Final disposal will be as dust abatement.
We have already engaged with WGS [Blair J Willis, Rodney O Bell, James Winter, and Matthew T. Campbell] regarding this matter. WGS's [Blair Willis et al.] guidance is copied below:
"I think we are good with the water. Environmental said it is OK to discharge as dust suppression. Once we get towards the end of this year's activities and prior to dumping the spent water (i.e., using for dust suppression), we may perhaps grab a field screen/confirmatory sample. Also, at that time, we may generate a WDDF using form 435.39. After sampling to ensure environmental compliance, it is anticipated the water can be discharged to the sanitary wastewater system at MFC or Central Facilities Area.

Disturbing Cultural or Biological Resources

Cultural: A Section 106 review was completed under CRMO project number (BEA-16-26) and resulted in No Historic Properties Affected. Please refer to the Cultural Resource Review (CRR) (BEA-16-26) for details or Hold Points and Project Specific Instructions of the ECP.

Generating and Managing Waste

Industrial/Universal: Lithium-ion battery, up to 1200lbs/EV test. The EVs will be removed from INL by Spiers New Technologies (SNT) (https://www.spiersnewtechnologies.com/) and recycled at their facility after postmortem/ teardown analysis. SNT is performing a similar activity as part of Phase I of this project, i.e., SNT is moving 10 Florida flood damaged EVs from Florida to their facility at OKC and helping INL perform

an investigative teardown.

Approximately 5000 gallons per EV test of water at a maximum salinity of ~39 PPT. Will be reused to the extent possible. Final disposal will be as dust abatement. We have already engaged with WGS [Blair J Willis, Rodney O Bell, James Winter, and Matthew T. Campbell] regarding this matter. WGS's [Blair Willis et al.] guidance is copied below:
"I think we are good with the water. Environmental said it is OK to discharge as dust suppression. Once we get towards the end of this year's activities and prior to dumping the spent water (i.e., using for dust suppression), we may perhaps grab a field screen/confirmatory sample. Also, at that time, we may generate a WDDF using form 435.39. Per a research of battery chemistry, there is no indication of RCRA heavy metals in the battery matrix. Furthermore, correspondence with Dr. Judy Jeevarajan who performed similar research said the RCRA metals we discussed (i.e., As Ba, Cd, Cr, Hg, Pb, Ag, Se) are not present in li-ion cells. Therefore, the only possibility for any RCRA metals in the water would come from the cars themselves (e.g., Circuitry, computer chips, wheel weights, bearings, etc.). It is highly unlikely those will have any significant contribution of RCRA metals to the water for one vehicle. Multiple vehicles would increase that likelihood. This is why WGS recommends a field screen/confirmatory sample prior to using the water for dust suppression.

DE (diatomaceous earth), Sand, and cartridge type water filter elements. Approximately 30-40 lbs. per year. Dry and dispose of it in INL landfill.

PPE, wipes: Possible incidental use of nitrile glove and safety glasses. Small quantities of silicone sealant (Approximately 10 lbs. per year).

Samples will be collected: Water samples will be taken to verify water is safe for disposal after the first few tests. Samples will not be retained.

Vehicles will be observed in a safe location for a minimum of 2 days and up to 30 days depending on reaction during immersion. If the vehicle reacts vigorously during immersion, a short observation period is indicated. If the vehicle shows little sign of reaction or none, a longer observation period will be required. Vehicles will be removed by SNT to their facility in Oklahoma for postmortem analysis. Once the analysis is complete, batteries will be recycled by SNT.

Releasing Contaminants

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

Project description indicates materials will need to be purchased or used that require sourcing materials from the environment. Being conscientious about the types of materials used could reduce the impact to our natural resources.

Environmental Justice

According to the CEQ Climate and Economic Justice Screening Tool, the INL site as well as the Research and Education Campus in Idaho Falls, ID are located in U.S. Census tracts that are identified as disadvantaged communities. Census tracts identified as disadvantaged meet or exceed socioeconomic, environmental, health, or demographic thresholds identified by CEQ. Given that activities analyzed in this document will happen within the boundaries of existing DOE/INL land and/or facilities where there are no permanent residents, any impacts to Environmental Justice in surrounding communities are anticipated to be negligible.

SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification: Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

References: B1.2 "Training exercises and simulations", B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

Justification: B3.6 Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

B1.2 Training exercises and simulations (including, but not limited to, firing-range training, small-scale and short-duration force-on-force exercises, emergency response training, fire fighter and rescue training, and decontamination and spill cleanup training) conducted under appropriately controlled conditions and in accordance with applicable requirements.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) ☐ Yes ☒ No

Approved by Robert Douglas Herzog, DOE-ID NEPA Compliance Officer on: 1/9/2024