INL experts assisted Japan many ways, including equipping a robot to map radiation levels. Here, INL employees, Craig Conner, Cal Christensen, Victor Walker and Robert Kinoshita pose with Japanese colleagues and the robot.

INL contributes expertise to Fukushima response

By Nicole Stricker, *INL Communications & Governmental Affairs*

The wealth of knowledge at the U.S. Department of Energy's national laboratories has been a reassuring asset during Japan's nuclear plant crisis and recovery.

Cal Christensen, center, was one of four INL experts who travelled to Japan to help set up the Talon robot and train Japanese operators.

As news from the Fukushima plant grabbed headlines, America's nuclear energy experts have been toiling behind the scenes to provide critical information to Japanese responders and U.S. decision-makers. And as the DOE's national nuclear energy lab, Idaho National Laboratory and its experts are playing a critical role.

For example, INL helped teams of technical experts answer critical questions about the Fukushima accident and response, such as how salt water may behave as a reactor core coolant. Lab experts equipped a robot to assess Fukushima conditions in high-radiation areas of the plant. And INL organized a workshop to set the stage for reconstructing and analyzing the accident and its progression.

In the week after the tsunami, INL employees constituted three members of a 12-person team providing information to Energy Secretary Steven Chu. INL's contributions added to those from six other DOE national labs, the nuclear energy industry, the Nuclear Regulatory Commission and the U.S. Navy's Nuclear Reactors Program.

"This was a very effective collaborative effort," said Doug Burns, an INL Fuel Cycle Science & Technology manager who helped coordinate INL's assistance. "And I personally learned a lot about the deep expertise here at INL."

Robotic assistance

Among the most visible of INL's efforts was its work to equip and ship a robot to help assess radiation levels at the Fukushima plant. INL robotics experts outfitted a commercially available Talon robot with radiation-hardened cameras and sensors, which conferred the ability to take radiation readings, stamp them with a GPS location, and overlay the information on a Google Earth map.

Japanese responders practice using the Talon robot INL equipped for radiation mapping at the Fukushima plant.

The robot went to Japan the week of April 3. A team of four INL engineers traveled to Japan in mid-April to help set up the equipment and train Japanese operators. In early June, INL received initial reports about the robot's deployment at the Fukushima facility. Although the robot itself is commercially available from QinetiQ North America, INL's expertise was crucial to configure and integrate the supplemental components.

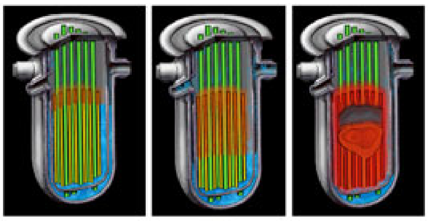
"INL doesn't make the robot, we make the robot smarter and more useable," said Derek Wadsworth, who led the INL effort. "We take off-the-shelf components and integrate them to create a system designed to solve a particular problem."

Nuclear safety expertise

INL's richest history and expertise resides in the nuclear energy research realm. Together with Oak Ridge National Laboratory, INL helped organize and lead collaborations for finding answers to technical questions emerging from Japan.

In the days following the Fukushima Daiichi power losses, INL helped the DOE convene a group of national laboratory experts that could help supply technical information to Japanese emergency responders. As new questions arose, the group could quickly task the most capable experts with finding an answer. Within a couple of days, DOE officials had solid information to share with counterparts in Japan.

For example, INL nuclear safety analysts suggested passive cooling approaches that might remove heat from the reactor cores more quickly. And INL Fellow and nuclear safety engineer Nam Dinh worked with other INL experts to prepare an evaluation of worst-case-scenario accident progressions to help inform the Japanese response. Their work gave one of the earliest warnings of potential issues associated with seawater injection into the damaged cores by suggesting, for example, how salt inside the reactor core might insulate or corrode reactor components and how that might affect the future progression of events.



Core damage sequence at Three Mile Island unit 2, where INL officials contributed significantly to recovery and cleanup efforts.

INL Directorate Fellow and nuclear engineer Joy Rempe led an INL effort to analyze data coming out of Japan and provide event reconstruction information to the DOE response team. This effort included archiving instrumentation data, reports of mitigating actions, photos and video coming out of Japan as events unfolded. Such information is a valuable analytical resource, but may be short-lived on news media and emergency response websites.

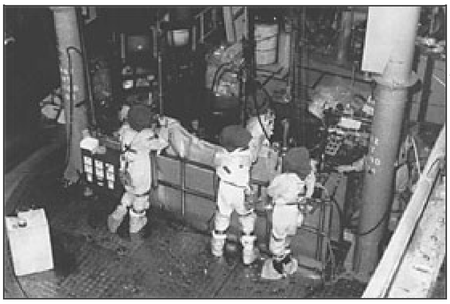
INL also helped organize a recent workshop where the large number of DOE analyses completed over the past few months was discussed. The workshop helped set the stage to develop an evaluation of the exact sequence of events involved in the Fukushima Daiichi emergency. A team led by INL, ORNL and Sandia National Labs will perform this analysis with the aim of issuing a detailed report on the accident progression later this year.

Nuclear cleanup experience

In the meantime, INL is continuing to lend expertise to the response. From April 5 to 16, INL manager Scott Raish travelled to Japan on behalf of Toshiba consultant Babcock & Wilcox to advise the emergency response team. He offered technical advice on ways to contain contamination, remove debris and control used nuclear fuel.

Around the same time, INL hosted two representatives from Japan's Central Research Institute of Electric Power Industry (CRIEPI), which is similar to the U.S. Electric Power Research Institute. INL has a long-standing working relationship with CRIEPI and has performed research and development activities for it related to dry cask storage of used nuclear fuel.

So when the crisis struck at Fukushima, CRIEPI representatives contacted INL to discuss used fuel retrieval technology, transportation and storage systems. They have also requested additional assistance related to the used fuel recovery.



Removal of the damaged Three Mile Island core debris, which was analyzed at INL and is now stored there in above-ground casks.

"They told us they came to INL because they trusted us, and they thought we'd provide good unbiased information for a path forward," said Phillip Wheatley, director of Environmental and Natural Resource Management for INL's Energy and Environment Directorate. "That's the role of a national lab, to be viewed as a technology provider and also provide unbiased information."

During their visit, the CRIEPI representatives also met with INL staff who were directly involved in the recovery, packaging, transportation and long-term storage of core materials from Three Mile Island. Because INL aided that cleanup effort and analyzed the melted core materials, lab expertise could inform other aspects of the Fukushima recovery and cleanup, which will continue for years.

In fact, INL boasts the largest concentration of Three Mile Island experience remaining in the DOE complex, with more than 40 employees who worked directly on Three Mile Island recovery. Lab leaders are now evaluating the range of Three Mile Island experience that resides within INL, so that the laboratory can provide experts with the best possible background if recovery assistance is needed.

Overall, INL employees are eager to contribute to the technical assistance DOE is providing to Japan. The country has long collaborated with U.S. national labs and nuclear experts to bolster Japan's considerable expertise. Those collaborations have paid off in the exchange of information that has helped inform the emergency response with objective, reliable analyses.

"It's very easy to get tunnel vision in the middle of a crisis," Burns said. "DOE and the national laboratories were voices of reason that helped provide technical perspective as the emergency unfolded."

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