

How Does Fukushima Radiation Affect Sonoma County and The Surrounding Areas?

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Introduction:

This investigative paper highlights the lack of research being conducted on the long-term effects of nuclear radiation. Corporate media outlets have refused to address the negative health effects that nuclear radiation has caused to the populations it surrounds. Little research has been conducted that is aimed towards uncovering the health effects of nuclear radiation caused by Fukushima. Although we are aware of the radiation contamination in the Pacific Ocean, there is a lack of information of the overall effects Fukushima radiation has on the ecosystem, and therefore the population that depends on it. Through interviews with local professionals of Fukushima, we are able to uncover the damaging effects of Fukushima radiation that the corporate media has not reported. Our research hopes to uncover the long-term health effects Fukushima has caused to Sonoma County and the surrounding areas.

Many Sonoma County residents are unaware of the effects radiation from Fukushima can have on themselves and their families. Through education and awareness, preventative measures can be taken to protect families and other residents. We will hopefully be able to report what individuals in the community can do to protect themselves, if and when the Fukushima radiation arrives to the West Coast at a higher and more damaging rate.

Research Question:

How does Fukushima radiation affect Sonoma County and the surrounding areas?

Literature Review:

Bodega Bay rests on the Northern California coast and has maintained its commercial fishing economy for generations. During World War I, Bodega Bay's commercial fishing industry boomed, as salmon drove the local economy. Current commercial fisherman focus on albacore tuna, chinook salmon, halibut, rockfish, dungeness crab, sole, and more recently sea urchin. In the year 2000, Bodega Bay had 317 commercially registered vessels that delivered fish to one processing plant. According to the National Oceanic and Atmospheric Administration, in 2000, commercial fishing from residents in Bodega Bay and Timber Cove produced 22 tons of coastal pelagic worth \$21,133, 35.7 tons of groundfish worth \$247,021, 59 tons of highly migratory species worth \$144,711, 300.6 tons of salmon worth \$1,245,430, and 283 tons of other species worth \$560,426 ("Bodega Bay," 2007). Commercial fishing in Bodega Bay is a prominent feature in the local economy.

Fukushima Daiichi, one of Japan's nuclear plants, was built right on the Northeast coast. On March 11, 2011, an earthquake with a magnitude of 9.0 hit the eastern coast of Honshu Island, the main island of Japan. Triggered by the earthquake, a tsunami hit the coast killing 19,000 people and severely damaging the Fukushima Daiichi nuclear power plant. Four reactors and three nuclear cores were damaged during the tsunami, causing radiation isotopes to leak into the atmosphere and ocean ("Fukushima Disaster," 2016). The cooling system for the plant was destroyed during the disaster, and as a result 200-300 tons of groundwater was used to cool the systems. However, officials have not established an effective plan to prevent the contaminated water from leaking into the ocean (Jamail, 2016). This man made disaster could have been prevented; however, with the Government and other major corporations, TEPCO, NISA and

NSC promoting nuclear power it makes it hard for nuclear power to be replaced with natural power (Williams, 2012). NISA, NSC, and TEPCO took measures to prevent the accident, but they made decisions on their organization's self interest, not the interest of the public's safety. They rationalize these decisions based on profit. In 2009, TEPCO's net profit was 1.7 billion through corporate affairs and electricity plants that produced one third of electricity in Japan. Japanese citizens pay twice as much for electricity than US citizens, but the corporations are considered "too big to fail." TEPCO didn't end up taking credit for the disaster, even though the government says they are responsible, and this man made disaster could have been preventable (Williams, 2012). With TEPCO and other corporations reaping a large profit off nuclear power plants, they are going to make sure they don't get shut down, even if they could become a future disaster.

The amount of radiation in our waters is more than anyone would think; we know this through individual citizen testing. The problem is who is reporting radiation in the air and water to the public. In April 2012, an audit by EPA reported 25 out of 124, or 20%, of EPA's air monitoring stations weren't working after the Fukushima event occurred (Kazem, 2014). This limits the accuracy of the population knowing the amount of the radiation in the air in all locations. In December 2015, water samples showed radioactive cesium 4,000 times higher than the previous year according to TEPCO's reports (Jamail, 2016). TEPCO has also been using groundwater to attempt to cool the reactors, which caused 300 tons of contaminated water leaking into the Pacific Ocean (Schabracq, 2016). We don't fully know the effects and how much water is contaminated but we do have estimates. The first radioactive plume from Fukushima is expected to hit the West Coast in 2017, followed by a peak in 2018, and remain along the coast until about 2026 (Jamail, 2016). It is affecting Sonoma County's surrounding area and ocean more than we

know, a recent study showed that, radiation levels located 1,600 miles west of San Francisco and have increased by 50%; however, the Government doesn't consider it a dangerous level of radiation (Jamail, 2016). This is proof that Fukushima radiation has increased radiation levels in the Pacific Ocean and therefore affecting everything in it's waters. There needs to be more testing on our waters and air that reports to the individuals in the US and those whom swim in the Pacific Ocean. We should have access to the levels of radiation our seafood is exposed to.

The radiation from Fukushima affected more than just our water, it also affected other aspects of our ecosystem. When the three nuclear reactors and four fuel cores were exposed, it caused, "25% of the total fuel in unit 2 released to the atmosphere ... 50% of the total spent fuel from unit 3 was released to the atmosphere, and ... 100% of the total spent fuel was released to the atmosphere from unit 4" (Jamail, 2016). Due to these affected ecosystems we have noticed an increase of sea life deaths and health effects. For example, bloody tumors have been found on pacific marine animals, including, Alaskan fish, Canadian whitefish, sea lions, walruses, polar bears, sharks who are suppose to be immune to tumors and a human-style like skin cancer on a coral reef in Australia's Great Barrier Reef (Gutierrez, 2016). According to NOAA Pacific Marine Environmental Laboratory and the GEOMAR Research Center, radiation along the West Coast of the US could eventually be ten times higher than most places in Japan (Schabracq, 2016). The water contamination and the radiation contamination in our air, is affecting our sea life and our own health effects.

Along with the health effects experienced by the individuals in Japan, US sailors experienced a high amount of radiation exposure and health effects after they served in Japan. The USS Ronald Reagan was deployed to provide relief and aid efforts, and were unaware of the health effects that could come from the radiation contamination (Burnett 2014). By June of 2013, there

was 51 sailors and marines who had experienced illnesses that included, “thyroid cancer, testicular cancer, brain cancer, unusual uterine problems, excessive uterine bleeding, and all kinds of gynecological problems that you do not see in a population of 20-year olds, 23-year olds” (Democracy Now, 2014). The soldiers reported bathing, brushing their teeth and even cooking with the contaminated water, “The sailors were ingesting the radiation through their food, water, and air” (Democracy Now, 2014). Years later the sailors are still reporting illnesses from the amount of radiation the sailors were exposed too, as a result, most of the sailors have joined a lawsuit against TEPCO. The US sailors are suing TEPCO (Tokyo Electrical Power Company) for, “misleading the Navy about the level of radioactive contamination” (Democracy Now, 2014). TEPCO didn’t report the exact levels of the radiation, and in fact the amount of radiation found was 30 times higher than what TEPCO originally reported to the public and to the Navy (Democracy Now, 2014). The health effects for the sailors shows a direct correlation, and there is also a possible correlation with infant mortality.

After the man made disaster infant mortality rose and no one knows why this is occurring. In 2011 infant mortality rose 1.8%, compared to the previous year being a 8.37% decrease for infant mortality (Mangano and Serman, 2011). There could be a correlation, especially because, “The number of deaths from SIDS rose from 1 to 10 in the months of March, April, May, and June 2011, after Fukushima fallout arrived, compared with the same period in 2010” (Mangano and Serman, 2011). We can’t prove that there is a direct correlation, but the article also mentions that a fetus or infant are at greater risk than an adult due to their immune systems being weaker than an adults (Mangano and Serman, 2011). This doesn’t seem like a coincidence, but if a nuclear radiation event occurs it could cause infant mortality. Therefore, the main issue is how can nuclear power be prevented for the future.

Since 1998, the German government has been trying to carry out policies phasing out nuclear energy. The Chernobyl disaster of 1986 left the German public with strong opinions against nuclear energy (“Nuclear Power In Germany,” 2016). In June 2011, the German government decided to shut down eight nuclear power plants and limit the operation of the remaining nine by 2022. The country wants to move from fossil-fuel based energy generation to a largely-carbon free energy sector while phasing out nuclear energy (Appunn, 2015). Coal and gas fired plants have been a main source of energy in Germany while they expand their wind and solar energy. To help ease the transition, in May of 2012, the government announced plans to upgrade and expand its electricity grid over the next ten years. As of right now, nine of the seventeen plants have been shut down (“Nuclear Power In Germany”). This is proof it is possible to shut down nuclear power plants and get energy from natural and renewable sources.

Methodology:

Our process began through contacting local professionals on the topic, which is how we met John Bertucci, a lead organizer of the Fukushima Response Group located in Sonoma County and executive director of Petaluma Community Access. John helped us network with other local professionals, such as the members of the Fukushima Response Group. Through these meetings we met Jina Brooks, a heavily involved member for the FRG, and Linda Speel, the president Peace Roots Alliance. We conducted interviews with Jina Brooks and Linda Speel while doing radiation testing at the lab in Sebastopol. Both women invited our group to go experience water testing with her organization.

We created an interview guide broken up into three sections to aid us during our interviews with 7 local professionals on the subject. Our guide consisted of questions divided into the following categories: water contamination, local effects, and policies and preventative measures.

When we asked questions about local effects, we focused on Sonoma County and Bodega Bay, the nearby coast. Our research focuses on the Northern California coastline. Each professional interviewed will be asked their opinion on the radiation contamination of Fukushima and the health effects it will have on the local area in Sonoma County.

Findings:

Our initial interest in Fukushima started after reading an article written on January 2016, by Dahr Jamail in Truthout. He reported interviews he conducted with professionals explaining how the radiation emitted from the Fukushima Daiichi incident is moving towards the West Coast. We decided to call Dahr, who lives in Seattle, and conduct a brief phone interview with him. He told us as of March 2016, he has not heard any new updates since his January article, but he reinforced that the radiation from Fukushima is still a problem. The cores at the plant are still emitting radiation, and TEPCO is unable to contain it. They are using groundwater to cool the cores, but this flushes more radiation into the ocean. Officials argue the radiation in the ocean is so dilute, it is not an issue, but radiation is persistent and cumulative. Dahr explained how bioaccumulation illustrates the nature of radiation. As larger fish consume more small fish exposed to radiation, the amount of radiation accumulates in the larger fish. This means the effects of radiation are amplified, as one serving of tuna holds a large dose of radiation.

When asked why he thinks the EPA has shut down their radiation monitors, Dahr emphasized how the EPA does not want to create a public panic or citizen pushback on nuclear power policies. Nuclear power has a lot of deep political and financial ties. The nuclear lobby is very powerful and especially within law. This keeps people ignorant of the damage of Fukushima and also prevents data from being collected. This results in evidence of Fukushima being produced and reported in the media. Through independent monitoring we can uncover these alarming rates

of radiation in the ocean. We need updated data, interviews with scientists, and resources to show there is a problem, according to Dahr.

We asked Dahr if he thought the local fish economy of Bodega Bay would be affected by the radiation spilled during the Fukushima nuclear meltdown. He explained most likely it would not be affected, as many people wouldn't know the fish along the coast is contaminated. Even if data comes out showing there is radiation in the fish, the government is likely to change its measuring criteria, by raising the limits of exposed areas, much like they did with BP oil disaster. Dahr reaffirmed that there is no "safe" level of radiation, and while the government claims there isn't a problem, experts claim radiation exposure increases health risks. He believes public safety should be a concern, as it has been shown that some fish are currently contaminated. The best way to decrease radiation exposure is to cut back on fish consumption and avoid fish from the Northern Pacific, as this is where the radiation runoff is moving towards.

The first step in our research was contacting local activist and Executive Director of PCA (Petaluma Community Access Television), John Bertucci. John first started looking into Fukushima the summer of 2010, a year before the man made disaster occurred. John is very knowledgeable on the disaster, including how Fukushima radiation is affecting Sonoma County and other locations. John is aware of other locations where radiation cesium 134 has been found or where the radiation is predicted to be found in the future.

When we met with John on February 12, 2016, he told us about 15 blue finned tuna that tested positive right after the event, for cesium 134 along the California coast at Stanford University. John also mentioned that the food they couldn't sell in Japan because of contamination they sold to the US. John said that, "Risks that are involved with nuclear power is too much." We need to have a clear and clean power, and it is possible. We know that clean

power is possible because, John told us about Germany becoming nuclear free for the future to prevent a future disaster in their country. After Fukushima, Germany chose to start becoming nuclear free, and putting up more monitors in their country to measure the radiation levels and making the recorded levels, available to the public. John Bertucci helped us develop our interview questionnaire and introduced us to our future interviewees including: the Fukushima Response group, testing centers, and other researchers and activists in the community.

John Bertucci introduced us to the Fukushima Response Group, which is where we meet Linda Speel. Along with being a member of the Fukushima Response Group, Linda Speel is President of PeaceRoots Alliance in Petaluma, California. Linda discussed a local concern for radiation and how samples for radiation should be collected to test the items for radiation. When collecting a sample of something to be tested like leaves or bark, the sample has to be dry if wet and it is better if the sample is over 3 feet above ground. If someone wanted to test the radiation amount along the drain after a rainstorm, than they would have to use a paper towel to wipe the drain gutter and then test the paper towel for cesium. This is important because people can actually send in their samples to the lab International Medcom Inc., located in Sebastopol, California. She works locally and is concerned about the effects of radiation that are occurring in Sonoma county. She is concerned because a nurse from Kaiser Permanente wanted to know about the child thyroid cancer in Santa Rosa. The nurse noticed an increase and thyroid cancer in children and wanted opinions on if there was a connection with Fukushima radiation. We do know that there is a connection to thyroid cancer and radiation but can't prove a correlation, but can bring awareness. When we asked Linda who should educate our community, she responded, "It should be apart of public health."

Jina Brooks is a local activist working at the International Medcom, Inc. facility in Sebastopol. She is a leading member of the Fukushima Response Group and does radiation testing weekly at the IMI lab. The facility recently acquired a Kromek, a device used to measure cesium 134, cesium 137, and iodine 131 in different samples. The facility also has a probe used to measure cesium levels in water along the coast at Bodega Head. Jina has been involved with radiation monitoring, testing, and education since 2011, when the Fukushima Daiichi nuclear plant meltdown. The lab has tested a number of items including canned tuna, salmon from Washington, tea from Japan, seaweed from the coast, and even a piece of debris from Japan that has washed up on the shore. As of right now they have not found anything too contaminating, but it is important to keep testing in order to establish a baseline of what the levels are before the radiation from Fukushima reaches the coast. Jina referenced the UC Stanford study that found 15 out of 15 tuna had positive readings for radiation, proving the fish are contaminated and the radiation is moving towards our coast. She went on to say that right now we should be concerned with the radiation levels in large traveling fish, such as tuna. Personally, Jina has cut back on fish consumption and limited it even more for her young son, as children and women are more susceptible to the harmful effects of radiation.

We asked Jina who she thought should be responsible for testing radiation levels, whether it be in the water, the fish, or the atmosphere. Theoretically, it should be a responsibility of TEPCO, as it was their negligence that led to extreme contamination of radiation. However, large corporations like TEPCO are known for not being responsible while the government is denying any problem at all. Jina explained how the shutdown of the EPA monitors right after Fukushima proved the government cannot be trusted, as they are negligently withholding information. This leaves independent monitoring, as citizens are more trustworthy than TEPCO or the government.

It is through citizen testing, we can hold the corporations accountable for the damages of nuclear radiation.

Jina's main concern is the health of the public, especially children's health, as children are very susceptible to the health effects of radiation. Education in the form of a solution and safety measures needs to be provided to citizens. There are three things to remember when it comes to radiation: learn, measure and avoid. Bringing awareness to people is an important step is public safety. Teaching people how to measure radiation with geiger counters and to be aware of contaminated food is an important measure that will have to be the responsibility of concerned citizens. Everyone should have access to information on radiation, but since the media and corporations responsible are downplaying the damages, the responsibility has fallen into concerned citizens' hands. When it comes to finding a radioactive object on the beach, Jina explained it should be treated like a piece of medical waste. First, screen it with a geiger counter to see how radioactive it is, then step back at least 500 feet from it. You can call NOAA to dispose of it, or handle it yourself if they refuse. Always put it into something, never directly touch it. Paper or plastic can be put around it to avoid too much contamination. Keep it in the trunk of your car and contact a state program, like NOAA, to dispose of it.

When asked how she thought the radiation contamination of Fukushima into the fish supply would affect the local economy in Bodega Bay, Jina explained if the radiation levels were being tested and more people were educated on the effects, it would hurt the local fish economy. We then asked how she thought we could prevent another incident like Fukushima from happening again. Jina argued the first steps are shutting down the nuclear plants, not building plants on fault lines, and taking care of the dangerous materials nuclear energy produces. There are alternatives, such as wind, solar, or hydroelectric power, that can be used instead of nuclear power. As our

interview was drawing to an end, we inquired as to whether or not she thought Germany's process of weaning off nuclear power would be successful. Jina concluded saying she does think their transition will be successful. In the long run it is the best decision they could make, as nuclear power is not worth the problems it creates.

The UC Davis Marine lab is located at Bodega Head State Park along the Northern Californian coast. We attempted to reach out to the lab, assuming they were involved in some type of radiation monitoring along the coast. However, upon inquiry to their involvement with radiation testing, a representative of the lab was quick to explain they do not conduct any type of testing related to Fukushima as "[they] do not want to start anything."

Ken Buesseler was introduced to us after meeting with John Bertucci, and we conducted a brief interview through emails. Dr. Ken Buesseler is a marine radiochemist with the Woods Hole Oceanographic Institution (WHOI) and director of the WHOI Center for Marine and Environmental Radioactivity. Ken conducted sampling of West Coast seawater in 2014 to see if there was any detectable cesium 134. One of his first reports of samples was from Point Reyes, La Jolla and two sites in Washington state which showed that there was no detectable cesium.

We asked him some of our local research questions, where he clarified some of our concerns about local radiation. In response to our question on how people in Sonoma County can protect themselves from high levels of radiation Ken responded, "Levels for example in ocean off Japan in 2011 were 50 million times higher than we now detect off California. I will accept that there is no zero risk for radioactivity, but a big difference depending upon exposure and time/duration of exposure." Here Ken is stating that we do have radiation in California, but not even remotely close to the levels experienced in Japan after the Fukushima disaster. Ken continues to do research and collect samples along the West Coast detecting radiation levels.

Ken made it clear that in order to fully understand the situation extensive amounts of scientific research must be done. “Bottom line is to separate beliefs for/against nuclear power from what we know from scientific measurements,” according to Ken.

We listened to Arnie Gundersen’s interview on Project Censored, to better understand contamination and to get his professional opinion. Arnie Gundersen has 45 years of nuclear energy experience, is a former Senior Vice President for nuclear power company (turned whistleblower), and currently working for Fairewinds Organization. Fairewinds was started by Arnie’s wife Maggie Gundersen in 2008, and her goal was to educate the public about nuclear power production. In the podcast on Project Censored, Arnie mentions he was recently in Japan for a month and the issues that have risen. He took over 100 samples of radioactive material in Japan and came to the conclusion that the cities are becoming recontaminated. To enable Japanese families to move back into their original cities, Japan is raising the radiation standards and what is allowed in the cities to twenty times higher levels. They are raising the levels; however, the most concerning element is that Arnie mentions, kids are at ten times higher risk of radiation health effects than adults, and girls are at a twenty times higher risk than adults.

Even though radiation is affecting individual people’s health, nuclear radiation isn’t being replaced with solar because banks want their money back and therefore continue to fund nuclear power plants. The big corporations are making substantial economic gains and they don’t want the power plants to be shut down. Therefore, they make sure the plants stay working, and that includes the 23 power plants that are exactly like Daiichi, according to Arnie. We can prevent future nuclear power by spreading education awareness through the internet and if every person put a single solar collector on their roof. By doing this, nuclear power companies profits would

decrease because of the increased supply of energy. By bringing awareness through the Gundersen's website fairewinds.org, citizens can be aware of how nuclear power can be changed and the negative effects it has on our society.

Caroline "Cea" Higgins is a policy maker and volunteer coordinator for the Surfrider Foundation Sonoma Coast Chapter. Cea is also a volunteer coordinator who organizes local cleanups around the community in Bodega. During Cea's weekly beach cleanups, she often finds items on the beach, and a couple weeks ago found some objects from Japan. She also mentioned that the debris we find on our beach originally starts appearing in the Aleutian Islands and will eventually start moving along the California coast. Items from Fukushima could arrive along the West Coast at different rates depending on their size, shape, and ocean currents. She mentioned the history of Bodega Head which includes a location where a nuclear power plant was going to be put. She stated that Bodega is one of the first anti-nuclear towns to fight to keep nuclear power plants out and succeeded. Her main focus is to prevent nuclear disaster in Sonoma County. We asked what could be a solution for the future, and her response was, "Social media is the answer." She explained how old activists and people who are capable of collaborating through mainstream media need to discuss and compromise to make a change. She emphasized unification, which is to find a common ground and all pursue it. One important question was how was it that the Sonoma County and the North Coast are not educated about Fukushima, yet they are known as one of the first anti-nuclear towns. Cea said a possible reason could be how hard it is to spread awareness when there is mainly volunteers. To reduce likelihood of radiation exposure, she suggested eating yellow tuna instead of blue tuna, as blue tuna travels further and may be more contaminated. If Bodega Bay is contaminated with Fukushima Radiation she believes the local fish economy will be greatly impacted, since she noticed how hurtful it was on

the community when the crab population was unsellable due to algae. She continues to pursue people who have a passion for the world and want to take care of it, so awareness is spread across Sonoma County and near by communities.

Conclusion:

Based on our research we discovered the lack of education and awareness of Fukushima radiation contamination and the effects it will bring to Sonoma County. Health effects ranging from various types of cancer, infant mortality, uterine bleeding, along with other uncommon gynecological problems are associated with radiation contamination. Ecosystems, especially the oceanic ecosystem, will experience unnatural growths in the form of tumors, newly developing cancers in species, and mass die-offs of the populations. The pollution into the ecosystem will also damage the local economy in Bodega Bay that relies on healthy fish populations.

Through our interviews with local professionals, we realized how important education of these effects of Fukushima radiation is to local residents in Sonoma County. It is through education that we can inform the public of the radiation contamination and how to avoid the severe effects. Measures such as limiting fish intake, looking out for contaminated debris along the coast, and monitoring local levels of radiation published by Sonoma County residents can be taken to limit radiation exposure.

The best way to prevent further contamination is through the deactivation of all nuclear plants. Germany has been a leading example, as they are in the process of weaning off nuclear energy. It is by following their lead that the United States can prevent any further pollution of nuclear radiation before there is too much contamination to control and clean-up.

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