

Fukushima Dai-ichi's Fourth Reactor Needs Independent Assessment

by Gordon Edwards, October 24, 2011

In his recent blog, entitled "The Fourth Reactor and the Destiny of Japan", Akio Matsumura correctly identifies the spent fuel pool in Unit 4 as the most serious potential threat for further massive radioactive releases from the Fukushima Daiichi nuclear power plant. (<http://tinyurl.com/6dlxek5>)

If not cooled by mechanical means for at least several years, the irradiated fuel in the spent fuel pool will overheat due to radioactivity alone. The heat generated by radioactivity must be removed as fast as it is being produced to keep the temperature of the nuclear fuel from soaring out of control.

If the temperature climbs toward 900 degrees C, the metal coating ("cladding") on the outside of the fuel pellets rapidly deteriorates, releasing large quantities of radioactive gases and vapors.

At these elevated temperatures, the cladding also reacts with steam (H_2O) to produce hydrogen gas (H_2) which explodes with great force, as it did in Unit 4 on March 15 – blowing the roof off the building and providing a pathway for radioactivity to escape into the atmosphere.

At about 1000 degrees, the fuel cladding can catch fire, emitting tiny radioactive cinders – miniscule particles of irradiated fuel called "nuclear fleas" – particularly dangerous when inhaled or ingested.

Currently, the situation in Unit 4 is under control – but things could change quickly if the spent fuel pool collapses or the support structure is severely damaged by a strong aftershock. It may then be impossible to cool the irradiated fuel effectively. Temperatures will climb, and the irradiated fuel will overheat and may even catch fire.

In such an event, with no roof on Unit 4, and no containment structure surrounding the spent fuel pool, there is no barrier to prevent or even limit further radioactive releases. Thus there is no way to protect the Japanese population or the environment from these renewed emissions.

Ten years ago, a technical study from the US Nuclear Regulatory Agency pointed out that “the long-term consequences of an SFP [spent fuel pool] fire may be significant.... Analysis indicates that when air flow has been restricted, such as might occur after a cask drop or major earthquake, the possibility of a fire [in a spent fuel pool] lasts many years.” (US NRC NUREG-1738, <http://tinyurl.com/65aa4ue>)

Because of the serious nature of this threat, it would be wise for the Japanese Government to call in experts from other countries to assess the structural integrity of the spent fuel pool in Unit 4 and to recommend measures that can be taken to strengthen it. It is imperative that the spent fuel pool and its supporting structures are capable of withstanding the most severe imaginable aftershock.

Experience has shown that TEPCO and the Japanese regulatory body have not always been correct in their assessments of the situation at Fukushima Daiichi. On numerous occasions misinformation has been communicated to the government and to the public.

In such circumstances, it is important to seek the advice of experts who are genuinely independent – having no conflict of interest and no need to save face. National pride makes it understandably difficult to seek help from outside, but sometimes it is the best thing to do.

As an example, here in Canada, the Board of Directors of Ontario Hydro decided in 1997 to ask a team of American nuclear experts to carry out an Independent Integrated Performance Assessment (IPPA) of Ontario's 20 operational nuclear power reactors.

This unprecedented decision was taken in order to provide the Board with a truly independent review of safety-related questions associated with Ontario Hydro's large fleet of nuclear reactors. (http://ccnr.org/hydro_report.html)

The reason for calling in outside experts was to overcome a significant degree of confusion and uncertainty created by obscure and seemingly contradictory reports from the nuclear division of Ontario Hydro and from Canada's regulatory agency at that time, the Atomic Energy Control Board.

As a result of the independent review, 7 of Ontario Hydro's reactors were shut down for more than 7 years. This allowed management and staff to

focus on a large backlog of important safety-related maintenance tasks and to improve the safety culture within the nuclear division of Ontario Hydro (now Ontario Power Generation).

We in Canada have observed that, under extraordinary circumstances, it can be very beneficial to have the advice of outside experts who bring fresh eyes to bear on the problems and who have no need to defend past pronouncements or justify decisions that may have been previously made.

I believe that such an independent assessment is needed for the spent fuel bay in Unit 4, aimed at producing specific recommendations for ensuring the integrity of the pool and its support structure against any foreseeable earthquake or other stresses they may be subjected to.

It is important to remove the irradiated fuel from the damaged spent fuel pool of Unit 4 as soon as possible. But for this, it is necessary to have (1) a destination pool prepared to receive the irradiated fuel from Unit 4, (2) a containment structure to prevent radioactive emissions during transfer, (3) two cranes (with needed infrastructure) for managing the fuel removal, and (4) transport flasks with cooling capabilities. The fact that the fuel is already damaged further complicates the procedure.

Clearly it will not be possible to remove the irradiated fuel from the spent fuel pool until 2014 at the earliest. In the meantime, it is urgent that action be taken to obtain objective advice from structural experts to ensure that the existing spent fuel bay is as strong and secure as possible.

The stakes are too high to accept unsupported reassurances from TEPCO without first subjecting their analysis to the disinterested scrutiny of others. The dangers associated with the Unit 4 spent fuel pool that were described in a recently-released simulation by Japan's Nuclear and Industrial Safety Agency (completed in June, but only released in October) are still present. (<http://tinyurl.com/3b7dmwn>)