FUKUSHIMA DISASTER: IMPACTS AND CONTINUING THREATS

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More than two years since the nuclear disaster began at the Fukushima Daiichi reactors, its impact is massive and widespread. It will be decades before the full scope of the impacts of this ongoing disaster is fully understood but significant health, economic, environmental and social consequences are already evident and quantifiable. Furthermore, independent expert analyses has documented extraordinary industry influence on government regulators, especially widespread collusion among the Japanese government, Tokyo Electric Power Company (TEPCO), the owner/operator of Fukushima, and the nuclear/utility industry. The Fukushima disaster leaves Japan with massive economic loss, radiation exposure to children and others, and a nation grappling with an uncertain nuclear future.

Public Health Effects & Radiation Exposure

- **Thyroid Disease –** According to the proceedings of the 12th Prefectural Oversight Structure Committee Meeting for Fukushima, released on August 20, 2013, Thyroid ultrasound examinations conducted on 216,809 Fukushima children since October 2011 revealed 18 confirmed and 25 suspected thyroid cancer cases, with the youngest who was 6 at time of the accident. [1] The incidence of 22.3 per 100,000 overall, or 9.3 per 100,000 for confirmed cases exceeds even adult thyroid cancer rates. In 2007 in Japan, normal incidence of thyroid cancer is 0.1 in 100,000 below age 15 and 0.9 in 100,000 in age 15-19.[2] According to the National Cancer Institute, pediatric thyroid cancer incidence in the US is 0.2 in 100,00 below age 15,[3] and 1.76 per 100,000 in age 15-19 (12.2 in 100,000 adults). While this may reflect screening bias, there has been an increasing rate of abnormalities including cysts and nodules in over 43% since the screening first began.

- **Radiation Release -** Initial estimates of radiation expelled into the air from Fukushima Daiichi indicate 900,000 terabecquerels compared to 5,200,000 terabecquerels released at Chernobyl.[4] Fortunately, most of the radioactivity fell in the Pacific Ocean away from population centers due to favorable winds—only 19 percent of the released radioactivity was deposited over land—keeping the exposed population relatively small compared to the predicted impact if winds had caused much of the airborne radioactivity to settle over Tokyo.[5]

- **Radioactive Cesium –** Which has a half-life of 30 years, has been found in all over Japan due to the initial explosion. The total atmospheric cesium-137 release from Fukushima Daiichi was about 100,000 TBq, similar to levels at Chernobyl and from 6,000 to 47,000 TBq of 137Cs discharged into the Pacific Ocean.[6] This is significant because cesium is absorbed into the body when inhaled or from eating contaminated food.

- **Strontium-90 'The Bone Seeker'** – another byproduct of nuclear accidents is Strontium-90. Strontium-90 is chemically similar to calcium, and tends to deposit in bone and blood- forming tissue (bone marrow). Internal exposure to Sr-90 is linked to bone cancer, cancer of the soft tissue near the bone, and leukemia.[7] High levels of Strontium 90 have been found in the groundwater near the Fukushima reactors, which have increased by more than 100 times between December 2012 and May 2013. The current readings show Strontium-90 levels more than 30 times the legal limit.[8]

- **Cesium bio-accumulates** in human tissue, especially in children, who receive a proportionately higher degree of damage from its effects. A primary isotope released by the reactor meltdowns, Cesium is accumulated at levels up to 10 times higher in heart and endocrine tissues, as opposed to skeletal muscle or surrounding tissues.

- **Ocean Contamination –** Levels of radioactive cesium off the Japanese Northeast coast peaked at more than 100,000 becquerels per cubic meter in early April, 2011— about 100 times higher than the peak levels detected in the Black Sea after the Chernobyl disaster in 1986. The central government hastily banned Fukushima's sales of 36 types of fish other than octopus and whelk. In return fisherman received about $125 million from TEPCO.[9] Trace amounts of leaked cesium have been found in Bluefin tuna caught off the western coast of the United States. While public officials report that the levels of cesium in the tuna pose no risk to public health, this information underscores the magnitude of this disaster.[10] Since the Fukushima nuclear power plant disaster, the Fisheries Agency has measured the radiation levels of about 20,000 fish. The overall trend has been a decline of radioactive cesium, according to the news outlet, Asahi Shimbun. However, in August 2012, two greenlings caught 20 kilometers north of the Fukushima plant were found to have cesium levels of 25,800 becquerels per kilogram, the **highest level ever measured in fish** since the nuclear accident. The Japanese government standard for food is 100 Becquerels per kilogram.[11] High amounts of cesium have been found in freshwater fish as well in areas far removed from the Fukushima disaster.[12]

- **Growing levels of tritium** have also been found in seawater near the Fukushima reactor.[13] Tritium is a highly radioactive isotope of hydrogen, with a specific activity of almost 10,000 curies per gram. In gaseous form, it poses far fewer risks than in other chemical forms. Since tritium has the same chemical properties as hydrogen, it can combine with oxygen to form water. Since tritiated water is processed by plants, animals and humans like ordinary water, the tritium in it can become transformed into other chemicals, such as proteins, needed by the body. It can become part of the DNA and has been linked to problems with reproduction and abnormal development.[14]

Government /Industry Collusion

- **No Radiation Maps –**The Japanese Central government and TEPCO withheld radiation maps from the public in the wake of the meltdown of the Fukushima Daiichi Plant in order to avoid "creating a panic." This left local governments without data to develop evacuation plans and resulted in thousands evacuating directly into the pathway of leaked radiation.[14] Despite the presence of tellurium 132, which experts indicate is telltale evidence of reactor meltdowns, the day after the meltdowns at three of Fukushima Daiichi's six reactors were officially and publicly unacknowledged for nearly three months .[16] Several days before the disaster, a government panel softened the wording of a report warning that a massive tsunami could strike northeastern Japan after TEPCO and two other utilities specifically requested the edits.[17]

- On February 27, 2012 the Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident blamed TEPCO, for its systematic failures and the government for weakness in its regulatory regime for the disaster triggered by the earthquake and tsunami. TEPCO is characterized as "not taking the culture of nuclear safety seriously," and the commission pointed out that nuclear regulators in Japan isolated themselves from international standards and created measures to deal with very severe disasters that were not obligatory.[18]

- Although they would waver on this decision[19] in response to public outcry, one of the first actions taken by the Japanese government only days after the advent of the disaster was to raise the allowable radiation exposure levels in children to 20 times higher than previously permitted. The decision raised exposure limits to 20 millisieverts, or that of an adult German nuclear worker. [20] Fukushima parents recently sued the Japanese government to evacuate their children to areas with normal background radiation. The Sendai High Court ruled against them in April 2013.[21]

- Reminiscent of the Japanese regulatory response to Fukushima, the US Environmental Protection Agency has recently proposed a protection action guideline (PAGs) that would rollback evacuation triggers, drinking water and cleanup standards in the event of a radiological incident.[22] In soil, the PAGs allow long-term public exposure to radiation in amounts as high as 2,000 millirems. This would, in effect, increase a longstanding 1 in 10,000 person cancer rate to a rate of 1 in 23 persons exposed over a 30-year period.[23]

- One third of Japanese Nuclear Safety Commission members who served on committees overseeing nuclear power plant inspections and nuclear fuel, received nearly 85 million yen ($1.1 million) in donations over a five–year period until 2010 from companies and organizations affiliated with the nuclear power industry.[2]

Economic Losses

- The Japanese government has set aside 15 billion yen to cover the costs of decontamination including the disposal of 15 million to 31 million cubic meters of contaminated soil and debris.[25] Early estimates of the cost of decontamination reached 10 billion yen ($110 million) while estimates of the total disaster and aftermath have a range of $250 billion–$650 billion, which is comparable to the 2008 U.S. mortgage crisis.[26] However, TEPCO now projects that the original government-decommissioning estimate will be exceeded, forecasting "an enormous cost," according to Bloomberg on 11/7/2012.[27]
- The Japan Atomic Industrial Forum's International Cooperation Center estimated that the cost to purchase an additional 20 million tons of LNG needed to make up for the loss of the nuclear power plant outages will be $44 billion (3.4 trillion yen).[28] While this is significant, a study by the Japan Center for Economic Research has determined that the cost of abandoning nuclear energy in Japan by 2050 is estimated to equal the cost of remaining reactor-dependent.[29]
- The Japanese central government provided Tokyo Electric Power Co. with a taxpayer bailout with an equity investment of 1 trillion yen ($12.78 billion) in July 2012. However, prior to that, 2.5 trillion yen in public funds had already been provided to TEPCO to pay compensation to victims of the Fukushima disaster.[30] By June 14, 2013, TEPCO has paid out 2.44 trillion yen in compensation to people and businesses affected by the Fukushima Daiichi nuclear disaster[31] with total compensation costs expected to reach 4.5 trillion yen.[32] To recover its costs, TEPCO's electricity rates are estimated to increase an average 8.46-percent for household users and an average 14.9-percent hike for corporate customers. Even so, on November 7, 2012, Bloomberg reported TEPCO had requested another 11 trillion yen ($137 billion) to compensate victims and for contamination around the plant.[33]
- 80,000 farms in the Fukushima prefecture have been contaminated by the nuclear disaster, and crippling the local agriculture sector worth 250 billion yen. As of March 1, 2012, 25 percent of Japanese agriculture production or about 58 billion yen ($694 million) had been lost. In 2011, the agriculture ministry reported that the cost of imported farm products jumped 16 percent to 5.58 trillion yen.[34]

Turning Away from Nuclear Reactor Dependence

- While Japan recently pushed back making a decision on its nuclear energy future to 2015 with Japan's ruling party advocating a proposal to be nuclear free by 2050 other nations are already pioneering towards a future of safe and clean energy.[35]
- In May 2011 Germany, the world's fourth largest economy, announced plans to shut down all 17 of its nuclear reactors by 2022. This date was pushed up from 2036 in the wake of the Fukushima nuclear disaster.[36]
- In an Italian referendum vote in June 2011with approximately 55% of the population voting, 94% were against the construction of any new nuclear reactors in Italy. Italy had previously phased out its nuclear power plants in 1990 after the disaster in Chernobyl.[37]
- In reaction to Fukushima, the Swiss government decided to phase out nuclear power with the first plant coming offline in 2019 and the last in 2034.[38]
- Belgium similarly elected to uphold a 2003 policy to phase out nuclear reactors. Two reactors will go offline in 2015, and the rest should go offline by 2025.[39]
- Kuwait and Mexico have also abandoned previous plans for large scale nuclear expansions.[40]
- Taiwan is currently holding a national referendum on whether or not to begin operations at its fourth reactor, in the wake of recent news that the reactor is on a fault-line and with the memory of Fukushima still very fresh in residents' minds.[41]
- Even nuclear-loving France is debating the technology's role in its energy future. The Government of Francois Hollande has commissioned a council to review French energy policy with a view towards cutting reliance on nuclear reactors.[42]

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FUKUSHIMA DISASTER: END NOTES

1 Fukushima Medical University. 12th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey. (2013, Aug.20). www.fmuc.ac.jp/radiationhealth/results/media/12-2_ThyroidUE.pdf

2 Asahi Shimbun (2013, June 6). Experts: More Data Needed to Assess Radiation's Role in Cancer Among Fukushima kids. ajw.asahi.com/0311disaster/fukushima/AJ201306060092

3 National Cancer Institute. Unusual Cancers of Childhood Treatment (PDQ). (2013 Oct. 17). www.cancer.gov/cancertopics/pdq/treatment/unusual-cancers-childhood/HealthProfessional/page2#Section_778

4 Inajima, T., Okada, Y. and Matsuyama, K. (2012, May 24). Fukushima's estimated radiation leak double versus government. Bloomberg Business News. http://www.businessweek.com/news/2012-05-24/fukushima-s- estimatedradiation-leak-doubles-versus-government

5 Ten Hoeve, J. and Jacobson, M. (2012, June 26). Worldwide Health Effects of the Fukushima-Daiichi nuclear accident. *Royal Society of Chemistry.* www.stanford.edu/group/efmh/jacobson/TenHoeveEES12.pdf

6 Arutyunyan, R, et.al, "Estimation of radionuclide emission during the march 15, 2011 accident at the fukushima-1 npp. Atomic Energy. July 2012 Vol 112 pp188-93. http://enenews.com/highest-yet-us-govt-funded-study-estimates-fukushima-cesium-137-release-at-90-of-chernobyl. Accessed 10/21/13

7 US Environmental Protection Agency, (2012, April 24) "Strontium." http://www.epa.gov/radiation/radionuclides/strontium.html#inbody (accessed 2013, June 26).

8 Reuters (2013, June 19). Japan finds highly toxic strontium in Fukushima groundwater. http://thestar.com.my/news/story.asp?file=/2013/6/19/worldupdates/japan-finds-highly-toxic-strontium-in-fukushima-groundwater&sec=Worldupdates

9 Tabuchi, H. (2012, June 25) Fears accompany fishermen in Japanese disaster region. *The New York Times.* http://www.nytimes.com/2012/06/26/world/asia/fears-accompany-fishermen-in-japanese-disaster-region.html?_r=0

10 Burke, M. (2013, Feb. 20) Bluefin tuna from nuclear meltdown still have traces of radiation. Forbes. http://www.forbes.com/sites/monteburke/2013/02/20/bluefin-tuna-from-the-fukushima-nuclear-meltdown-still-have-traces-of-radiation/

11 Radiation 258 times legal limit found in fish off Fukushima. (2012, August 22). *The Asahi Shimbun.* ajw.asahi.com/article/0311disaster/fukushima/ AJ201208220077

12 Mizuno, T. and Kubo, H. Overview of active cesium contamination of freshwater fish in Fukushima and Eastern Japan. Scientific Reports (3:1742) April 2013. http://www.nature.com/srep/2013/130429/srep01742/full/srep01742.html

13 *Asahi Shimbun* (2013, June 25) Higher seaborne tritium levels outside Fukushima plant suggest leaks not plugged. http://ajw.asahi.com/article/0311disaster/fukushima/AJ201306250085

14 Makhijani, A. Statement on Tritium (2006, Feb. 7). http://ieer.org/resource/nuclear-power/statement-on-tritium/

15 Ministry tries to justify fallout data delay, (2012, July 28) *The Japan Times.* http://www.japantimes.co.jp/text/nn20120728b7.html

16 Onishi, N. and Fackler, M. (2011, August 8). Japan held nuclear data, leaving evacuees in peril. *New York Times.* http://www.nytimes.com/2011/08/09/world/asia/09japan.html?pagewanted=all&_r=0

17 Tsunami alert softened days before 3/11. (2012, February 27). *The Japan Times.* www.japantimes.co.jp/text/nn20120227a2.html

18 Nishikawa, J. (2012, February 28). Private panel blames TEPCO's 'systematic negligence.' *The Asahi Shimbun.* ajw.asahi.com/article/0311disaster/fukushima/AJ201202280030

19 blogs.wsj.com/japanrealtime/2011/05/27/japan-bows-to-parent- pressure-over-radiation-concerns/

20 Willacy, M. (2011, May 24). Japan raises permissible radiation levels for children. ABC News Australia. www.abc.net.au/am/content/2011/s3225020.htm>

21 japandailypress.com/japan-court-rejects-fukushima-children-evacuation-lawsuit-2527718

22 www.epa.gov/radiation/docs/er/pag-manual-interim-public-comment-4-2-2013.pdf

23 www.peer.org/news/news-releases/2013/04/08/white-house- approves-radical-radiation-cleanup-rollback/

24 Nuclear watchdog members received donations from energy sector. (2012, January 2). *The Asahi Shimbun.* ajw.asahi.com/article/0311disaster/fukushima/AJ201201020044

25 Japan allocates money for decontamination. (2011, December 19). *The WallStreet Journal.* online.wsj.com/article/SB10001424052970204879004577107703452346104.html

26 Lavelle, M. (2012, March 8). One year after Fukushima, Japan faces shortage of energy, trust. *National Geographic News.* news.nationalgeographic.com/news/energy/2012/03/120309-japan-fukushima-anniversary-ener-gyshortage/

27 Staff Writers. (2012, November 7). TEPCO says Fukushima clean up, compensation may hit $125 bn. *Nuclear Power Daily.* www.nuclearpowerdaily.com/reports/TEPCO_says_Fukushima_clean_up_compensation_may_ hit_125_bn_999.html

28 Taxpayers, electricity users finance TEPCO bailout. (2012, July 31). *The Asahi Shimbun.* ajw.asahi.com/article/0311disaster/fukushima/AJ201207310068

29 Kobayashi, T. (2011, December 27). Energy Saving and Renewable Energy Development Less Costly Than Sticking with Nuclear Energy. Japan Center for Economic Research. www.jcer.or.jp/eng/research/pdf/pe%28kobayashi20120130%29e.pdf

30 Reuters. (2012, July 25). Japan govt sanctions TEPCO reform plan, including rate hike. www.reuters.com/article/2012/07/25/energy-japan-tepcoidAFL4E8IP4F220120725

31 www.tepco.co.jp/en/comp/images/jisseki-e.pdf

32 Urabe, E. (2012, February 23). TEPCO said to be in talks for 1.07 trillion yen of borrowing. *Bloomberg.* www.bloomberg.com/news/2012-02-23/ tepco-said-to-be-in-talks-for-1-07-trillion-yen-of-borrowing-1-.html

33 Inajima, T. and Song, Y. (2012, November 7). Fukushima $137 billion cost has TEPCO seeking more aid. *Bloomberg.* www.bloomberg.com/ news/2012-11-07/fukushima-137-billion-cost-has-tepco-seeking-more-aid.html

34 Takada, A. and Song, Y. (2012, March 8). Fukushima farmers face decades of tainted crops as fears linger. *Bloomberg.* www.bloomberg.com/news/2012-03-19/fukushima-farmers-face-decades-of-tainted-crops-as-fears- linger.html

35 Tabuchi, H. (2012, , September4). Japan sets policy to phase out nuclear power plants by 2040. *The New York Times.* www.nytimes.com/2012/09/15/world/asia/japan-will-try-to-halt-nuclear-power-by-the-endof-the-2030s.html?pagewanted=all&_moc.semityn.www

36 Davidson, O. (2012, November 16). Germany abandons nuclear power and lives to talk about it. *Bloomberg Business Week.* www.businessweek.com/news/2012-11-16/germany-abandons-nuclear-power-and-lives-to-talk-about-it#p2

37 Faris, S. (2011, June 14). Italy says no to nuclear power-and to Berlusconi. *Time.* www.time.com/time/world/article/0,8599,2077622,00.html

38 Kanter, J. (2011, May 25). Switzerland decides on nuclear phase out. *The New York Times.* www.nytimes.com/2011/05/26/business/global/26nuclear.html

39 www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Belgium/#.UaTXlpzm9MQ

40 www.worldnuclearreport.org/IMG/pdf/2012MSC-WorldNuclearReport-EN-V2.pdf

41 rt.com/news/taiwan-nuclear-plant-protest-828/

42 www.technologyreview.com/news/510046/will-france-give-up-its-role- as-a-nuclear-powerhouse/

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