Issued on October 2, 2018

DOE-ID Operations Summary
For the Period January 1, 2018- April 30, 2018

EDITOR'S NOTE: *The following is a summary of contractor operations at the Idaho National Laboratory Site, managed by the DOE- Idaho Operations Office. It has been compiled in response to a request from stakeholders for more information on health, safety and environmental incidents at DOE facilities in Idaho. It also includes a brief summary of accomplishments at the Site. POC: Danielle Miller, (208) 526-5709.*

Idaho Cleanup Project (ICP)

February 15: An employee at the Idaho Nuclear Technology and Engineering Center injured their finger while fabricating an item in support of an equipment upgrade project. The injured employee was transported to the Central Facilities Area medical facility for evaluation. [EM-ID--FID-LANDLORD-2018-0001]

March 13: A glovebox sleeve that had been removed from the glovebox transfer port and sealed during a glovebox sleeve change out breached after being removed from the glovebox. Workers placed the area into a secure condition and all personnel exited the area. The workers commenced doffing of contamination protective clothing at the step off pad, were surveyed by Radiological Control Technicians for contamination, and had their mouths and noses swabbed and surveyed. All monitoring results showed no personal contamination was present. [EM-ID--FID-ICPWM-2018-0001]

March 26: An employee operating a forklift at the Advanced Mixed Waste Treatment Project inadvertently contacted a fellow worker who was moving a rope barrier in support of the forklift operation. The worker was transported to the INL Site Medical facility and was examined/evaluated with no injuries. [EM-ID--FID-AMWTF-2018-0002]

April 12: Idaho Cleanup Project contractor, Fluor Idaho and the U.S. Department of Energy received a warning letter from the Idaho Department of Environmental Quality (ID-DEQ) informing Fluor Idaho of apparent violations of the Hazardous Waste Management Act Storage and Treatment Permit for the INTEC CPP-659 Hot Cell Upgrades. The warning letter noted that Fluor Idaho had failed to make the necessary notifications to ID-DEQ regarding recent upgrades/modifications to the hot cells. [EM-ID--FID-INLPROGM-2018-0001]

April 11: A repackaged sludge drum staged inside of the Accelerated Retrieval Project (ARP) V retrieval enclosure experienced an over-pressurization event. Over the course of the next five hours it was determined that approximately two additional drums experienced a similar drum failure. There were no workers in the facility at the time when the drums over-pressurized. A Formal Cause Analysis team has been assembled consisting of a cause analyst, engineers, and chemists to ascertain the root causes and contributing causes to this event. [EM-ID--FID-RWMC-2018-0001]

April 12: Repair work on an electrical receptacle at the Idaho Nuclear Technology

and Engineering Center (INTEC) was performed prior to the installation of the appropriate lock-out tag out.
[EM-ID--FID-LANDLORD-2018-0002]

April 16: A worker performing a repair on a lighting system at the Idaho Nuclear Technology and Engineering Center (INTEC) observed a spark, an indication that hazardous energy was not completely isolated. The worker initiated a step-back and notified management.
[EM-ID--FID-LANDLORD-2018-0003]

April 20: During drum unloading operations at the Accelerated Retrieval Project, a drum adjacent to a drum being unloaded was inadvertently dragged from a flatbed truck, landing upright on the ground. The forklift operator backed away from the flatbed truck and lowered the drum in the drum handler to the ground. Operations were stopped and workers secured the area. Radiological control technician's surveyed the immediate area and found no contamination. [EM-ID--FID-RWMC-2018-0002]

Notable Accomplishments: **Idaho Site Crew Develops Shielded Containers for Unique Waste**

A team working for the Idaho Site EM program recently built a shielded container to ship a unique waste to the Waste Isolation Pilot Plant (WIPP), an in-house project that saved time and money over procuring the product off-site.

A team from the EM cleanup contractor Fluor Idaho worked with fabricators in the Idaho Nuclear Technology and Engineering Center (INTEC) Maintenance Shop to develop the container to shield neutron-emitting transuranic sources fabricated at the Monsanto-Dayton Laboratory prior to its demolition in the late 1980s. Neutron-emitting sources are extremely rare at INTEC, a facility that has extensive experience handling gamma radiation sources most often shielded by lead.

Idaho National Laboratory (INL)

January 24: A worker performing a crane inspection at the Advanced Test Reactor Complex did so without utilizing proper lockout tagout requirements. Upon discovery, inspection of the crane was stopped. [NE-ID--BEA-ATR-2018-0001]

January 25: Excavation work resulting in soil disturbance was inadvertently performed outside of the designated excavation area while digging a test hole for a new Central Facilities Area septic tank. [NE-ID--BEA-CFA-2018-0001]

February 7: An electrician at the INL Research Complex was performing electrical work in preparation for a water fountain installation when a circuit breaker tripped unexpectedly. Work was stopped and the circuit was put in a safe configuration. [NE-ID--BEA-INLLABS-2018-0001]

February 28: Radiological contamination was unexpectedly detected on the leg of an operator's personal clothing at the Advanced Test Reactor Complex. The operator had been assisting in the transfer of a hydrogen sample cylinder out of a radiological bag and into a secondary cubicle sample box prior to being surveyed by a radiological controls technician. No skin contamination existed and there was not an environmental release. The Radiological Work Permit (RWP) for this evolution has been revised to include Personnel Protective Equipment (PPE) requirements and radiological control support. [NE-ID--BEA-ATR-2018-0002]

March 29: Advanced Test Reactor Complex Maintenance electricians were performing voltage measurements in support of lighting upgrade activities when a short circuit resulting in an arc occurred. The electricians were dressed in the appropriate arc flash rated Personal Protective Equipment when the event occurred. Work was secured, and the Idaho National Laboratory (INL) fire department was notified and responded. The INL fire department verified that no fire or other hazards were present in the building. The electricians were evaluated and were released to work with no restrictions. [NE-ID--BEA-ATR-2018-0003]

April 3: An employee experienced an injury to their knee when exiting the cab of a high clearance pickup truck at the Remote-Handled Low-Level Waste (RHLLW) facility. A magnetic resonance imaging (MRI) evaluation of the knee revealed that the damage to the knee required surgical repair. [NE-ID--BEA-MFC-2018-0001]

Notable Accomplishments: **New Fuel Cell Technology Runs on Solid Carbon**
Advancements in a fuel cell technology powered by solid carbon could make electricity generation from resources such as coal and biomass cleaner and more efficient, according to a new paper published by Idaho National Laboratory researchers.

The fuel cell design incorporates innovations in three components: the anode, the electrolyte and the fuel. Together, these advancements allow the fuel cell to utilize about three times as much carbon as earlier direct carbon fuel cell (DCFC) designs.

The fuel cells also operate at lower temperatures and showed higher maximum power densities than earlier DCFCs, according to INL materials engineer Dong Ding. The results appear in the Jan. 25 edition of the journal Advanced Materials and are featured on its inside front cover.

Whereas hydrogen fuel cells (e.g., proton exchange membrane (PEM) and other fuel cells) generate electricity from the chemical reaction between pure hydrogen and oxygen, DCFCs can use any number of carbon-based resources for fuel, including coal, coke, tar, biomass and organic waste.

Because DCFCs make use of readily available fuels, they are potentially more efficient than conventional hydrogen fuel cells. “You can skip the energy-intensive step of producing hydrogen,” Ding said.

But earlier DCFC designs have several drawbacks: They require high temperatures — 700 to 900 degrees Celsius — which makes them less efficient and less durable. Further, as a consequence of those high temperatures, they’re typically constructed of expensive materials that can handle the heat.

Also, early DCFC designs aren’t able to effectively utilize the carbon fuel.

Ding and his colleagues addressed these challenges by designing a true direct carbon fuel cell that’s capable of operating at lower temperatures — below 600 degrees Celsius. The fuel cell makes use of solid carbon, which is finely ground and injected via an airstream into the cell.

The researchers tackled the need for high temperatures by developing an electrolyte using highly conductive materials — doped cerium oxide and carbonate. These materials maintain their performance under lower temperatures.

Next, they increased carbon utilization by developing a 3-D ceramic textile anode design that interlaces bundles of fibers together like a piece of cloth. The fibers themselves are hollow and porous. All of these features combine to maximize the amount of surface area that's available for a chemical reaction with the carbon fuel.

Finally, the researchers developed a composite fuel made from solid carbon and carbonate. "At the operating temperature, that composite is fluidlike," Ding said. "It can easily flow into the interface."

The molten carbonate carries the solid carbon into the hollow fibers and the pinholes of the anode, increasing the power density of the fuel cell.

The resulting fuel cell looks like a green, ceramic watch battery that's about as thick as a piece of construction paper. A larger square is 10 centimeters on each side. The fuel cells can be stacked on top of one another depending on the application. The Advanced Materials journal posted a video abstract here: https://youtu.be/M_wOsvze2qI.

The technology has the potential for improved utilization of carbon fuels, such as coal and biomass, because direct carbon fuel cells produce carbon dioxide without the mixture of other gases and particulates found in smoke from coal-fired power plants, for example. This makes it easier to implement carbon capture technologies, Ding said.

The advanced DCFC design has already attracted notice from industry. Ding and his colleagues are partnering with Salt Lake City-based Storagenergy, Inc., to apply for a Department of Energy Small Business Innovation Research (SBIR)-Small Business Technology Transfer (STTR) Funding Opportunity. The results will be announced in February 2018. A Canadian energy-related company has also shown interest in these DCFC technologies.