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Separating Fact and Fiction

By Tami Thatcher

The Nuclear Regulatory Commission has relied on the 1990 National Cancer Institute study for its conclusion that cancer mortality rates were not elevated around nuclear power plants.[1] The NRC, with some prodding, selected the National Academy of Sciences to perform a new cancer risk study. Phase I of the study to identify scientifically sound approaches was completed in 2012.[2] It will be several more years before the pilot study of cancer risks around selected facilities will be completed.

In 2008, a study was conducted in Germany that focused on infants and children living near nuclear plants. They consistently found that the rate of childhood leukemia was doubled within 3 miles of the plants.[3] Many studies have found radiation health risks are larger to developing fetuses and children than to adults.

The maximum external doses to citizens living near the 1979 Three Mile Island accident have been revised based on measurement of unstable chromosomal aberrations of the people who had complained of erythema, hair loss and vomiting. This increased the estimated does from 100 mrem to 60,000 mrem. But, you aren't likely to read about that on pro-nuclear industry websites.[4]

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[1] NCI (National Cancer Institute) 1990. Cancer in Populations Living near Nuclar Facilities. 017-042-00276-1. Washington, DC: Superintendent of Documents, U.S. Government Printing Office.

[2] The National Academies Press, Analysis of Cancer Risks in Populations Near Nuclear Facilities (Phase I), 2012. http://www.nap.edu/catalog.php?record_id=13388

[3] Spix C., Schmiedel S., Kaatsch P., Schulze-Rath R., Blettner M. 2008. Case-control study on childhood cancer in the vicinity of nuclear power plants in Germany 1980-2003. Eur J Cancer 44(2):275-284.

[4] Steve Wing, David Richardson, Donna Armstrong, and Douglas Crawford-Brown, A Reevaluation of Cancer Incidence Near the Three Mile Island Nuclear Plant: The Collision of Evidence and Assumptions, Volume 105, Number 1, January 1997, Environmental Health Perspectives.

If you rely on information from pro-nuclear boosters, you are likely to believe:

• "*Fast reactors burn all the waste*." Fact: they don't and they remain commercially unsuccessful in the US, Japan and France, despite decades of research and billions of dollars spent. Sodium-cooled traveling wave reactors aren't likely to change this.[5]

• "*Spent fuel storage is mainly a political problem."* Fact: it is a costly, intractable problem to transport and safety store this waste.

• *"Technology will soon achieve higher levels of reactor safety.*" Fact: To be as safe as existing plants, each small modular reactor will have to be several times safer than current 1000 MW plants because it will require several SMRs to replace one larger plant. Are we to be satisfied that perhaps we won't have a nuclear catastrophe every decade?

• "Nuclear energy is the best way to prevent global warming." Fact: This diverts money from the affordable and safe renewable energy we need to further develop. No one is willing to build the number of plants needed in time to make a difference to global warming.

Yes, solar, wind, biomass and hydro don't run all the time, but energy storage technology is the answer.[6] [7] [8] [9]And simply put, there is ample proof today that building enough plants to combat global warming will poison the inhabitants of this planet.[10] [11] [12]

There is an overabundance of disinformation that understates the costs, financial risks, and human health impacts from the routine emissions and accidents at nuclear plants. Whatever figures you chose to believe about the health risks of nuclear energy, Mikhail Gorbachev wrote

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[5] Dr. Arjun Makhijani, Traveling Wave Reactors: Sodium-cooled Gold at the End of a Nuclear Rainbow? Washington DC, September 4, 2013. http://ieer.org/resource/nuclear-power/traveling-wave-reactors-sodium-cooled-gold-at-the-end-of-a-nuclear-rainbow/

[6] http://www.bloomberg.com/news/2013-12-02/hitachi-announces-storage-technology-for-renewable-energy.html

[7] http://spectrum.ieee.org/energywise/energy/renewables/doe-us-could-easily-incorporate-80-percent-renewables-in-2050 A study published by the Department of Energy's National Renewable Energy Laboratory (NREL) found that renewable energy sources could "adequately supply" as much as 80 percent of electricity demand in 2050, using only the technologies that are commercially available today. With a flexible electric system, NREL says in the Renewable Electricity Futures study, the US could provide balance between supply and demand for electricity on an hourly level.

[8] Lovins A., Germany's Renewables Revolution, Rocky Mountain Institute, April 17, 2013, http://blog.rmi.org/blog_2013_04_17_germanys_renewables_revolution

[9] Lovins A., "Separating Fact from Fiction in Accounts of Germany's Renewables Revolution," Rocky Mountain Institute, Aug 15, 2013. http://blog.rmi.org/separating_fact_from_fiction_in_accounts_of_germanys_renewables_revolution

[10] Gould J and Goldman B, *Deadly Deceit – Low Level Radiation, High Level Cover-up*, Four Walls Eight Windows, New York, 1990.

[11] Morgan K and Peterson K, *The Angry Genie – One Man's Walk through the nuclear age*, University of Oklahoma Press, Norman, 1999.

[12] Apsley J, *Fukushima Meltdown and Modern Radiation: Protecting Ourselves and Our Future Generations*, Temet Nosce Publications, 2011.

in his memoirs that the Chernobyl accident destroyed the Soviet Union. The fact remains that one nuclear catastrophe can destroy a nation. [13] [14][15] [16]

Thatcher is a former nuclear safety analyst at INL. This was an editorial printed in the Post Register December 13, 2013.

Exposed worker at INL fired

Alex Stuckey reports in the Idaho Falls Post Register, 12/27/13; "An Idaho National Laboratory employee who is suing contractor Battelle Energy Alliance after he was exposed to plutonium contamination in 2011 was fired Monday.

The contractor would not share the specifics of Ralph Stanton's firing "due to privacy concerns." In a statement, however, Battelle said the firing was not related to Stanton's lawsuit or a complaint related to a 2011 radiation contamination incident.

Stanton said Thursday he was fired for allegedly sleeping on the job, which he denied. He added that he wasn't surprised by the firing.

"I knew this was coming since the first time I stopped work on a milestone job for safety concerns back in March 2011, I just didn't know how or when," Stanton said.

On Nov. 8, 2011, Stanton and 15 other workers were exposed to plutonium radiation at the building that once housed the Zero Power Physics Reactor at the Materials and Fuels Complex. The aftermath of the accident, as well as decisions made by Battelle leading up to it, led Stanton and a colleague, Brian Simmons, to file a whistle-blower complaint against the company in April.

Stanton and Simmons say Battelle created an unsafe work environment and then retaliated against them after they raised health and safety concerns regarding the radiation incident. In

[13] Pfugbeil S., Paulitz H., Claussen A., Schmitz I, German Affiliate of International Physicians for the Prevention of Nuclear War (IPPNW), "Health Effects of Chernobyl-25 Years After the Reactor Catastrophe," April 2011.

[14] Yablokov AV, Nesterenko VB, Nesterenko AV. Chernobyl: consequences of the catastrophe for people and the environment. Ann N Y Acad Sci. 2009 Dec;1181(1). While the often repeated health impacts of the Chernobyl nuclear accident were less than 50 immediate deaths from acute radiation exposure, it is rarely mentioned that there were an estimated 1 million latent fatalities due to Chernobyl as estimated by Russian scientist Yablokov.

[15] Medvedev G., *The Truth About Chernobyl*, 1989. Grigori Medvedev was the chief engineer at the time of the plant's construction and returned to Chernobyl to investigate the accident. He interviewed the people involved with the accident.

[16] Medvedev S., *The Legacy of Chernobyl*, 1990. Zhores A. Medvedev is a senior research scientist for the National Institute for Medical Research in London and author of many books, including Nuclear Disaster in the Urals.

previous Post Register reports, Battelle officials said they disagree with the allegations in the complaint.

On two occasions in 2011, Battelle allegedly refused to allow Stanton and Simmons to use lead shielding to protect themselves when handling plutonium, according to the complaint. The two workers "exercised their rights to stop the jobs," according to the complaint.

In October 2011, Stanton and Simmons allegedly were asked to "falsify 25 Type 1 safety procedures on a job that was done the day before." They refused, the complaint said.

In retaliation for those actions, the complaint alleges that Battelle sent them to a psychologist for evaluation, gave them negative performance evaluations and withheld radiation dosage information.

The Department of Labor has a year to investigate and report a resolution.

Stanton's wife, Jodi, still works for the Idaho Cleanup Project, managed by CH2M-WG Idaho LLC, also known as CWI.

The couple doesn't have financial concerns or plans to move from Idaho Falls, Stanton said, though he's not sure about his next career move.

"I can do a lot of different things," he said.

Idaho National Laboratory reporter Alex Stuckey can be reached at 542-6755.

Safety Concerns Still Not Addressed and Retaliation Continues Against Manager of Environmental and Nuclear Safety at Hanford Waste Treatment Plant

Whistleblower Donna Busche files new retaliation complaint with Department of Labor to address ongoing acts of discrimination and retaliation.
Immediate Release Contact: Tom Carpenter
November 18, 2013 206-419-5829

Seattle, WA: **A senior nuclear safety manager at Hanford has filed a new complaint with the Department of Labor, Occupational Safety and Health Administration alleging continued retaliation, harassment, and discrimination since filing her initial complaint of discrimination with the Department of Labor in 2011.**

Donna Busche, the Manager of Environmental and Nuclear Safety at the Hanford Waste Treatment Plant (WTP) has filed a new complaint of retaliation and harassment against her employer, URS Energy and Construction, Inc. and Bechtel National, Inc. under the Energy Reorganization Act (ERA), also known as the Nuclear Whistleblower Protection Act.

In the complaint released today (dated November 13, 2013) Ms. Busche alleges that she has experienced continued harassment, isolation, exclusion, and unwarranted criticism as she tries to ensure that one of the "largest environmental cleanup efforts in the world" is completed safely. The WTP is being built to treat Hanford's inventory of 56 million gallons of high-level nuclear waste. The WTP continues to be plagued with safety, design and quality assurance issues as well as significant delays and cost overruns, with the costs skyrocketing from an estimated $4.6 billion to over $13.4 billion.

Busche's complaint states, "One of Busche's job duties is to ensure that adequate documentation supports company assertions regarding environmental and nuclear safety. On the nuclear safety side, she is responsible for the development, coordination, and maintenance of safety basis documents that will be used to license the five facilities at Hanford. Fundamental to those processes is evaluating any changes to verify compliance with regulatory and safety requirements and direct actions as needed to ensure strict compliance. In brief, Busche's job is to raise technical and safety issues."

Further, "Busche repeatedly reported to URS and Bechtel management, her concerns related to the inadequacy of the WTP design and safety basis documents that were noncompliant with 10 CFR 830, **failure of BNI engineering to integrate safety into the design** of WTP facilities, and **adequacy of the WTP fire safety systems**."

America's Fukushima?

By Alexander Nazaryan, published in Newsweek, 11/20/13

At Atomic Ale Brewpub & Eatery in Richland, Wash., you can feast on a "Reactor Core" pizza, made with "spicy nuclear butter," wash it down with a Half-Life Hefeweizen or an Atomic Amber, and finish your meal with Plutonium Porter Chocolate Containment Cake. Later you might have at some pins at Atomic Bowl, the "Home of Nuclear Bowling," or catch a Richland High School football game, the team's name – Bombers – looming over the field, a mushroom cloud logo on the scoreboard.

The town's pervasive dark humor alludes to a darker past – and a troubling, radioactive present. The plutonium for the atomic bomb dropped on Nagasaki came from what's known today as the Hanford Nuclear Reservation, around which Richland grew and thrived. During the Cold War, Hanford churned out plutonium for our nuclear arsenal. Then the Soviet threat ended, and the residents in this corner of eastern Washington were left with what is routinely called the most toxic place in the Western Hemisphere.

Today, it is not a Soviet missile that threatens this once-pristine high desert. If disaster strikes Richland, it will be because the federal government (namely, the Department of Energy) allowed 56 million gallons of radioactive waste to fester in this sandy soil, where some say it is rife for an explosion. And, critics charge, the DOE has watched its prime contractor on the site, Bechtel, grossly overcharge the American public for a waste-treatment plant so poorly built that, once it's finished (if it ever gets finished), feeding nuclear material through it could cause a catastrophe.

A poster from the recent Occupy Portland protests called Hanford "North America's Fukushima." That isn't just left-wing, anti-corporate fear mongering – a catastrophic accident involving radioactive waste scares the two most prominent Hanford whistle-blowers, nuclear engineer Walter L. Tamosaitis, fired from the site last month, and Donna Busche, a nuclear safety compliance officer who remains employed by URS, a Hanford subcontractor, even as her legal complaints – which include allegations of everything from pressure to downplay safety concerns to sexual harassment – proceed. Unprompted, Busche told Newsweek she is worried about "when 'Fukushima Day' hits."

Last year, nuclear scientist Donald H. Alexander, formerly of the DOE, likened Hanford to the doomed 1986 Challenger mission, a disaster arising from an excess of confidence.

Speaking of the cosmos: Some have suggested we launch our nuclear waste into space, to be swallowed by the sun. That may sound insane, but spend a little time sorting through the Hanford morass, and just about anything other than the status quo will seem appealing.

Taking Out the Manhattan Project Trash

Tamosaitis began working at Hanford on April Fools' Day in 2003. Back in 1989, he had started another job on April Fools' Day – at the Savannah River Site in South Carolina, a Manhattan Project legacy whose waste had to be safely secured. He says that job was better, though. The New Jersey–born engineer with a Ph.D. from the University of Alabama at Huntsville still speaks fondly of life in Columbia, S.C., where his family – wife and two daughters – remained while he started work at Hanford as an employee of URS, which is a Bechtel subcontractor on the site.

It was a lonely existence, with Tamosaitis ensconced in temporary quarters at the Washington Square Apartments, a row of gray polygons on the town's meager main strip. He points these out as we drive toward the Hanford site, which sits at the northern edge of town, just past a severe turn of the Columbia River. "I considered work my calling, I really enjoyed it," he says in the booming voice of a general who has no need or patience for affectation. "Many times, work came before the family."

Bechtel had taken over the site three years prior to Tamosaitis's arrival, promising to clean up what had become a confounding problem for the DOE. It was here, in 1943, on the tumbleweed-covered banks of the Columbia, that the federal government confiscated 586 square miles of land in the name of the Manhattan Project, effectively leveling two towns – White Bluffs and Hanford. Remote and close to a large supply of water, Hanford became – along with plants in Savannah River, S.C.; Rocky Flats, Colo.; and Oak Ridge, Tenn. – a secretive node where the musings of Los Alamos physicists took bellicose shape.

The reactor on these desiccated steppes converted uranium-238 into plutonium-239, the fissionable stuff inside the Fat Man bomb dropped on Nagasaki on August 9, 1945. The ensuing Cold War escalation was a boon for the engineers and workers at Hanford, with eight more reactors built throughout the subsequent two decades. Only one of them – completed in 1963 and visited by John F. Kennedy two months before his assassination – was ever harnessed to produce energy. The rest worked solely to enrich nuclear materiel for rockets intended to fend off a Soviet assault that never materialized.

The last of those nine reactors was decommissioned in 1987, inaugurating an era that would prove even more lucrative for those who sought to make Hanford their livelihood: cleaning up the waste left behind

from four decades of making nuclear weapons. The Atomic Energy Commission had by now become the Department of Energy, and it presented a daunting challenge to contractors: 177 underground storage tanks (the bucolically named "Tank Farms") holding 56 million gallons of waste that included radionuclides like strontium-90 and cesium-137.

Private firms quickly realized how profitable a contract here could be, yet little actual cleaning up was done for years, with The Economist noting, "most of the 1990s [were] frittered away, along with billions of dollars." A potential savior arrived when British Nuclear Fuels Limited (BNFL) contracted with the DOE to build a waste-treatment plant in 1998 that was going to turn the radioactive refuse into glass, thus allowing it to decay in a form that would be largely impervious to outside shocks, whether from earthquakes or terrorists. Two years later, with costs having risen to a projected $15.2 billion from the original $6.9 billion estimate, Energy Secretary Bill Richardson booted BNFL. An executive for the company said he was "sorry to lose the Hanford contract" but noted, prophetically, that it "promised too little reward and left us with a high level of financial risk."

That risk is indeed great. Vast and vastly radioactive, Hanford has some 1,000 separate waste sites of varying size, according to John M. Zachara, senior chief scientist for environmental chemistry at Pacific Northwest National Laboratory. These include a plume of hexavalent chromium – the carcinogenic villain in Erin Brockovich – moving towards the Columbia, the Northwest's largest river, as well as technetium-99, which has also seeped into the groundwater, in addition to uranium, beryllium, and other wastes, both radioactive and not. The technetium has a half-life (the length of time it will take for half of the element to decay) of 212,000 years, meaning it's pretty much around until the proverbial end of time.

Yet risk didn't deter Bechtel, the nation's largest construction firm, one which has been responsible for projects as varied as the Hoover Dam and Boston's Big Dig. It built the 1,068-mile Trans-Arabian Pipeline and has upgraded the London Underground. In late 2000, Bechtel promised the DOE that for only $4.3 billion, it could finish the job BNFL had started. Its motto back then: "Glass in 2008."

Thirteen years later, no waste has been vitrified at Hanford – there may be some glass in 2019, but even that is an optimistic projection. In the process, Bechtel has been accused of silencing and even firing those who've raised concerns about its Hanford project, which has been slow, expensive and full of evasions. It has nearly tripled in estimated cost (now at about $13 billion), and could hit $25 billion. The nuclear waste, all 56 million gallons of it, remains underground and will stay there for a while, because in 2012 the DOE – no longer able to ignore whistle-blowers, including those within its own ranks – stopped all but some marginal work on the waste-treatment plant, worried that Bechtel was rushing to meet benchmarks without thinking the project through, potentially exposing nuclear materials to conditions that could lead to an explosion.

Company chief Stephen Bechtel Sr. once boasted, "We can build anything, anytime, anywhere." That may be true, but at what cost?

Corporate Welfare and Radioactive Ketchup

Those proud predictions of "Glass in 2008" ended in 2005, recalls Tamosaitis. He had been part of the team that built a successful vitrification plant at the Savannah River site, but Hanford resisted easy solutions. Six different processes had been used there to enrich plutonium from uranium, which made for

radically different waste signatures within the 177 canisters at the Tank Farms, where one container could hold up to a million gallons of waste. Sixty-seven of those tanks were single-shell carbon steel containers that had leaked at one time or another, which isn't much of a surprise, since they were supposed to last only 20 years. And each tank holds its own toxic cornucopia. As Scientific American noted last spring, "Overall, the tanks hold every element in the periodic table, including half a ton of plutonium, various uranium isotopes and at least 44 other radionuclides." While the Tank Farms were not Bechtel's responsibility – that is now managed by Washington River Protection Solutions – the creep of nuclear waste toward the Columbia River has made it imperative that the tanks be drained, that their waste be turned into glass.

In late 2005, Tamosaitis was asked by his bosses to head a review team that identified the 28 most trenchant problems with the treatment plant, from the broad ("Inconsistent Long-Term Mission Focus") to the particular ("Instability of Baseline Ion Exchange"). That Tamosaitis was picked to lead the review seemed an endorsement by URS of his ability to solve complex problems. I don't know if Tamosaitis is a creative thinker, but he is obviously a meticulous one. This is obvious from the museum-quality antique cars in his basement, each of which he restored to its near-original condition. He is now working on a Chevy pickup with his 5-year-old granddaughter, who helps him paint each part.

The daunting challenges at Hanford, however, would not allow for a car hobbyist's leisurely pace. Part of the problem was the "design-build" approach Bechtel chose for the project, meaning that it moved ahead rapidly with construction before resolving some major technical challenges, hoping to solve problems as they arose, rather than testing exhaustively beforehand. Design-build is not uncommon, but perhaps not prudent for an engineering feat as complex as the waste-treatment plant. It is like trying to change a tire while flying down the highway.

By 2009, an issue coded M3 was the largest remaining problem: "Inadequate Design of Mixing Systems." The plant Bechtel was racing to complete called for a facility that would pull waste from the Tank Farms and send the contents to either to a High Level or Low Activity vitrification plant, where it would be turned into glass by 2,000-degree melters. The glass canisters bearing less dangerous elements could remain on site, while the rest would be shipped to a permanent storage facility – for example, the beleaguered Yucca Mountain 90 miles northwest of Las Vegas, a project President Obama halted in 2009.

The waste in the Tank Farms is not uniform: about 33 percent is liquid, according to a 2003 study, "a caustic brine containing sodium, nitrate, nitrite, hydroxide, fluoride, phosphate, and sulfate"; another 42 percent is "salt cake" precipitated from the liquid. What remains, the last 25 percent, has proven to be the trickiest – a radioactive sludge that has settled at the bottom of tanks. Laced with radioactive isotopes, it is viscous like an especially thick, pulpy ketchup, difficult to move through pipes because it does not follow the Newtonian properties of most fluids.

Before the waste becomes glass, it has to be properly separated and prepared for vitrification. That's to take place at the Pre-Treatment Plant, where it flows into tanks in which pulse-jet mixers – Tamosaitis describes them as giant turkey basters – are supposed to stir it into a homogenous mixture. But tests found that the heavier sludge may still settle at the bottom. At the Savannah River site, mechanical agitators – Tamosaitis likens these to the blades of a blender – whip this grainy goo back up; no such agitators have been installed at Hanford, meaning that the flow of the heaviest, most radioactive particles could be impeded by their settling at the bottom of the vessels or inside pipes.

Should that occur, there will be little chance to correct an accumulation of radioactive sludge, since the mixers are installed in "black cells" that will be so rife with radiation that workers won't be able to enter them, meaning that the plant will have to operate with minimal human input, even if something goes amiss.

An incident at the Sellafield nuclear complex on England's northwest coast was an ominous warning: In 2004, a pipe feeding into a black cell burst, spilling what a British governmental investigation calls a "highly radioactive liquor" rich in uranium and plutonium. A report in The Oregonian on Hanford's problematic black cells noted of the Sellafield incident: "The cell contained the leak. But operators didn't discover it for three months, and the plant shut down for two years."

Even worse, the accumulation of nuclear material in Hanford's tanks could create highly combustible hydrogen gas pockets. "You get enough [hydrogen] and some spark source and you get an explosion," MIT nuclear engineer Michael Golay told Scientific American, explaining what had precipitated Fukushima and Three Mile Island, the worst nuclear accident in United States history.

An outright nuclear explosion is highly unlikely, but possible. The radioactive material at the bottom of the mixing tanks could cause the splitting of radioactive atoms known as fission, similar to what happens in a nuclear bomb (blessedly, on a much smaller scale). That would be an unspeakable disaster, one that would almost certainly endanger workers at the Pre-Treatment Plant, while also shutting down the site. It might not kill a lot of people, but it would cost hundreds of millions dollars and take years to clean up.

The risks of a Fukushima-type disaster are incredibly slight, and those who make the comparison caution against a literal interpretation of their warnings. Yet the consequences of such a mishap would be so catastrophic that it cannot be allowed to happen. The Tokyo Electric Power Company was not worried about an earthquake causing a tsunami, and that tsunami in turn flooding and disabling a nuclear power plant on the eastern coast of the island of Honshu. Much later, a panel would find "collusion" between the Fukushima Daiichi plant operators and government regulators, as well as "ignorance and arrogance" and a "disregard for public safety."

Tamosaitis calls Hanford an example of "corporate welfare," in which Bechtel is stringing along the federal government as it moves completion dates further and further into the future, all for the supposed sake of the very safety issues it has repeatedly ignored. As long as nothing horrific happens, he says, the money will flow. Tamosaitis sums up Bechtel's strategy as "delay, delay, delay, deny."

Recall that Tamosaitis is a spurned and clearly bitter former employee, but plenty of evidence supports his claims. His first seven years at Hanford were challenging. The last three were close to unbearable, pitting him against his superiors, who actively conspired to marginalize and discredit his work.

In early 2010, as Tamosaitis and his team were still grappling with the mixing problem, Hanford got a new manager: Frank Russo, a Bechtel vice president who had spent his entire professional career with the corporation, having worked just about everywhere from Iraq to Idaho. Russo's objectives were clear from emails during his first four months on the job: meet a mid-year DOE bonus, potentially worth $6 million, and secure another $50 million of annual funding from Congress.

Tamosaitis, with his persistent nagging about the balky flow of nuclear sludge, stood in the way of that massive payday.

The Hanford Necklace and Other Scars

"They are so schizophrenic," Tom Carpenter, head of Hanford Challenge, a watchdog group based in Seattle, says of the people who live near Hanford. The 250,000 residents of these communities, he explains, see the plant as a source of jobs, a constant stream of money into a local economy that would otherwise have to fall back on the region's orchards and vineyards. Of course, money isn't the only thing that has wafted into Richland from the nuclear site. And they know that, too.

Carpenter alleges that Bechtel and the DOE have created a nuclear tinderbox at Hanford. As he talks, two dogs gambol through his sunny office – equipped with a treadmill desk – in Seattle's Pioneer Square, 200 miles from the semi-arid steppe upon which he is fixated with Ahab-like intensity. "Hanford is a long-term threat to humanity," Carpenter declares.

Not everybody in Richland agrees. Suspicion of the defense industry does not run especially high in this conservative corner of the United States. Sarah Palin came here in 2009, in the midst of her book tour for Going Rogue, to have Thanksgiving dinner with her aunt (Palin's grandfather came to Richland in 1943 to work as a labor relations manager at the Hanford plant).

On a day that is probably too windy for boating, I head out on the Columbia River with Neal, a native of Richland who has been navigating these waters for 52 years. He refers to having worked on projects associated with Hanford, though his association with the site is unclear. He says Bechtel is an "awesome company" and that Hanford has made the area rich: "We've always been in a bubble," immune to the most recent recession. Yes, his father had cancer four times and parts of the site are "screaming hot" with radiation. But these facts he takes in stride, much as he does the waves that yearn to capsize our boat.

On the eastern bank of the Columbia are orchards and vineyards. Cormorants alight on the water, a coyote searches for food. In 2000, President Bill Clinton designated this stretch of river, called the Hanford Reach, a national monument. And when that last reactor drops out of view, this still looks like the land Lewis & Clark traversed in 1805, a land still sacred to the Native American tribes who have lived here since the Ice Age glaciers receded.

Nobody really knows if Hanford has made people sick. Locals refer to the "Hanford necklace" – "a thyroidectomy scar that distinguishes many of the downwinders whose diseased thyroid glands were removed," as the Associated Press once described it. Yet the Hanford Thyroid Disease Study did not find an association between the release of iodine-131 during the 1940s and 1950s and an increase in cancers of the thyroid gland, thus discounting a major illness related with radiation exposure.

That is only one cancer dismissed, however, and maladies from the past aren't the most pressing concern here anyway. It's what remains in the ground that worries the likes of Carpenter, the Seattle watchdog. He says of Hanford: "We've opened a Pandora's box that we can't put the lid back on." Behind him, the city settles comfortably into dusk.

'Don't Do What That Guy Did'

"We need to kill this BS now," reads an April 25, 2010, email from Russo to senior Bechtel and URS officials at Hanford.

Earlier that day, URS senior manager William Gay had noted in an email to Russo and other project managers that Tamosaitis and his team wanted more testing, which would prevent Bechtel from collecting its $6 million bonus. And that wasn't the worst news Gay had to deliver: "In the 2004 timeframe, [we] spent about $143 [million] on testing these tanks. We are essentially being told that we start over from scratch."

With Bechtel intent on declaring the mixing issue solved, Tamosaitis decided he needed more people echoing his grave concerns. Emails show him soliciting the opinions of outside consultants, who responded that Bechtel's approach to high-level waste is "a bit of smoke and mirrors" and "criminally negligent." Tamosaitis shared these opinions with managers at Bechtel and URS, who were plainly coming to feel that he was undermining their work.

"By the end of May I felt like I had a target on my back," Tamosaitis would later tell Congress. "I could sense that Bechtel management was not happy with my continual raising of issues."

Tamosaitis was acutely aware of the June 30 deadline, but he was increasingly convinced that declaring M3 solved was irresponsible and dishonest. If something were to happen, he would have to answer to his neighbors, to his government, to his God. And so he kept up the pressure, even as Russo was reminding his managers that "fee is in play in a big way," that nothing could jeopardize the bonus Bechtel stood to collect from the DOE for timely resolution of the mixing issue.

DOE signed off on the M3 issue just as Russo hoped – but the notion of Tamosaitis as a fifth column at the Waste Treatment Plant remained. On July 1, Russo wrote to URS's Gay: "Walt is killing us. Get him in your corporate office today." Gay responds: "He will be gone tomorrow."

And he was. On July 2, Tamosaitis was told that he was being transferred to URS headquarters in downtown Richland. URS tells Newsweek that his "reassignment had been discussed with him for several months prior to June 2010, as his work scope on the project was coming to an end," a position seconded by Bechtel, which says he had been offered a job at Sellafield in England.

Tamosaitis says the transfer was retaliation. "They wanted to send a signal" to other potential whistle-blowers: "Don't do what that guy did."

Tamosaitis was buried in a basement office with two copiers, one of which was "used to compile large documents," he told Congress. "I brought in a pair of earmuffs to dampen the sound when it was running." One time, with a snowstorm approaching, everyone else left the building without bothering to tell him. He jokes that when he emerged from the basement into a silent office in the middle of the afternoon, he thought the rapture had come.

Two weeks into his banishment, Tamosaitis wrote to the Defense Nuclear Facilities Safety Board, a government organization whose concerns Russo had effectively minimized. He told it of Bechtel's desire

to "suppress…safety concerns" and the "chilling effect" his removal from the project would have on others wishing to voice dissent.

The Defense Board notified URS, in a July 27 letter, that it was "conducting an investigation...of health and safety concerns" raised by Tamosaitis. The board, a presidentially appointed panel of scientists, does not have regulatory powers, but it can hold hearings and issue subpoenas. More important, its recommendations carry significant weight within the DOE.

The hearings took place over two days in Kennewick, Wash., in early October 2010. Russo and other senior managers heard Defense Board chairman Peter Winokur tell them his group was "deeply concerned that the plant may be commissioned before several key technical issues are fully resolved," singling out the black cells that worried Tamosaitis as both expensive and potentially dangerous.

Bechtel and DOE officials did their best to dismiss Winokur's worries. But then Donna Busche spoke. She told the board members she had concerns about the pulse-jet mixers in the black cells, the ones Tamosaitis said could cause a hydrogen explosion or even a criticality (i.e, an uncontrolled nuclear reaction). Busche later alleged in a legal complaint that, during a break, her superiors were furious and asked her to "provide a different answer" when the hearings resumed later that day. No such luck. In subsequent testimony, Busche told the Defense Board that Bechtel had not done a thorough enough job of evaluating risk at the plant. Hers was the lone cautionary voice that day amid a litany of sunny assurances. (Tamosaitis was not invited to testify.)

The next day's session featured a painfully prescient warning from a board member who realized that Busche had made enemies of her own bosses; he wondered if Busche was "up to working under this kind of pressure." She answered that she was. And she has been, for three years running.

The assault on Bechtel continued throughout 2011. That August, Don Alexander, the senior DOE scientist who had been among the first to sound warnings about safety issues, wrote in a letter to his superiors (including the department's chief nuclear safety officer) that Bechtel, Washington River Protection Solutions and on-site DOE staff had "deliberately conspired together to try to undermine the pursuit of legitimate technical issues." He added, "I have been under tremendous stress for more than a year. It seems to me that this is beyond a purely technical issue and is a whistle-blower issue."

Nobody's whistle was louder than that of Tamosaitis. He appeared before a Senate subcommittee on contracting and oversight on December 6, 2011. There, he found a receptive audience in Senator Claire McCaskill, D-Missouri, who called his plight "unbelievable…I'm speechless about the reality of you still going there every day as a walking billboard to everyone about – to keep their mouth shut. Because that's essentially what you are."

A month later, URS moved Tamosaitis out of the basement, into a first-floor office with a window.

The DOE finally seemed to validate his concerns in the spring of 2012, when then-Secretary of Energy Steven Chu halted a good portion of the work at Hanford, citing concerns about how the radioactive waste was going to be pumped through the 100 miles of piping, mixed and turned into glass.

The pressure on Bechtel was growing. That summer, DOE scientist Gary Brunson, who at the time oversaw engineering work at the plant, sent an internal memo – subsequently leaked to the press – in

which he documented 34 instances when Bechtel had "provided a design solution that was not technically defensible, technically viable, or was technically flawed." He said, also, that safety was widely ignored and that some of the conclusions Bechtel had reached about the Waste Treatment Plant were "factually incorrect."

Brunson was difficult to ignore because he was not a spurned employee; he was a senior engineering official putting his reputation on the line. He did it once again that December, sending Chu a memo detailing seven major technical and safety lapses on Bechtel's part. He recommended that all work at the Waste Treatment Plant be suspended. Then he resigned.

Six months later, in May of this year, MIT physicist Ernest Moniz was sworn in as Chu's successor at the Department of Energy. In June, he came to Richland, meeting with Busche and Tamosaitis, as well as three other Hanford employees concerned about the damage Bechtel had caused there.

In late September, Moniz wrote a memo to his departmental heads in which he vowed to enforce "a culture in which workers at all levels are empowered to bring forth problems" – a tacit endorsement of whistle-blowers that can be interpreted as extending to all DOE contractors and subcontractors.

Two weeks after that, URS fired Tamosaitis.

URS's high-end New York crisis-management firm, Sard Verbinnen & Co., told Newsweek what it has told every outlet seeking an explanation: "In recent months URS has reduced employment levels in its federal sector business due to budgetary constraints." Among the most dispensable, apparently, was an engineer with 44 years of experience, one who had dedicated much of his professional life to the safe disposal of nuclear waste.

I visited Tamosaitis, who is 66, a month after he was fired. He lives in a subdivision in the hills high above Hanford. To get there, you drive past a wine bar called Three-Eyed Fish, with its radioactively deformed piscine logo. His house is at the end of a lane overlooking the parched hills. The decor is heavy on floral arrangements, Christian imagery (he and his wife are devout Presbyterians) and replicas of antique cars.

In the afternoons, Tamosaitis's wife Sandy plays tennis, and he is left in the house alone with his dog, a turgid black terrier named Maggie. "We've lost a lot of friends," he tells me. This is a small town, and while some support what he has done, enough people don't to make almost any outing uncomfortable.

Tamosaitis could have signed a severance agreement with URS that included a financial settlement, but that would have come with the promise to shut up, and he can't do that. "I want change," he says. He isn't seeking money or revenge, he says. He wants whistle-blowers protected from corporate bullies, and he wants the American people protected from nuclear waste, whether in Washington, New Mexico, or New Jersey. As for the Waste Treatment Plant, his message remains both frightening and simple: "The place will never run, and it will never run safely."

The Man Without Friends

Whistle-blowers are, by definition, shrill – they shout in our ears, telling us things we don't want to hear, but need to hear. Tamosaitis was not a federal worker, so he could not seek protection under the

Whistleblower Protection Act. He filed a complaint with the Department of Labor on July 31, 2010, but was quickly disheartened by the federal bureaucracy. "Things seemed very dark," he said in his congressional testimony. "The more I learned, the more helpless I felt." Thus, that September, he filed lawsuits against Bechtel, in state court, and URS and the DOE, in federal court.

Tamosaitis does not like the term whistle-blower, which he thinks most people equate with troublemaker. Nevertheless, he says, "I've grown used to it." Tall and wide, he seems to diminish in size as he describes the challenges ahead, not to mention those of the past three years.

He may not have many friends in his town, but he has a few powerful ones in Washington, D.C., most notably senators Ron Wyden of Oregon and Edward Markey of Massachusetts, both of whom were infuriated by Tamosaitis's recent firing. Wyden told me Tamosaitis is "the most visible whistle-blower in the nation," one whose firing could have a "chilling effect." He calls Hanford "a very real safety, environmental and health concern" and urges Moniz to "turn this around."

On November 14, during nomination hearings for the DOE's general counsel, Wyden voiced his chagrin about the department reimbursing its contractors for legal fees incurred while fighting whistle-blower claims; that essentially means taxpayers are funding the attempts to muzzle Tamosaitis.

Unlike Tamosaitis, Busche is garrulous and cheerful, though her position is arguably just as challenging as his, if not more so – she remains a URS employee, even as her prominence as a Hanford whistle-blower rises (she appeared, with Tamosaitis, on CBS Evening News in June).

I meet her in a small frame house renovated by her husband, who sits with us throughout the interview. Educated at Texas A&M, Busche is animated and confident, her hair a wild gray shock. As we sit in her airy studio, she describes with something approaching cheer the predictable hell of going to work at a place where you are loathed.

"They would do anything to have me not speak," Busche says. She filed her first discrimination complaint against URS in November 2011. Among the allegations is that William Gay – who had helped Russo expel Tamosaitis from the Waste Treatment Plant – told "Ms. Busche [that], as an attractive woman, she should use her 'feminine wiles' to better communicate with the men at URS. Mr. Gay also stated that if Ms. Busche were single, he would pursue a romantic relationship with her." That complaint was later turned into a federal lawsuit. Late last week, she also filed a discrimination complaint with the Department of Labor against both Bechtel and URS.

On the day after meeting with Busche, I went to Tamosaitis's hearing before the Ninth Circuit Court of Appeals in Seattle. A district court judge had thrown out Tamosaitis's complaint against the DOE and URS, almost fully on technical grounds, and Tamosaitis was hoping to have that decision overturned.

Essentially, the hearing involved lawyers for both URS and the DOE disavowing all responsibility for employing Tamosaitis – and hence for firing him. They tried to convince the judges it was all Bechtel's fault. (The chief Bechtel spokeswoman at Hanford, Suzanne Heaston, told me, "He has never been employed or paid by [us]," although the email trail appears to show that managers from all three entities had a hand in axing Tamosaitis.)

The three judges seemed to side with Tamosaitis. At hearing's end, the lawyers for the DOE and URS huddled at their table as if over a coffin.

Speed Over Safety

After the hearing, I got into my rental and drove back to Richland, through the sharply winding passes of the Cascade Mountains that essentially divide the state in two, sequestering the eastern counties from the center of power and influence that is Seattle, as well as the capital city of Olympia, which is also on the Pacific Coast. The following day, my last in Washington state, I would finally be allowed to set foot in the Hanford plant.

It is truly a strange place, with its mixture of the postapocalyptic – defunct reactors, men in full-body protective suits – and the pristine, the prairie and the tumbleweeds and the slow Columbia River. In the distance is the low, ugly hump of Rattlesnake Mountain, which a local tourism bureau claims is "the tallest treeless mountain in the Western Hemisphere."

The concrete and steel of the Pre-Treatment Plant, the black cells over which so many battles have been waged – all looked impressive but also obviously incomplete. Lacking outside walls, the Pre-Treatment Plant seemed at once massive and vulnerable. From its higher floors, the sight lines receded into a beige infinity of hills. The laboratory building had the feel of a never-used chemistry classroom. "This is like Willy Wonka's chocolate factory," said a local NPR reporter.

The site was quiet that day – Friday is a day of rest for the roughly 2,300 Bechtel and URS employees there. But even if it weren't, the plant would not have been the hive of activity it was three years ago. That's because Secretary Moniz has not lifted the moratorium imposed by Secretary Chu. On September 24, he did release a framework that suggests, among other recommendations, pulling the least radioactive waste directly from the Tank Farms and bypassing the problematic Pre-Treatment Plant. This would dispose of perhaps as much as 80 percent of the waste, but it would leave behind the radioactive sludge that poses the greatest threat.

Chu's shutdown has probably been the most firm action taken by the federal government at Hanford. It didn't solve any problems, but it finally acknowledged that problems exist. Moniz's plan may be well-intentioned, but he will have to battle against an insular Bechtel culture that is averse to outsiders' orders.

Just a week after the framework was released, Department of Energy Inspector General Gregory H. Friedman accused Bechtel of favoring speed over safety. His report found "significant shortcomings" in how design changes had been made.

In response, Frank Russo's successor, Peggy McCullough, said what Bechtel always says: There is nothing new here, nothing to get worked up about. That's not to say its engineers aren't trying to get Hanford fixed: Russell Daniel, the technical director of the site, accompanied the press tour and has persuasive rebuttals for pretty much all of the concerns raised by Tamosaitis. He claims that the pipes of the Pre-Treatment Plant can easily contain a hydrogen gas accumulation of up to 20 feet in length, if not longer. The four feet of concrete around the black cells would absorb even the most serious incident, as would the eight feet of concrete along the cells' floors. The pulse-jet mixers will not corrode the mixing vessels, which have been outfitted with wear plates. And the waste will be adequately mixed, with no

radioactive deposits, as the frequency of mixing will not allow for settling. Waste will move through the pipes. Waste will become glass.

Bechtel also sent me a memorandum from atomic physicist Nils Diaz explaining why "a Fukushima-like event is impossible." Diaz, a former chairman of the Nuclear Regulatory Commission, headed a task force to study the disaster and whatever lessons it held. Diaz – previously a paid consultant for Bechtel – noted that Hanford's radioactive waste was neither hot nor pressurized enough for a "Fukushima-like" event. Tamosaitis, and others, disagree with that assessment.

At the same time, Bechtel subtly deflects blame toward the Tank Farms, managed by Washington River Protection Solutions and overseen, like almost everything else here, by the DOE. The suggestion seemed to be that the true danger lay in these enormous vats, whose exact contents remain unknown and possibly seeping into the ground. Bechtel couldn't fairly do its job unless it knew "what's coming through the front door," explains Heaston.

Tamosaitis says this deft evasion of responsibility is part of what he calls "the Bechtel approach" – keep the project going while managing to neither complete it nor fall entirely out of favor. That way, Tamosaitis explains, it can keep collecting federal money (congressional funding is back down to $690 million per year) while claiming progress.

Bechtel's record elsewhere supports his accusation. In 2003, The Boston Globe ran an investigative series called, "Easy Pass: Why Bechtel never paid for its Big Dig mistakes." The first article of the series describes what might generously be called an error of omission: in its designs for fixing Boston's knotted highways, Bechtel overlooked the sports arena known today as the TD Bank Garden. The mistake would cost $991,000, all of it borne by the public.

"[Even] as Bechtel's errors helped drive up the Big Dig's cost, the company never paid for any of its mistakes," the Globe said. "Instead, it profited… in part because Bechtel received additional money to fix its errors."

Of course, Bechtel's primary job as a corporation is to make money – which is why many believe the DOE deserves blame for leakages and oversights and whatever other horrors may yet materialize at Hanford. The Defense Board's technical director, Steven Stokes, says the DOE "continues to be slow" in resolving safety issues. Tom Carpenter, an acerbic critic of Bechtel, nevertheless says the corporation "is capable of doing the job" – except that it knew it could get away with what he calls its "C-team," always shuffling managers, never taking the project quite seriously enough because, with the DOE in charge, it didn't really have to.

The most problematic captain of that C-team was Russo, who oversaw the plant during the three most contentious years of its recent history. He was variously described to me as a villain, a ruthless money-maker, a liar, a bully, an above-the-law renegade, and a slick salesman who will say anything to close the deal.

I liked him from the start. Friendly and plain-spoken, Russo deployed a gimme-a-break tone to dismiss the technical issues Tamosaitis raised – as well as accusations that he ordered the engineer fired, even if emails convincingly show Russo doing precisely that. Ditto for allegations that he was rushing to meet deadlines to the detriment of safety. Of course he wanted the Pre-Treatment Plant done; who in his right

mind wouldn't? He was doing what he had been asked to do, what he had been doing for the 40 years he'd spent with Bechtel: "building stuff."

Russo says that ultimate authority resides with the DOE, and on this, if little else, he and Carpenter agree, the latter calling the department "incompetent" and "systematically unwilling…to accomplish this mission." Senator Wyden says much the same thing: "The clock is running out on the Department of Energy," he told me.

Busche told me that when she met with Secretary Moniz this past summer, he had only paid lip service to her concerns.

After many off-the-record conversations, the DOE finally gave me a statement for attribution. It is "absolutely committed to completing the important work at the Hanford Site."

His Last Great Challenge

As Tamosaitis drove around Richland or talked for hours at his living room table, we returned frequently to the recent book Toms River by the environmental journalist Dan Fagin, about a cancer cluster in coastal New Jersey. We had both been deeply touched by the book, which details one of the most tragic lapses in environmental safety in modern American history – the ongoing pollution of drinking water by Ciba Geigy, a Swiss firm that ran a dye plant in town that later made industrial solvents. The childhood cancers that resulted – of the blood and central nervous system, mostly – could have been prevented by the right questions posed at the right time.

Someone told Tamosaitis to read the book after he gave a talk at Portland State University. He grew up about 50 miles inland from Toms River and vacationed at Ortley Beach, a part of the town that fronts the Atlantic Ocean.

There were no whistle-blowers in Toms River; it took the relentless mother of a child born deformed by cancer to finally shame the state and federal authorities into action.

In 1984, when Toms River residents become alarmed about the safety of their water supply, an official from Ciba Geigy assured them that the chemical plant's effluent was "99 percent water and a little salt." This was criminally untrue – the wastewater was teeming with carcinogens. But human beings are trusting creatures; we do not want to be suspicious of those in power. And so the people of Toms River believed what they were told.

Today, the people of Richland are getting restless. Other parts of Washington State are celebrated for their vineyards and their mountains; Richland is known for nuclear waste. Recently, efforts have started to re-brand the region and make it friendly to tourists. It is today possible to schedule a tour of the reactor where the plutonium for Fat Man was enriched, but officials want to use the supposedly cleaner outer edges of the site for "outdoor recreation," according to a recent AP report. Local tribes hope to use the land for growing traditional foods and hunting, arguing that their claims to Hanford are at least as valid as those of weekend warriors looking for caloric catharsis.

Not everyone thinks that's realistic. Zachara, the Pacific Northwest National Laboratory scientist, is hesitant when I ask him about recent plans for recreation at Hanford. "I am not sure about that, to be

honest with you," Zachara tells me over the phone. When he says the word "remediation" – that is, cleanup – he prefaces it with the word "quote."

In the middle of this toxic maelstrom resides Tamosaitis – a man of God but also a company man, a believer in nuclear energy who fears nuclear waste, a maligned employee who became a principled whistle-blower, a fixer of things who was powerless to fix the last great challenge placed before him. Because of what he saw at Hanford, he started talking. Nothing can make him stop.