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Comment
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RADIOACTIVE OPTIMISM: JAPAN'S NUCLEAR POWER PLANTS AND NEW MEXICO'S CROWNPOINT URANIUM MINE

As the horror of Japan's nuclear accident continues to unfold, some American scientists and analysts are already identifying flaws in the Japanese system. We are told that the Japanese failed to properly assess the risks inherent in the placement and design of their nuclear power plants.[1] We are also told that the nuclear regulatory agencies in Japan merely "rubber stamped" the nuclear facility's reports.[2] Yet Japanese scientists and officials have no monopoly on overly optimistic projections and a lack of independent judgment. In 2010, the Court of Appeals for the Tenth Circuit upheld a permit issued by the Nuclear Regulatory Commission ("NRC") for an in-situ leach uranium mine in northwestern New Mexico.[3] The NRC approved the project even though the method that will be used to restore the aquifer had never been shown to work.[4] Further, the NRC established cleanup procedures based on economic considerations and reports from the regulated industry.[5] If nuclear power is ever to become a safe alternative to fossil fuels, America's officials and scientists must do a better job of avoiding the "radioactive optimism" that is prevalent among promoters of nuclear energy.

Japan's Nuclear Crisis

On March 11, 2011, a massive earthquake off the coast of Japan left the Fukushima Daiichi Nuclear Power Plant without electricity.[6] To prevent the reactor cores from overheating, backup generators circulated cooling water through the reactor.[7] These generators, however, were subsequently destroyed by the ensuing tsunami.[8] In response, engineers brought in mobile battery units to keep the coolant flowing, but they were unable to keep the reactors cool.[9] Within five days, superheated cooling water caused explosions in all four of the reactors that had been operating at the time of the earthquake.[10]

The radioactive contamination from the nuclear accident continues to mount. In early April, Tokyo Electric Power announced that it would release more than 10,000 metric tons of contaminated water into the sea in order to free up space for water with higher levels of radioactivity.[11] At the time of that announcement, radiation levels in the ocean nearby were more than 4,000 times the legal limit.[12] On land, all residents closer than 30 kilometers to the accident were advised to stay indoors and, by April 12, some locations 60 kilometers from the accident had already experienced cumulative exposure levels that exceeded the yearly radiation limit.[13] On April 12, Japan raised the accident's severity level from a "Level 5-Accident with Wider Consequences" to a "Level 7-Major Accident,"[14] a level which had previously only been assigned to the 1986 Chernobyl nuclear catastrophe[15] Even before then, some rescue workers had accepted the possibility that their continued presence within the radioactive area would likely kill them.[16]

As Japanese rescue workers continue to struggle to contain the radioactivity, scientists and journalists have started to place blame. Reports surfaced that Japanese engineers ignored geological evidence of a tsunami in 869 A.D. that "displayed striking similarities to the events in and around the Fukushima [Daiichi] reactors."[17] Additionally, a science paper published in 2001 concluded that large-scale tsunamis recur every 800-1,100 years.[18] As one American scientist noted, Tokyo Electric

Power ““absolutely should have known better.”[19]

Another flaw identified by American commentators was the cozy relationship between the nuclear industry and the Japanese government:

> Unlike France and the U.S., which have independent regulators, responsibility for keeping Japan's reactors safe rests with the same body that oversees the effort to increase nuclear power generation: the Trade Ministry. Critics say that creates a conflict of interest that may hamper safety.[20]

But to anyone who is familiar with New Mexico's Crownpoint uranium mine, this condemnation seems remarkably hypocritical. After more than fifty years of radioactive contamination, American scientists continue to paint rosy pictures of uranium mining in the United States; and American regulators base their regulation more on the exigencies of the nuclear industry than the health needs of communities.

A Short Introduction to Uranium Mining

In order to appreciate the threat posed by the Crownpoint Uranium Project, it is necessary to understand a bit about mining technology. Uranium mines can be separated into three basic types: open pit mines, underground mines, and in-situ leach operations.

Both open pit mines and underground mines involve extracting ore from the ground and "milling" the ore.[21] Milling crushes and grinds the ore before treating it with chemical solutions to dissolve the uranium.[22] The uranium is later recovered from the solution.[23] Once the milling and processing is complete, the resultant sludge, called tailings, retains radioactive materials such as radium-226, which has a half-life of 1600 years.[24] Radium-226 is "about one million times more active than uranium, chemically similar to calcium, and when ingested [, a small fraction is] deposited in bone."[25] Additionally, it is absorbed by plants and passed up the food chain to humans.[26] Radium-226 decays into radon gas which causes lung cancer if inhaled in sufficient quantities.[27]

The third type of uranium mining, in-situ leach ("ISL") mining, avoids the milling process by dissolving the uranium from the ore underground (see figure 1). At an ISL plant, the mining outfit drills a series of "production wells" and "injection wells." Groundwater is combined with oxygen and bicarbonate to produce a "lixiviant" which is pumped through the injection wells into the underground "ore zone."[28] Uranium dissolves into the lixiviant, causing it to become "pregnant."[29] The suction power from the pump at the production well causes the pregnant lixiviant to migrate in a general direction toward the production wells where it is ultimately pumped to the surface.[30] The now "barren" lixiviant is recharged and pumped back underground for another cycle.[31]

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

ISL mining produces no tailings because the spent ore remains underground. However, this situation creates new problems because there is no hard barrier between the uraniumladen lixiviant and the larger aquifer. An ISL mine is able to direct the movement of this contaminated groundwater by pumping more water out of the production wells than it pumps into the injection well.[32] Nevertheless, the contaminated water routinely migrates into the surrounding aquifer. Residents in Texas have observed contaminants in their domestic wells which they believe are related to an ISL operation 1½ miles away.[33] One member of Eastern Dine against Uranium Mining who worked as an ISL researcher for Mobil Oil Corporation reported that Mobil ultimately gave up on the research because there was no way for them to completely remove uranium from the water.[34] Even the NRC admits that pollutants migrate out of the ISL well fields. In a 2008 report, it identified sixty events of migration in three ISL facilities; some of these "excursions" lasted for several years.[35] After the ISL mine has shut down, the operator will attempt to return the quality of the groundwater to its pre-mining state by repeatedly flushing the mined area with clean water.[36] However, the NRC's report only reports that "over 60 percent" of the known pollutants had returned to pre-mining concentrations.[37] Of particular note is the fact that NRC admits it is not possible to obtain pre-mining concentrations of uranium and radium-226.[38]

Nevertheless, uranium mining is expanding in the United States. The number of uranium mines increased from three to four facilities in 2010 (all currently ISL mines[39]) and 2010 uranium production[40] increased by 14% over 2009 figures.[41]

Additionally, a number of mining projects are currently "in the pipeline," such as the Crownpoint Uranium Project, an ISL mine in northwestern New Mexico.[42]

The Crownpoint Uranium Project

On March 8, 2010, the United States Court of Appeals for the Tenth Circuit upheld the decision by the NRC to grant a license to Hydro Resources, Inc. ("HRI") for the Crownpoint Uranium Project.[43] The project involves ISL mining at four locations near the Navajo Reservation in northwestern New Mexico.[44] A portion of the Crownpoint Uranium Project is "on land held in trust by the U.S. Government for the Navajo Nation."[45] The aquifer in which the uranium ore is contained "supplies drinking water for more than 10,000 residents of the Eastern Navajo Agency."[46]

The Navajo People have suffered a disproportionate number of the harms from uranium mining. Mines were first established on Navajo Nation land in the 1940s.[47] Although a link between uranium mining and elevated rates of lung cancer had been demonstrated conclusively by the late 1930s,[48] workers in the Navajo mines were not told of the risks.[49] Workers were not told to wash after leaving the mines and they washed their work clothes at home, bringing radioactive material into the very place where they and their families should have been safe from it.[50] Some miners in the 1940s and 1950s even wore moccasins while working.[51] When one specialist with the public health service argued for better ventilation within the mines, his views were not made public.[52] In fact, the scientist who first hypothesized that radioactive decay of radon caused cancer was forbidden by the United States government from traveling west of the Mississippi![53] As a result, radiation was identified as the "primary cause of lung cancer among Navajo men diagnosed with lung cancer from 1965 to 1979."[54]

On July 16, 1979, a dam at United Nuclear Corporation's uranium mill burst, releasing 1,100 tons of radioactive milling waste and 94 million gallons of contaminated wastewater into the Rio Puerco.[55] It was the "largest single release of uranium-mine tailings and uranium-mill wastewater in U.S. history."[56] When the Navajo who lived in the area crossed the river (normally a dry arroyo) to gather up their sheep, they developed blisters and sores on their feet and legs.[57] At least one individual reportedly died of "cancer of the foot."[58] Radioactive contaminants later passed to the Navajo's sheep, which could not be sold for their meat or wool.[59]

Nevertheless, the uranium mill did not cease operation until 1982.[60] The mill is now a Superfund site, but the Old Church Rock Mine, one of the mines which supplied the uranium mill,[61] is part of the area that will be mined under the Crownpoint Uranium Project.[62] The Old Church Rock Mine still contains debris that "emits a greater amount of airborne radiation than the NRC regulations allow," however, the NRC decided not to require HRI to restore the site.[63] A divided panel of the U.S. Court of Appeals for the Tenth Circuit upheld the NRC's determination, concluding that the NRC need only ensure that the radioactive dose attributable to HRI's new mining activities be kept below the legal maximum.[64]

Not only did the Tenth Circuit allow NRC to ignore existing radioactive contamination, it allowed the NRC to approve a mine that creates new groundwater contamination. When the NRC granted the license to HRI for ISL mining, it required a surety to be held for the decontamination of the aquifer. The value of the surety was set to cover the estimated cost of decontamination; however, at the time the license was granted, "no one had, as yet, fully restored the groundwater quality after an ISL mining operation."[65]

The license granted by NRC to HRI requires "ground water restoration of the initial well fields ... based on nine pore volumes."[66] "Pore volume" is a unit of measurement that represents "how many times the contaminated volume of water in the rock must be displaced or processed to restore groundwater quality .... In general, the more pore volumes of water it takes to restore groundwater quality, the more money it will cost to achieve restoration."[67] The NRC decided to evaluate groundwater restoration by considering thirty-five "parameters" (levels of individual contaminants within the water).[68] The primary goal of groundwater restoration is to diminish each of the contaminants to levels equal to that found in the aquifer before ISL mining.[69] However, if that cannot be reached, the NRC will accept a ""secondary goal" of achieving contamination levels no higher than the EPA's limits for drinking water.[70] But it doesn't end there: if the secondary goals cannot be reached, the NRC will allow the mining company to apply for a "license amendment that would allow some change in restoration requirements on a parameter-by-paremeter basis."[71]

The process outlined by the NRC makes the idea of decontamination laughable. Under the NRC's license, HRI need not restore the water quality even to the minimum standards for drinking water if it can demonstrate to the NRC (not to the EPA) that the concentration “would not be a threat to public health and safety.”[72]

Not only were the “standards” set out by the NRC for this uranium mine subject to continued renegotiation after the mining began, there was no evidence that the “primary goals” of restoration would ever be met with nine pore volumes. In a pilot project conducted by the mining industry, passing 9.7 pore volumes through the aquifer did not restore uranium concentrations to the NRC standard.[73] The pilot project also considered total dissolved solids (“TDS”) and noted that, after 9.7 pore volumes of water was pumped through the aquifer, TDS was restored to 587 parts per million “which was close” to the safe drinking water limit of 500 parts per million.[74] Nevertheless, the NRC’s hydrologist concluded that it is “extremely likely that after in situ leach mining is completed, the groundwater quality will be restored to acceptable levels.”[75] In sum, a restoration project using 9.7 pore volumes to flush the aquifer failed to restore six of the thirty-five contaminants to the “secondary groundwater restoration goals,” yet the NRC approved a project where only nine pore volumes would be used for decontamination.

How could a regulatory agency determine that nine pore volumes was sufficient to decontaminate an aquifer when a pilot project conducted by the mining industry showed 9.7 pore volumes was insufficient? Perhaps it is because the NRC knew that mining companies couldn’t do any better. The NRC noted in its environmental analysis that pollution showed “little improvement with continued pumping after 8 to 10 pore volumes.”[76] But in upholding the permit, the court noted that “the NRC rejected HRI’s original proposal that a four-pore-value restoration would be sufficient.”[77] Perhaps that is why Bloomberg News reported that, unlike the Japanese, U.S. nuclear regulators are ““independent.”[78]

Conclusion

In Japan, a tsunami of the magnitude felt in March 2011 had not been felt for over 1,000 years. Japanese engineers concluded that such a serious tsunami was not a realistic risk to the Fukushima Power Station. In the United States, at the time of HRI’s application, no one had ever successfully decontaminated an aquifer after ISL mining. Yet American regulators somehow “became convinced that it was possible ... to restore the groundwater ...” While Japanese engineers failed to consider the worst scenario, the NRC only considered the best scenario.

Indeed, there are reasons to question whether the future decontamination at the Church Rock mine would be as “successful” as the experimental decontamination project conducted by Mobil. The pilot project was conducted on a different site. As a demonstration project, the researchers had a great motivation to achieve positive results. Motivation may be lower when the regulating agency is willing to approve amendments to the license. Preventing contamination of the aquifer depends on pumps working properly--if the pump fails at a production well, uranium-laden lixiviant will no longer migrate toward the production well and will instead start to mix with the surrounding aquifer. Additionally, wells can leak lixiviant into the overlying aquifer if the well casings are flawed or damaged[79]--one ISL mine reported 135 failures in the integrity of its wells during the period spanning 1998-2009.[80] Much as it did in Japan, an earthquake could induce both of these problems: power outages causing pump failures and well casing ruptures.

The Fukushima nuclear accident shows what can happen when scientists and engineers make optimistic predictions of radioactive technology. But, as the Crownpoint Uranium Project shows, such optimism is not isolated to Japan or to nuclear power generation. Rather, it seems that many scientists are infected with a kind of radioactive optimism that downplays the risks of nuclear energy and assumes that all major harms will be averted in the future. The Crownpoint ISL uranium mine will likely never affect as many people as the Fukushima Nuclear Power plant but, like Fukushima, the mine will ultimately add to the earth’s ever-expanding zones of radioactive land and water. If we wish to halt these expansions in the future, we must demand a little more pessimism from our scientists and regulators.

Footnotes

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http://www.bloomberg.com/news/2011-03-17/japan-s-nuclear-disaster-caps-decades-offaked-safety-reports-accidents.html

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18 Id.

19 Id.

[20] Clenfeld, supra note 2. See also Norimitsu Onishi & Ken Belson, Culture of Complicity Tied to Stricken Nuclear Plant, THE NEW YORK TIMES, Apr. 26, 2011, available at http:// www.nytimes.com/2011/04/27/world/asia/27collusion.html?_r=2&src=me&pagewanted=all ("Already, many Japanese and Western experts argue that inconsistent, nonexistent or unenforced regulations played a role in the accident ...").

[21] U.S. EPA, OFFICE OF RADIATION & INDOOR AIR, PUB. NO. EPA 402-F-06-037, URANIUM MINES, 1 (2006) available at http:// www.epa.gov/radtown/docs/uranium-mines.pdf.

[22] Id.

[23] Id.

[24] Rob Edwards, Who Will Pay for a Nuclear Future? NEW SCIENTIST 8, June 10, 2006. Simply stated, a "half-life" is the time that it takes half of the atoms in a radioactive isotope to decay. Half-Life, U.S. EPA, http:// www.epa.gov/radiation/understand/halflife.html, (last visited Apr. 25, 2011). Thus, if radioactive tailings contain 1 kilogram of radioactive radium-226 today, those same tailings will contain half as much radium-226 in 1600 years.

[25] WASHINGTON STATE DEPARTMENT OF HEALTH, DIVISION OF ENVIRONMENTAL HEALTH, OFFICE OF RADIATION PROTECTION, FACT SHEET NO. 29, RADIUM-226 (2002), available at http://www.doh.wa.gov/ehp/rp/factsheets/factsheets-pdf/fs29ra226.pdf.

[26] Id.

[27] Id.

[28] Morris v. United States Nuclear Regulatory Commission, 598 F.3d 677, 682 (10th Cir. 2010).

[29] Id.

[30] Id.

[31] Id.

[32] See Id

[33] DOUG BRUGGE, TIMOTHY BENALLY & ESTHER YAZZIE-LEWIS, THE NAVAJO PEOPLE AND URANIUM MINING 174 (2006).

[34] Id. at 169

[35] Memorandum from Charles L. Miller, Director, Office of Federal and State Materials and Environmental Management Programs, Nuclear Regulatory Commission to Chairman Jacko, et al. at 1-2, available at http:// denr.sd.gov/powertech/GW/Appendix_C_1_Memo_Re_GW_Impacts.pdf [hereinafter Miller memo].

[36] See Morris, 598 F.3d at 695.

37 Miller Memo, supra note 35 at 1.

38 Enclosure to Miller Memo supra note 35 at 2-3.

39 Although the only operational mines in 2010 were ISL facilities, mining companies have not abandoned traditional methods. In March 2011, Arizona regulators issued some permits for three conventional mines on federal lands near the Grand Canyon. Cyndy Cole, Three Uranium Mines Advance, AZDAILYSUN.COM (Mar. 11, 2011), http://azdailysun.com/news/local/govt-and-politics/article_ ddfb5dfd-2887-5180-86ec-86182392a202.html.

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44 Id. at 681-82.

45 Morris, 598 F.3d at 683.

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47 Stewart L. Udall, Foreword to DOUG BRUGGE, TIMOTHY BENALLY, ESTHER YAZZIE-LEWIS, THE NAVAJO PEOPLE AND URANIUM MINING, at xi (2006).

48 Brugge, supra note 33 at 30.

49 Udall, supra note 47 at xvii.

50 Brugge supra note 33 at 15, 18-19.

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52 Id.

53 Id. at 34.

54 Leon S. Gottleib and Luverne A. Husen, Lung Cancer among Navajo Uranium Miners, CHEST 81:4 (Apr. 1982).

55 LAURIE WIRT, RADIOACTIVITY IN THE ENVIRONMENT; A CASE STUDY OF THE PUERCO AND LITTLE COLORADO RIVER BASINS, ARIZONA AND NEW MEXICO 15 (Water-Res. Investigations Report Ser. No. 94-4192, 1994), available at http:// pubs.er.usgs.gov/publication/wri944192; Marley Shebala, Poison in the earth: 1979 Church Rock spill a symbol for uranium dangers, NAVAJO TIMES, July 23, 2009, available at http://www.navajotimes.com/news/2009/0709/072309uranium.php.

56 Wirt, supra note 55 at 15.

57 Shebala, supra note 55.

58 Id.

59 Brugge, supra note 33 at 4.

60 UNC-Church Rock Mill Uranium Recovery Facility, U.S. NUCLEAR REGULATORY COMM'N, http://www.nrc.gov/info-finder/decommissioning/uranium/is-united-nuclear-corporation-unc.pdf (last viewed Apr. 25, 2011).

61 Id.

62 Morris, 598 F.3d at 684.

63 See Id. at 683-84.

64 Id.

65 Id. at. 695. The court noted in a footnote that after the NRC completed its analysis "the groundwater quality was successfully restored at the Bison Basin Mine following an ISL operation." Id. at 695 n. 19. However, this assertion does not change several important observations. First, the NRC was concluding that the aquifer would be restored even though an aquifer had never been restored in the past. The mere fact that one restoration was later found to be "successful" should have had no bearing on whether the NRC's granting of a license was arbitrary and capricious. Third, the successful restoration in one Wyoming mine does not automatically translate to successful restoration in New Mexico. See Id. at 704 n. 25 (noting that the Bison Basin Mine was restored by the State of Wyoming). Fourth, as discussed, infra, the standards imposed on restoration projects are negotiable and do not even guarantee that the "restored" aquifer meets the minimum federal requirements for drinking water.

66 Id. at 699.

67 Id. at 695.

68 Id. at 6

69 Id.

70 Id. at 698.

[71] Id.

[72] Id.

[73] See Id. at 701 (noting that uranium was "nearly in compliance with the NRC standard" (emphasis added)).

[74] Id. at 701.

[75] Id. at 700.

[76] Id. at 700.

[77] Id.

[78] Clenfeld, supra note 2. Also note that the NRC regulates nuclear power plants as well as ISL facilities. Our Governing Legislation, UNITED STATES NUCLEAR REGULATORY COMMISSION,http://www.nrc.gov/about-nrc/governing-laws.html (last visited Apr. 25, 2011) (explaining that the NRC regulates Nuclear Power Plants).

[79] See Miller Memo, supra note 35 at 1 (Explaining that "Potential groundwater impacts at an [in-situ uranium recovery] facility can result from ... a mechanical failure of the subsurface well materials releasing production fluids into the overlying aquifers).

[80] Enclosure to Miller Memo, supra note 35 at 9.