

The World's First Permanent Nuclear Waste Repository

Into Eternity. Director: Michael Madsen. Producer: Lise Lense Møller. 2010.
<http://www.intoeternitythemovie.com>

by Jenny McBride

The narrator of *Into Eternity* asks many questions. Some he poses to various representatives and officials from Finland's nuclear power industry, but others are addressed to the invisible target of his film. "Why did you come here?"

The 2009 documentary directed by Michael Madsen tells the story of Onkalo, the world's first attempt at a permanent repository for nuclear waste. Onkalo, a Finnish word for hiding place, is about 300 km northwest of Helsinki. A three-mile-long, downward-winding network of tunnels is being excavated in the bedrock, with the radioactive waste to be deposited at an eventual depth of 500 meters. The timescale associated with this repository is all but unknown.

The European security standard requires that nuclear waste be isolated from all living organisms for a minimum of 100,000 years. (The US minimum isolation period is a million years.) It is hard to fathom how people can be capable of planning for

the enormity of Onkalo's possible success and the duration of its possible failure.

We see the blasters dynamiting their way deeper into the earth, battering the rock to make room for the sorry by-product of our power supply. We also see the huge pools where nuclear waste is stored while waiting for something more permanent.

There are currently between 250,000 and 300,000 tons of nuclear waste in the world. Finland will bury all of its nuclear waste at Onkalo, yet only Finland's waste will be contained here. (Sweden is in the design phase of a similar repository.) Interspersed with the interviews and haunting narration are shots of native wildlife: reindeer alert to the noise of the film crew, a moose dropping its own temporary and proportionally very small waste.

Perhaps the strangest part of the film revolves around the need for precautionary signage to be placed above the storage site. Acknowledging that we can't expect any of our modern languages to survive for tens of thousands of years, nuclear experts admit that perhaps we will be trying to warn a very

It is hard to fathom how people can be capable of planning for such a dwarfing expanse of time.

such a dwarfing expanse of time. The human species as we know it today is believed to have existed for approximately 100,000 years. The oldest cave paintings date from about 30,000 years ago.

Work on this gargantuan storage facility was begun in the 1970s and is expected to be completed in the 2100s. After the used fuel rods have been deposited at the bottom of the tunnel, the opening will be sealed with layers of steel and concrete. There is still a long way to go; how certain are we that the work will proceed as planned throughout this century and into the next?

Onkalo personnel interviewed in the film include an engineering vice president, a communications manager, a research vice president and a blaster. We also hear from a radiologist and principal advisor employed by Finland's Radiation and Nuclear Safety Authority. Although most of the industry spokespeople in the film appear confident and comfortable with the site's storage plans, there are some who are clearly pained by the questions put to them. Yet even with the assured responses from the experts, it's hard to imagine many viewers coming away from the film with a positive view of nuclear energy.

In between interviews, Madsen poses questions to humans who might discover Onkalo tens of thousands of years in the future. He also provides many facts about the facility and nuclear waste in general, neither condemning nor advocating for nuclear power, but rather outlining the incredible divide between

Future archaeologist-types might find some clues and get the wrong idea.

different kind of species. How can we leave messages for beings so unlike us, so far removed into the future? Designers decided a skull would have the greatest communication potential.

But why would anybody dig into this monumental tunnel? Well, future archaeologist-types might find some clues and get the wrong idea. Many thousand years from now, the history of Onkalo will be forgotten, and if someone chances upon a relic – or even one of the warning signs, they might want to know more.

Onkalo may or may not succeed in its mission, but one thing is for certain: our nuclear waste will be the longest-lasting remains of our society. Michael

Madsen asks several of the nuclear industry employees what they would say to our descendants, who many thousand years from now might be investigating Onkalo. One woman responded emphatically,

“Go back up to the surface and take better care of the earth than we did. Good luck.”

Jenny McBride is a member of the *Synthesis/Regeneration* editorial board. She lives in Illinois, the US state with the most nuclear power plants.

Sea Level Rise Brings Added Risks to Coastal Nuclear Plants

by Alyson Kenward

California's Diablo Canyon power plant is one of nine US nuclear power plants located on the coast. How these coastal plants will withstand sea level rise-related impacts remains unclear. In many parts of the world nuclear reactors are often located near the ocean, due to their requirement for abundant supplies of water for cooling purposes. While tsunamis, like the one that hit Japan in March 2011, aren't a threat everywhere, the sea can pose other challenges. Hurricanes, for example, can push walls of water ahead of them, like the storm surge that did most of the damage to New Orleans when Hurricane Katrina swept through in 2005. In fact, one US nuclear plant has already been dealt a direct hit by a severe hurricane.

But scientists anticipate that in the future, sea level rise will cause hurricanes and their storm surges, as well as flooding caused by other types of storms, to be more severe than during the past few decades. In the wake of the Japanese crisis, which involved a more devastating tsunami than planners

throughout the next century. If the sea is higher to begin with, that means storm surges or tsunamis will pack an extra punch. The worst case, in short, could be worse than anyone imagined when these plants were first built.

In 1992 Hurricane Andrew blew directly over Florida's Turkey Point nuclear plant, cutting off access to external power. The diesel generators supplied back-up power for five days and maintained reactor safety. At Fukushima Daiichi, workers had just a few minutes warning that a tsunami was on its way; at Turkey Point, however, officials were aware of Hurricane Andrew's approach for days in advance. That extra time was crucial: employees began to shut the

plant down a full 12 hours before the storm was scheduled to strike.

The reactors and their protective concrete shells, built nearly 20 feet above the ground, resisted Andrew's hurricane-force winds. Yet across the rest of the Turkey Point property, owned and operated by Florida Power & Light Company (FPL), the combination of high winds and floodwaters brought down the fire-safety system, compromised the security system, and interrupted communication to stations off the property. Potentially the most hazardous incident

Nuclear reactors are often located near the ocean, due to their requirement for abundant supplies of water for cooling purposes.

anticipated, nuclear analysts in the US are now asking themselves how vulnerable coastal nuclear plants are to a comparable emergency.

“After the events in Japan, we took a hard look at whether our operating facilities are protected, based on current regulations and operating procedures,” says Roger Hannah, a senior public relations official with the US Nuclear Regulatory Commission (NRC). Relying on models of expected flood levels and storm surges, along with “real-world experience with hurricanes,” the NRC believes all US coastal nuclear facilities are already built to withstand the worst-case storm scenario, Hannah says. On March 23, the NRC also launched an additional two-step review of US nuclear plants, aimed to last about three months.

Of course, the Fukushima Daiichi plant was also designed to withstand what officials considered a worst-case earthquake and tsunami, but that wasn't enough. All of the nine US nuclear plants that are within two miles of the ocean were built at least 30 years ago. But during these three decades the sea has been rising as a result of climate change (not to mention local changes in the geology at some locations, where the land is sinking), and sea level will continue inching up

The Fukushima Daiichi plant was also designed to withstand what officials considered a worst-case earthquake and tsunami.

was a loss of access to external power for five days. Engineers at Turkey Point were forced to rely on the on-site diesel generators to maintain cooling of the reactors' cores. Fortunately, this back-up system was enough to keep everything operating safely. In Ja-