Nuclear Apocalypse in Japan

Lifting the Veil of Nuclear Catastrophe and cover-up

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As the sun set over quake-stricken Japan on Thursday 17 March 2011, we learned that four of six Fukushima nuclear reactor sites are irradiating the earth, that the *fire is burning out of control* at Reactor No. 4's pool of spent nuclear fuel, that there are six spent fuel pools at risk all told, and that the sites are too hot to deal with. On March 16 *Plumes of White Vapor began pouring* from crippled Reactor No. 3 where the spent fuel pool may already be lost. Over the previous days we were told: nothing to worry about. Earthquakes and after shocks, tidal wave, explosions, chemical pollution, the pox of plutonium, contradicting information too obvious to ignore, racism, greed — add these to the original *Four Horsemen of the Apocalypse:* Conquest, War, Famine and Death. The situation is apocalyptic and getting worse. This is one of the most serious challenges humanity has ever faced.

A Japanese child on the eastern shores of Japan.
Photo c. keith harmon snow, 1993.

The U.S. nuke industry is blaming Japanese experts, distancing itself from the monster it created. Instead of sending nuclear or health experts to assist the Japanese people in their time of desperate need, US President Barack Obama first sent teams of intelligence agents and FEMA trained military grunts with special security clearances. The Pentagon floated a naval strike force led by the nuclear-powered aircraft carrier Ronald Reagan off the coast of Japan: advertised as a 'humanitarian' operation, the strike force was repositioned after it was partially irradiated. Can we trust officials and the corporate news media to tell us what is happening in an honest, timely, transparent manner? Are there precedents to the nuclear crisis in Japan? What is the U.S. defense establishment really concerned with here?

Humanity now faces a deadly serious challenge coming out of Japan — the epicenter of radiation. Intentional efforts to downplay or dismiss this catastrophe reveal the immaturity of western civilization and some of our most acute human pathologies, including our worship of technology and our psychopathology of denial. The widespread distortion and cover-ups to protect private profits, national and corporate interests, to fool and betray the people, are unacceptable. Here are some of the deeper whats and whys and hows — some technical issues and the kinds of questions people need to ask — about the nuclear apocalypse unfolding on planet earth. Prayers are not enough. It's time to question everything, to put

politics aside, to take personal action to halt nuclear expansion and defend ourselves from this industrial juggernaut.

PRO-NUKE ANTI-NUKE NO NUKES

I know something about technology, and science: I have Bachelor's and Master's degrees in Electrical Engineering — with honors — from one of America's top Engineering schools. Before 1990 I worked in classified programs for General Electric — the maker of the nuclear reactors now irradiating Japan. I worked at GE Aerospace Electronics Laboratories: low-level classified government programs in communications, radars and missile guidance systems for Ronald Reagan's infamous Star Wars (Strategic Defence Initiative) programs.

From 1990 to 1993 I taught English at Japan's big *Soga Shosa* (trading houses) like Mitsubishi and Sumitomo Corporations, and meanwhile I biked the rivers, swam the beaches, hiked the mountains and studied the culture of Japan. Japanese corporations were paving the shorelines and rivers with concrete, sinking giant tetrapods off shore. One corporation even developed these giant rubber bladders — the size of football-fields — sunk offshore, which could be pumped full of seawater to provide a giant barrier against tsunami's. Of course, the profit margins for these corporations supplying these bags were huge, but I wonder what happened to the technology, if these were ever deployed, and where.

For the first 34 years of my life I was in favor of nuclear power. This changed when I saw young people in the United States put their bodies on the line to protest the Watts Bar Nuclear Power Station operations in Tennessee (1994). The commitment and integrity of these young people made me rethink my nuclear bias.

The giant sea walls of concrete tetrapods used off the eastern coast of Japan to protect
smaller sea ports and fishing villages from waves. Photo c. keith harmon snow,

1994.

I began my career as a journalist by looking deeply into the rabbit-hole of nuclear power from 1993 to 2000. I visited the Nuclear Regulatory Commission's (NRC) Public Document Rooms — which have since been closed in many places — where I read thousands of microfilms and scanned microfiche records and excavated document after document in search of truth. I visited nuke plants in New England and industry conferences. I interviewed officials and I attended the most boring and sometimes secretive public meetings with the most stifling and unimaginative bureaucrats and with engineers (like me) so dry they squeaked. And then I reported on regulatory corruption, technical failures, undemocratic initiatives to betray the public trust, and the accumulating radiation and nuclear poisons — and the many ways that the mass media supported and perpetuated the mythology.

THE ARROGANCE OF HUMANISM

"I repeat, there was and will *not* be any significant release of radioactivity from the damaged Japanese reactors," wrote Massachusetts Institute of Technology professor Dr. Joseph Oehmen on March 13. "By 'significant' I mean a level of radiation of more than what you would receive on — say — a long distance flight, or drinking a glass of beer that comes from certain areas with high levels of natural background radiation."

So begins a recent U.S. business sector article titled You Can Stop Worrying About A Radiation Disaster in Japan — Here's Why, published four days after the earthquake struck in Japan. It has already proved false. Properly understood for what it is — a childish, myopic, arrogant attempt to belittle the truth and influence public opinion — the article provides an apt example of the rampant industry disinformation that is sweeping aside rational and compassionate and precautionary assessments with irrational jingoism, simplistic emotional appeals, and wrong-headed thinking. The post went viral and was republished widely.

How do we define apocalypse? EARTHQUAKE + TSUNAMI + AGED NUKE PLANT + LOSS-OF-COOLANT ACCIDENT + PLUTONIUM + FIRES + DISINFORMATION + GREED + DENIAL + FEAR + POLITICS = APOCALYPSE.

How many nuke plants are involved? We don't really know. Not that we have not been told, we have. There are six reactors at the Fukushima site, one reactor at the Tokai nuclear facility and three reactors at the stricken Onagawa nuclear complex. There are toxic chemical spills, petroleum refinery fires, gas fires, dangerous debris and human pathogens from the thousands of dead people and animals. The place is an apocalyptic nightmare, to be sure, but from the beginning the most important facts regarding the status of the nuclear pants and their components, their functioning or failing systems, the operability of the control rooms or integrity of the reactor containment structures, were being denied to the public. Now we are seeing some damage control by the U.S., the Nuclear Regulatory Commission and the media.

It is simultaneously as though we are believed to be incapable of even the most rudimentary understanding of what is going on, while also being denied the truth in keeping with more than sixty years of secrecy and denial by the cult of the atom and its incestuous cult of intelligence.

The question is: what can we believe to be true? Look at the photos of the explosion. Are we stupid enough to believe that no radiation has been released from this reactor's primary or secondary containment systems? On Wednesday March 16 we were finally told that Tokyo Electric Power Company (TEPCO) had ordered its remaining staff to evacuate areas of the Fukushima plant after radiation levels spiked and plumes of white vapour "***were seen pouring from what authorities identified as*** [emphasis added] the station's No. 3 reactor.

The language about white vapors "*seen pouring from what authorities identified as the stations No. 3 reactor*" does not inspire confidence that 'authorities' had any clue about the status of things. Indeed, they are not in the control room, obviously, or anywhere near it, or anywhere near 'the station's No. 3 reactor' because they are standing back trying to identify what they are seeing, to see what is going on, and where it is going on. The reactor's are too hot: this is radiation: this is the nightmare scenario we were told could not happen. Radiation is contaminating air, soil, ocean, people.

The *You Can Stop Worrying* "article" first appeared as a reader's comment posted following the Business Insider journal story Japan Death Toll Climbs Astronomically As Nuclear Crises Intensifies, which was itself a republished and retitled New York Times feature of Monday March 13. At first glance, the two Business Insider stories couldn't be further apart in their general themes: *You Can Stop Worrying*, which translates to, calm down, don't get hysterical, pay no attention to those anti-nuclear fanatics who think that even microwave ovens will kill you, versus the *Death Toll Climbs Astronomically* feature, which for all practical purposes we can translate to *Holy shit, brother! Run for your life! Duck and Cover!*

However, both stories serve as part of the unraveling global media disinformation campaign about the ongoing nuclear catastrophe in Japan. The primary imperatives of this campaign are economic. In other words, most of the reportage out there about what is happening in Japan — so far — has been anchored in western epistemological frameworks based in money, greed, private profits and loss. The *loss* should not be interpreted to mean that people (mostly we are talking about people NOT affected by the apocalypse in Japan) care about who lives or dies, but rather that their primary concerns are their financial balance sheets, their corporate images, their personal retirement portfolios, and the fall of the Nikkei

Index and Dow Jones trading they drool over.

Sadly, the attitudes of many "news" writers (and their readers), government officials, energy consultants, corporate executives, nuclear experts and technicians, western humanitarian relief professionals (such as World Vision careerists), or of environmentalists for nuclear power — like scientist James Lovelock — and many other people who, for one reason or another, have had something to say about the nukes crisis in Japan, or about how Japan's nuclear misfortune can never become a Chernobyl, or how Three Mile Island didn't kill anyone, or why the events in Japan, no matter how alarming, should not be allowed to interrupt the "nuclear renaissance" touted by U.S. President Barrack Obama, or something about the beauty of some nuke somewhere else, are all based in self-interest, not the altruistic and compassionate concerns of all humanity, of environmental stewardship or the preservation of all life on earth, but in a self-righteous, arrogant and ignorant *selfishness* of the kind that author David Ehrenfeld elaborated in his monumental work, The Arrogance of Humanism.

Japanese are technical geniuses. The rail system and subways were precise: you could set your watch by them. In 2003, their advanced magnetic levitation *Shinkansen* bullet trains performed at 581 kilometers per hour (361 mph). If the Japanese can't do, no one can. Yet today Japan is on fire — the epicenter of deadly radiation now emanating out of that sizable island. This is not about Japan, folks, or national borders: its about all of us, everywhere.

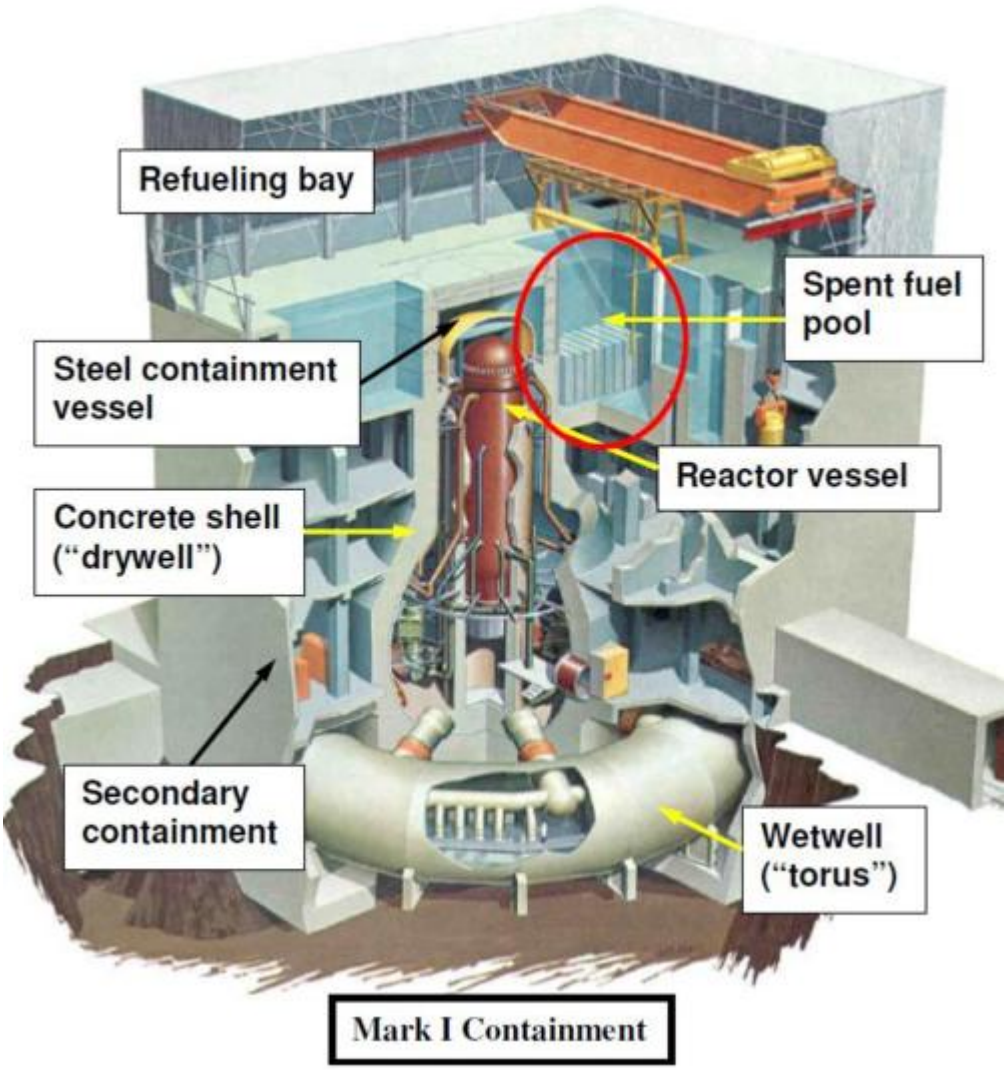
SPENT FUEL POOL FOOLS

While the absence of cooling water facilitated the nuclear crises in Japan, most likely some major reactor components (proven unsafe) also failed under the seismic stresses of the 9.0 quake. Key components likely cracked or shattered. The tsunami and huge aftershocks advanced the chaos. These factors were complicated by the loss of offsite electrical power (an electrical BLACKOUT), the failure of emergency diesel generators, and the subsequent loss-of-coolant (water).

Embrittlement of nickel-based superalloys that comprise reactor internals was flagged as a major safety issue as early as the 1960s, yet such problems were bureaucratically dismissed, covered over, buried in paperwork and regulatory studies produced by the NRC ("NUREG" documents), and ignored. Intergranular stress corrosion cracking of BWR core shrouds (the core shroud is next to fuel rods deep inside) is another major safety issue in GE designed BWRs built by Hitachi at Fukushima, and these plague every BWR reactor in the U.S.

We don't know, however, and for many days we were offered the standard industry refrain: no need to worry, no threat to public health and safety. BWR core shroud cracking (NUREG-1544), reactor pressure vessel cracking (NUREG-1511), embrittled components and aging (NUREG/CR-5939), cooling system failures (NUREG/CR-6087), reactor containment isolation systems failures (NUREG/CR-6339) — all thoroughly documented.

The redundancy and ever-touted 'defense-in-depth' systems failed at Fukushima. All over the U.S. such systems have been routinely disabled to minimize electricity-generating outages, increase output power and maximize corporate profits. There are as many possibilities of failures outside what we have been spoon-fed — the official sequence of events — as there are dead people.



Amongst the most troubling and most deeply underplayed questions of the entire crisis concern the Fukushima Spent Fuel Pools. These basin are packed with tons of irradiated fuel rods that need to be cooled. One of the major postulated accident scenarios involves a Loss-of-Coolant Accident (LOCA) to the reactor core, but a LOCA event can also occur with a spent fuel pool. It has. Fires and explosions in Japan. The Spent Fuel Pools at the six Fukushima reactors are NOT inside primary containment. They are exposed. Burning. About to burn.

Reactors No. 4, 5, and 6 at Fukushima were shutdown when the earthquake struck. After the water drained and the spent fuel became exposed, the pool at reactor No. 4 caught fire, and continues to burn, as of Thursday March 17, releasing massive amounts of radiation into the environment. The status of the other six spent fuel pools at Fukushima is unknown. A courageous U.S. journalist Rachel Maddow explored the spent fuel pool issue with a former government official. The most important, critical point made by Princeton professor Frank Von Hippel occurs at minute 14:19 — where Rachel Maddow talks over him: these are LONG-LIFE RADIONUCLIDES being emitted from the spent fuel pool(s). Isotopes of cesium: Cs-137 has a half-life of 30 years and will be around and hot for decades.

How much disaster are we talking about? The atomic bomb that exploded at Hiroshima created about 2000 curies of radioactivity. The spent fuel pools at Vermont Yankee Nuclear

Plant (U.S.) are said to hold about 75 million curies. There are six spent fuel pools at Fukushima, but the numbers of tons of fuel rods in each have not been made public.

The Nuclear Information and Resource Service (NIRS) did the math: If Fukushima's Reactor No. 4 operated for 35 years and produced 30 tons of irradiated fuel per year and each ton is equivalent to 24 times the amount of cesium-137 produced by the Hiroshima bomb, then each fuel pool could contain on the order of 24,000 times the amount of cesium-137 produced by the Hiroshima bomb, if all the produced irradiated fuel remains in the fuel pool.

Nuclear stupidity No. 1: the Fukushima reactor buildings are square (not circular) and had to absorb the force of the tsunami wave straight on. Stupidity No. 2: six reactors clustered too close together. Stupidity No. 3: no shoreline protection against a tsunami. Stupidity No. 4: reactors sited on earthquake faults. Stupidity No. 5: assumptions and calculations proving that the reactor, prior to its construction, could withstand anything that nature threw at it. Stupidity No. 6: it didn't begin in Japan: the industry, with all its corruptions, false assumptions and technological hubris, was born in secrecy in the United States of America.

Stupidity No. 125: spent fuel pools are packed too tightly, as is well-established by industry documents, for economic reasons, discarding safety concerns. Stupidity No. 458: the Spent Fuel Pools at Fukushima are suspended up high inside the reactor buildings secondary containment — the same buildings whose roofs are blowing off! Are we to believe that the massive explosions that were captured on film, and others that were not, did not damage these elevated time bombs?

How many stupidities do we need to admit before we admit that it can happen in the United States and Europe and Canada too? Imagine those courageous Japanese nuclear workers at Fukushima — sacrificing their lives! — trying to save their families, Japan and the rest of us from our unprecedented stupidity!

During World War II they were called kamikazis and we have always portrayed them as terrorists: they were soldiers and pilots sacrificing their lives for the sake of their nation. Well, these heroic men and women sacrificing themselves at Fukushima have my deepest respect.

There is an *ocean* adjacent to the Fukushima complex, and yet the reactors and fuel pools cannot be kept cool. Impossible. The huge heat sink necessary to cool the melting fuel is not available. This is not about earthquakes and tsunamis — it is about loss of off-site power, backup generators and emergency systems that occur in a blackout. Do electrical outages and blackouts occur anywhere else? Blizzards? Tornadoes? Hurricanes? The world is seeing more and more extreme and unpredictable weather. Claims that a serious nuclear 'accident' cannot happen in the U.S., Europe or Canada are false, and nuclear executives know it. That is why corporations refused at first to get into the nuclear power business, until the U.S. Government indemnified them with the Price Andersen Act (1957).

"What this [Fukushima] station suffered was a station blackout," says Deb Katz of the Citizens Awareness Network, who helped shut down Yankee Atomic in Rowe Massachusetts, "and the backup safety systems that were supposed to keep it operational — the backup diesel generators — failed. This can happen without an earthquake. A midwest [U.S.] power company caused the northeast grid to fail a few years ago; a flood or a terrorist attack could do the same. We could then experience a similar slow motion catastrophe though not on the grand scale of the Japanese site with its 6 nukes."

A LONG HISTORY OF DECEPTION

Like the U.S. Nuclear Regulatory Commission (NRC) and the International Atomic Energy Agency, Japanese officials have a long history of covering up ugly nuclear realities. In a recent WikiLeaks diplomatic cable, politician Taro Kono, a high-profile member of Japan's lower house, told U.S. diplomats that the Ministry of Economy, Trade and Industry (MITI) — the Japanese government department responsible for nuclear energy — has been "covering up nuclear accidents and obscuring the true costs and problems associated with the nuclear industry." In 2002 "the chairman and four executives of TEPCO, the company that owns the stricken Fukushima plant, resigned after reports that safety records were falsified."

Such singular but remarkable events follow a pattern of wholesale U.S. cover-ups that define the industry as secretive and criminal, and they involve shoddy equipment, human incompetence, unsafe designs, inadequate safety measures, and economic decisions that have occurred since the very beginining of Japan's nuclear power era — which itself was born out of the bombing of Hiroshima and Nagasaki with U.S.-made weapons of mass destruction.

The control room at the Watts Bar Nuclear Power Station, Tennessee. Photo c. keith harmon snow, 1994.

In the 1960's, TEPCO planned to build a reactor outside Kashiwazaki city: nuclear officials told the local community, for example, that radioactivity from the plant would increase rice cultivation and the coloring of the carp (a delicacy): seven reactors were eventually built there. In June 1973, radioactive waste water leaked from a storage tank at Fukushima's reactor No. 1. In July 1974, Kansai Electric asked Westinghouse Corporation to replace the steam generator of one of Kansai's two Mihama reactors after Mihama I experienced four major shutdowns in less than four years.

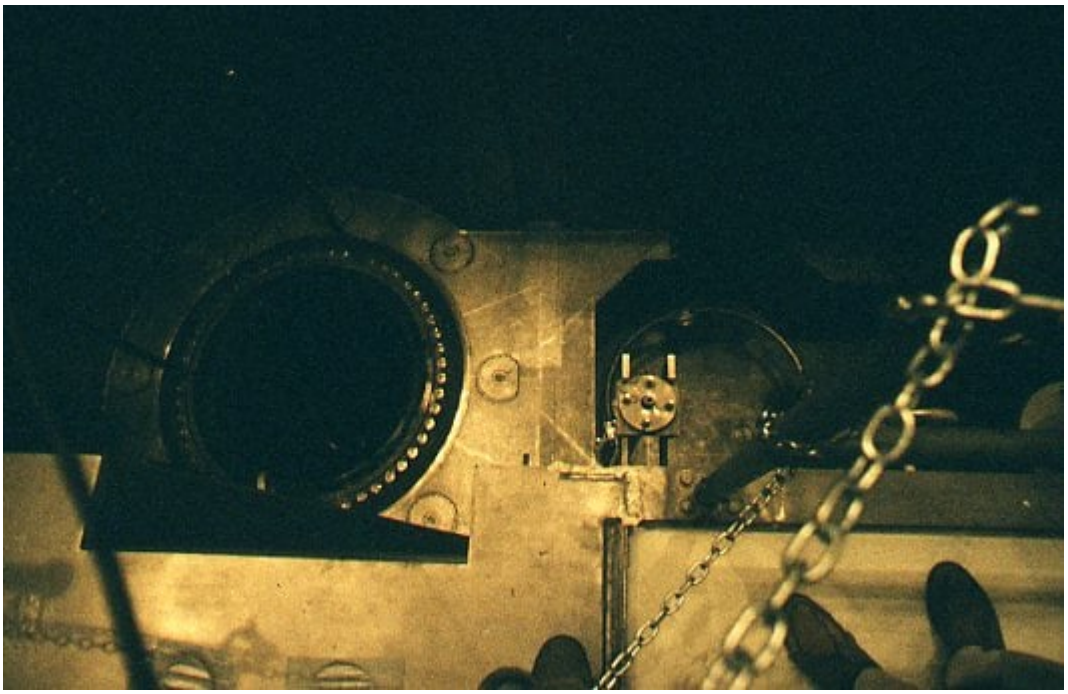
In September 1974, following the emergency shutdown of 21 of the then 55 U.S. reactors due to radioactive leaks at the Illinois Dresden Reactor No. 1, Japanese officials inspected their six Boiling Water Reactors (BWRs), similar to the Dresden BWR, and they found similar

defects at Fukushima I and Hamaoka. Ditto, 1975: emergency shutdown's in the U.S. prompted inspections that discovered Emergency Core Cooling System (ECCS) problems at the Fukushima I and Tsuruga BWR reactors. Japan's Mihama reactors were plagued with radioactive 'leaks' and faulty equipment that prompted Kansai officials to demand a refund from U.S. contractor Westinghouse Corporation. The Mihama Pressurized Water Reactors (PWRs) have been scrammed and shutdown and leaked. The accident at the Mihama Reactor No. 3 on 9 August 2004 was previously considered Japan's worst nuclear accident: there was no tsunami, and no earthquake.

Japan's fleet of white elephant nukes only grew more problematic. From April to September 1977, six of Japan's fourteen reactors were shutdown. Japanese corporations joined with Westinghouse and General Electric in the 1980's to export their destructive technology to other countries, mostly targeting the so-called Third World. Before 1979 there were some 25 reactors under construction or completed in Japan, and until last week there were 55 operating reactors. In 2006, GE and Hitachi Corporation teamed up to create three joint venture nuclear companies to expand nukes in North America.

One fact is certain: we have already been massively lied to about a massive and still unfolding nuclear disaster. The radiation releases from some four to six nuclear reactors in collapse are already known to be excessive, described by reputable experts as "worse than Three Mile Island but not as bad as Chernobyl." It may be worse than Chernobyl yet.

Additional radiation has been reported at the Onagawa complex, but this was explained away as wind-blown radioactivity from the Fukushima complex. Meanwhile, in the same reports, officials said that radiation was not leaking from Fukushima, or it was minimal, and there was no cause for alarm.



The core of the nuclear reactor at Tennessee Valley Authority's Unit 2 Pressurized Water Reactor (PWR) prior to irradiation. Photo c. keith harmon snow, 1994.

After several days of lies and distortions and official government censorship, reports

appeared under the headlines Japan radiation leaks feared as nuclear experts point to possible cover-up. Reports also began citing partial meltdowns of nuclear fuel rods. The threat of meltdown is real, it has been happening to some degree, and it has already occurred far more than we have been told. The physical and thermonuclear states of materials and systems and the spread of radioactivity at Japan's reactors remains shrouded in disinformation and silence.

THE CLEAN AND GREEN PROPAGANDA

Of course, technology gurus and corporate executives and financial consultants are hysterical, claiming there were no deaths from Three Mile Island and that deaths at Chernobyl are exaggerated by the mass media. These claims are false. The new book, Chernobyl: Consequences of the Catastrophe for People and the Environment provides irrefutable evidence of massive loss of life.

"The book is solidly based — on health data, radiological surveys and scientific reports — some 5,000 in al," says journalist Karl Grossman. "It concludes that based on records now available, some 985,000 people died, mainly of cancer, as a result of the Chernobyl accident. That is between when the accident occurred in 1986 and 2004. More deaths, it projects, will follow."

James Lovelock, author of the renowned GAIA Hypothesis, is a celebrated environmentalist for nuclear energy peddling nuclear power as a clean, green, renewable energy source of the future. However, Lovelock has a long history working for NASA — the outer-space division of the Pentagon — and is deeply enmeshed in the western epistemological framework.

Commenting on Japan's nuclear crisis, Lovelock said that people were 'prejudiced' against nuclear power unreasonably. "It is very safe," he said. Chernobyl, for instance, was "an idiotic mess-up that could only have occurred in the Soviet Union", and according to UN estimates had killed only about 56 people. More people are routinely killed in oil refineries and coal mines, he pointed out."

James Lovelock's Chernobyl statement should immediately discredit him as a quack: Even the Nuclear Regulatory Commission is unwilling to go on record claiming anything less than many, many deaths. Further, Lovelock's comment about the 'idiotic mess-up' by Russians is inherently racist: the Russians were the first to put a satellite (Sputnik) into orbit, for example, and NASA collaborated with the Russian MIR Space Station, which broke all kinds of records.

Lovelock suggests that nuclear reactors are our only hope to curtail global climate change, and that this may involve, for example, the 'suspension of democracy'. However, democracy has been long since suspended for many of the earths people and species — forced to live and die with our burgeoning wastes, consumption and exploitation. Lovelock's analysis is patently false — contaminated by his own inability to see beyond his privilege and self-interests.

Not convinced? Lovelock has also reportedly stated, wrongheadedly: "One of the striking things about places heavily contaminated by radioactive nuclides is the richness of their wildlife. This is true of the land around Chernobyl, the bomb test sites of the Pacific, and

areas near the United States' Savannah River nuclear weapons plant of the Second World War."

Tell this to the mutant babies, weak-spined and deformed children from the Chernobyl killing zones, chronicled in Russian filmmaker Vladimir Kuznetsov's, "***While We Are Still Alive***, and to the people of Bikini Atoll whose stolen island is officially acknowledged to be highly contaminated. Savannah River is another SUPERFUND site.

The nuclear power cycle involves disease, despair and death from the uranium mining to daily operations to the nuclear waste "'dumping'. Uranium mines in Niger that have built France's entire nuclear complex are toxic wastelands spreading radiotoxins across north and sub-Saharan Africa. The Tuareg and Toubou nomads have been completely shattered by the confiscation, exploitation and irradiation of their lands by the nuclear complex. Native Americans continue to suffer massive epidemics of disease, contamination and confiscation of lands in the Secret Nuclear War at the American Ground Zero: the nuclear complex has compounded the native American genocide begun in 1492. Daily contamination releases into water, soil and air occur at every operating nuclear reactor in the world. There is no 'disposal' of deadly nuclear toxins that now exist to perpetuity, and yet wastes are typically dumped on poor communities like Barnwell, South Carolina, or native American lands.

Out of sight, out of mind: nuclear poisons are colorless, odorless, and deadly.

START WORRYING, HERE'S WHY

The writing You Can Stop Worrying About A Radiation Disaster in Japan — Here's Why is packed full of disinformation and technical jargon, masked as scientific expertise, meant to confound, confuse and scientifically *impress* the un-technical (concerned) reader. The author at first did not identify himself, which is a tactic many people use so that they do not have to take responsibility, or worry about being held accountable. Appended as a sort of disclaimer to the article that morphed out of the comment we find the statement: "*Since posting this, we have learned that it was written by Dr. Josef Oehmen, a research scientist at MIT."*

In the nuclear arena, the Massachusetts Institute of Technology (MIT) is known for the infamous Nuclear Reactor Safety Study (WASH 1400), chaired by MIT nuclear scientist Norman P. Rasmussen (commonly known as *The Rasmussen Report*), that whitewashed the massive flaws and safety failures of a burgeoning, secretive, incestuous nuclear power industry, even while it exposed them to some degree.

According to a Nuclear Information and Resource Service fact sheet on Fukushima, in 1986, Harold Denton, then the NRC's top safety official, told an industry trade group that the GE "Mark I [BWR] containment, especially being smaller with lower design pressure, in spite of the suppression pool, if you look at the WASH 1400 safety study, you'll find something like a 90% probability of that containment failing."

Produced at the height of the United States' anti-nuclear movement in 1974, the Rasmussen Report downplayed the risk of nuclear accidents and polished the image of a technologically diseased industry. The stridently pro-nuclear MIT has spent billions of taxpayers dollars on secretive and highly biased research programs of all things nuclear. MIT is also a known hotbed of the Central Intelligence Agency (CIA), with a revolving door from MIT to government to the CIA.

“I have been reading every news release on the incident since the earthquake,” wrote MIT’s Dr. Josef Oehmen in his initial post of March 12. “There has not been one single report that was accurate and free of errors… By ‘not free of errors’ I do not refer to tendentious anti-nuclear journalism – that is quite normal these days. By ‘not free of errors’ I mean blatant errors regarding physics and natural law, as well as gross misinterpretation of facts, due to an obvious lack of fundamental and basic understanding of the way nuclear reactors are build and operated. I have read a 3 page report on CNN where every single paragraph contained an error.”

Turns out Dr. Oehmen’s report had so many errors, and yet was so widely regurgitated, that it was taken over by MIT’s nuclear experts. Dr. Oehmen employs the standard ruse of claiming that the press, which can very easily be shown to as stridently pro-nuclear as MIT itself, is instead plagued by “tendentious anti-nuclear journalism — that is quite normal these days.” He then explains nuclear power (wrongly) arriving at last at his definitive statement that, “I repeat, there was and will *not* be any significant release of radioactivity from the damaged Japanese reactors.”

Pollution off the coast of Japan caused large scale fishkills.
Photo c. keith harmon snow, 1992.

“The first ‘type’ of radioactive material is the uranium in the fuel rods,” wrote Dr. Oehmen,

“plus the intermediate radioactive elements that the uranium splits into, also inside the fuel rod (Cesium and Iodine). There is a second type of radioactive material created, outside the fuel rods. The big main difference up front: Those radioactive materials have a very short half-life, that means that they decay very fast and split into non-radioactive materials. By fast I mean seconds. So if these radioactive materials are released into the environment, yes, radioactivity was released, but no, it is not dangerous, at all. Why? By the time you spelled “R-A-D-I-O-N-U-C-L-I-D-E”, they will be harmless, because they will have split up into non radioactive elements…”

It takes about five seconds to spell R-A-D-I-O-N-U-C-L-I-D-E and it takes about the same amount of time to read a chart (below) which shows the actual lifetimes and half-lives of radioisotopes that people need to be concerned about today.

Not only does Dr. Oehmen intentionally misinform people about the inherent design flaws and potential failures of nuclear reactors and subsystems, but he knowingly disinforms about the potential for serious health consequences and the radioactive contaminants that are typically released during a nuclear power accident. While millions of people in Japan are suffering the personal psychological terror of a possible nuclear holocaust, the fears and horrors of life and death from a natural disaster, starvation and thirst, and radioactive poisoning. Dr. Joseph Oehmen — safe in Boston Massachusetts — has been been boasting about his blog post — equally popular with people who hate it and love it — which spread like a virus on the Internet.

During nuclear fission, the uranium from the fuel rods splits into many radioactive fission products that can then escape during a nuclear power ‘event’. These include dangerous **Noble Gases** (xenon and krypton); **Hallogens (**including iodines and bromines); **Alkali Metals** (including cesium 137); **Alkaline earths** (including barium 133 and strontium 90) and the elements **Tellurium** and **Ruthenium**. Some fissionable elements decay rapidly and are inconsequential during releases, but some decay into other, more deadly nuclides. The most dangerous nuclides have half-lives in days (I-131 = 8 days), years (Cs-137 = 30 years) or centuries (Pu-239 = 24,000 years). Half-life is the time it takes for one-half of the material to decay — lest we forget that the other half is still present.

Table 17.2. Activity of Radionuclides in a Reactor Core at 3560 MW(th)

Group/Radionuclide	Radioactive Inventory in Millions of Curies	Half-Life, Days
A. *Noble gases*		
Krypton-85	0.60	3,950
Krypton-85m	26	0.183
Krypton-87	51	0.0528
Krypton-88	73	0.117
Xenon-133	183	5.28
Xenon-135	37	0.384
B. *Iodines*		
Iodine-131	91	8.05
Iodine-132	129	0.0958
Iodine-133	183	0.875
Iodine-134	204	0.0366
Iodine-135	161	0.280
C. *Alkali metals*		
Rubidium-86	0.028	18.7
Cesium-134	8.1	750
Cesium-136	3.2	13.0
Cesium-137	5.1	11,000
D. *Tellurium–antimony*		
Tellurium-127	6.3	0.391
Tellurium-127m	1.2	109
Tellurium-129	33	0.048
Tellurium-129m	5.7	34.0
Tellurium-131m	14	1.25
Tellurium-132	129	3.25
Antimony-127	6.6	3.88
Antimony-129	35	0.179
E. *Alkaline earths*		
Strontium-89	101	52.1
Strontium-90	4.0	11,030
Strontium-91	118	0.403
Barium-140	172	12.8
F. *Noble metals and cobalt*		
Cobalt-58	0.84	71.0
Cobalt-60	0.31	1,920
Molybdenum-99	172	2.8
Technetium-99m	151	0.25
Ruthenium-103	118	39.5
Ruthenium-105	77	0.185
Ruthenium-106	27	366
Rhodium-105	53	1.50
G. *Rare earths, refractory oxides, and transuranics*		
Yttrium-90	4.2	2.67
Yttrium-91	129	59.0
Zirconium-95	161	65.2
Zirconium-97	161	0.71
Niobium-95	161	35.0
Lanthanum-140	172	1.67
Cerium-141	161	32.3
Cerium-143	140	1.38
Cerium-144	91	284
Praseodymium-143	140	13.7
Neodymium-147	65	11.1
Neptunium-239	1800	2.35
Plutonium-238	0.061	32,500
Plutonium-239	0.023	8.9×10^6
Plutonium-240	0.023	2.4×10^6
Plutonium-241	3.7	5,350
Americium-241	0.0018	1.5×10^5
Curium-242	0.54	163
Curium-244	0.025	6,630

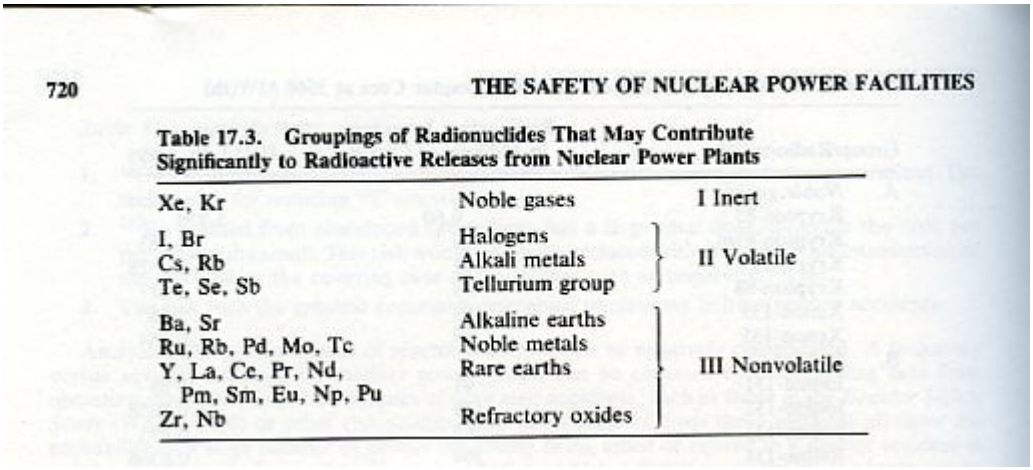


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Table 17.3. Groupings of Radionuclides That May Contribute Significantly to Radioactive Releases from Nuclear Power Plants

Xe, Kr	Noble gases	I Inert
I, Br	Halogens	II Volatile
Cs, Rb	Alkali metals	II Volatile
Te, Se, Sb	Tellurium group	II Volatile
Ba, Sr	Alkaline earths	III Nonvolatile
Ru, Rb, Pd, Mo, Tc	Noble metals	III Nonvolatile
Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Np, Pu	Rare earths	III Nonvolatile
Zr, Nb	Refractory oxides	III Nonvolatile

Tables 17.2 and 17.3 from: A Guide to Nuclear Power Technology (Wiley, 1984).

All of these fissionable products are potentially released and they have varying degrees of half-lives, mobility, migration and toxicity depending on factors like atmospheric conditions, temperature of the reactor core and operating capacity (megawatts) at shutdown, and the presence of coolants. The most dangerous of these are iodine 131 (I-131), cesium 137 (Cs-137), strontium 90 (Sr-90), cobalt 60 (Co-60) and plutonium 239 (Pu-239). All of these negatively affect the human body and all of these have been released in nuclear power ‘accidents’, during venting of radioactive steam or flushing of radioactive water, and other ‘events’. Another deadly isotope which seems to consistently ‘escape’ from nuclear power sites is cobalt 60 (Co-60), half-life 5.2 years. Co-60 accumulates and migrates through steam generator tubes and other secondary coolant processes, in core shrouds and reactor pressure vessels, and many of the other components of nuclear reactors whose histories of failures are thoroughly documented.

Is radiation leaking in Japan? Yes and no. The term ‘leak’ suggests air squeaking out of a balloon. In Japan we have leaks, here and there, but we also have explosions, fires and other phenomena that create massive radioactive emissions. To say ‘leak’ is to downplay what is happening. The balloons in Japan have burst: primary containment has been breached at Reactor No. 3 and at least one spent fuel pool is burning up. With the walls blown out and roof blown off, it seems at least one other spent fuel pool is gone or going.

Nuclear advocates deride and dismiss public ignorance about radionuclides like, for example, the noble gases. Nuclear advocates frequently state that both xenon and krypton decay and disappear in a matter of seconds or minutes. What they don’t tell us is that these isotopes decay into daughter isotopes that are extremely deadly emitters. Many credible physicians, scientists and other nuclear experts — free of the self-interests of nuclear profits, academic sponsorship or career advancement — have outlined the absence of epidemiological studies of certain radionuclides emitted or flushed at nuclear reactors. Dr. Helen Caldicott has elaborated the detrimental health effects of the noble gases xenon (Xe) and krypton (Kr), and she notes that these have appearance hundreds of miles from reactors believed to have emitted them.

• **Xenon 137**, with a half-life of 3.9 minutes, converts almost

immediately to the notoriously dangerous cesium 137 with a half-life of thirty years.
• **Krypton 90**, half-life of 33 seconds, decays to rubidium 90, half-life of 2.9 minutes, then to the medically toxic strontium 90, half-life of twenty-eight years.
• **Xenon 135** decays to cesium 135 with an incredibly long half-life of 3 million years.
• Large amounts of **xenon 133** are released at operating reactors, and although it has a relatively short half-life of 5.3 days, it remains radioactive for 106 days.
• **Krypton 85**, which has a half-life of 10.4 years, is a powerful gamma radiation emitter.
• **Argon 39** has a 265-year half-life.

"Other dangerous noble gases include xenon 141,143 and 144, which decay to cerium 141,143 and 144," Dr. Helen Caldicott reports in Nuclear Power is Not the Answer. "According to the National Council on Radiation Protection (NCRP Report No. 60) these three cerium isotopes,which are beta emitters,are abundant products of nuclear fission reactions and have moderately long half-lives. They bio-concentrate in the food chain, and they irradiate the lung, liver, skeleton, and gastrointestinal tract, where they act as potent carcinogens."

On March 14 Physicians for Social Responsibility (PSR) outlined the risks from Japan. Iodine 131 migrates in air and is known for causing thyroid cancers, especially in children. Strontium 90 causes different cancers. Cesium 137 concetrates in bone and causes leukemia. Microscopic particles of plutonium 239 cause lung cancer if inhaled and Pu-239 kills instantly in any sizeble dose. Areas contaminated by plutonium will have to be abandoned — as happened at Chernobyl.

"Since 2010, Fukushima Daiichi Unit-3 reactor had been using mixed-oxide fuel (also called plutonium fuel or MOX)," PSR reported, in Japan's Nuclear Crises Worsens, "which is even more dangerous to the public than a severe accident with uranium fuel. Plutonium fuel contains plutonium and other very toxic actinides that would increase the number of resulting cancers. Current reports say that this fuel has been exposed to air."

"Pressure in at least two of the reactors have reported to be well above normal levels," continued PSR, "and the reactor operator, Tokyo Electric Power Company, released some of the pressure by venting radioactive vapor from the containment structure. In addition, the radionuclide cesium has been reportedly found outside the reactor, which indicates that there has been fuel damage."

The proponents of nuclear power have used all kinds of disinformation and tactics to protect the industry — compelling the nuclear complex to arm guards to 'protect' these secrets and to 'protect' civilian reactors. It is not only 'terrorists' that the nuclear establishment seeks to protect us from: the armed guards and classified documents are to prevent the public from learning the truth about the destruction of documents, the disappearing of evidence, the falsification of reports and records, the calculated fudging of risk and safety assessments. There have been countless exposes, such as Daniel Ford's 1982 book The Cult of the Atom: The Secret Papers of the Atomic Energy Commission.

FALSE STATEMENTS AND PREMATURE ASSURANCES

The original New York Times story, Death Toll Estimate in Japan Soars as Relief Efforts Intensify (retitled by Business Insider, commented on by Dr. Joseph Oehmen), follows the patterns of the media and government begun on DAY ONE, wherein authorities offered false assurances, premature evaluations, and outright lies. These officials — and the media that quoted them — repeatedly reiterated that there was no cause to worry. At first, no radiation was released, we were told, over and over, even though, admittedly, there were some slight reactor problems here and there. Then there were explosions, but still the radiation levels were normal, or, well, maybe there was a puff of steam, which we were told was a hydrogen blast, but radiation monitors showed nothing, and there was no threat to the public health or safety.

The Japanese Government soon dispatched health and rescue teams dressed in white moon suits and breathing through respirators and hauling around geiger counters to measure radiation levels in frightened children, but still, no radiation was released, they chanted, no cause for alarm, the media reported. A handful of citizens reported to the hospital showing signs of radiation poising, but still there were 'no serious radiation concerns', officials were everywhere quoted, or else what little radiation was released was compared to what you might get riding on a school bus in the sunshine. While evacuating thousands of people in the 20 kilometer zone (12 miles) around Fukushima, on the one hand, the government continued to tell people that the public was not at risk, on the other, and the media continued to report the lie, as they have always done, and still do, with radiation emergencies in the United States.

For example, on November 23, 2009, a radioactive contamination at Three Mile Island led to a Reuters news report titled Federal Officials: Radiation Leak At Three Mile Island No Threat to Public Safety. Like the 'news reportage' coming out of Japan, the Three Mile Island leak story was bereft of any discussion, analysis, counterpoint or critique from anyone. Journalists who collaborate with the western English-language news-consuming media have no comprehension of the technological issues, the industry cover-ups, the deceptions, the bureaucratic inertia or the radiological poisons produced and the concomitant epidemics of disease clustered around nukes. They have swallowed the industry slogans and green-washing for so long that their capacity to provide comprehensive, informed, investigative reportage is less than zero. Hence we find innocent [sic] people like CNN's Anderson Cooper (360) reporting from 100 kilometers north of Fukushima and then freaking out and running for their lives from the invisible killer: radiation. Meanwhile, CNN cuts back-and-forth from Cooper to Jim Walsh — 'our nuclear expert and CNN contributor' — who arrogantly reassures the increasingly anxious Anderson Cooper that everything is under control and the blasts and white smoke are of no concern.

"We had an explosion," MIT's Dr. Jim Walsh reports, the Boston, Massachusetts skyline and the Prudential Center skyscrapers glimmering brightly behind him. "It turned out that explosion did not compromise the [nuclear] core facility," he guesses (minute 29). Walsh immediately betrays his speculation a few minutes later (minute 59). "***Hopefully*** [emphasis added], it's just the outer structure, and has left unaffected the reactor, and unaffected the containment vessel. Because if it were to affect those things…uh… that would be bad news…"

"The subtext here is Should I Get Out of Here?" interrupts the alarmed Anderson Cooper, in

the live on-the-air broadcast. Of course, from this point on the western press increasingly focuses the public's attention on the trials and tribulations and death-defying escape of the courageous [white] investigative reporter, Anderson Cooper.

"I hear you Anderson," responds expert Jim Walsh, chuckling. "I want to err on the side of caution for you here, Anderson." Walsh is barely able to contain his laughter as he sells Cooper out. "Uh, ah, my guess is that you are O.K. But I don't want you to sue me if I am wrong. But, uh, I'm inclined that you're O.K."

"There have been release of..uh..uh…I guess a gas," Cooper continues, "and correct me, I flunked science… There have been releases out over the ocean…why were they doing these controlled releases?"

Dr. Jim Walsh then pontificates that radiation releases that ostensibly drift out over the ocean — releases questioned by the ill-prepared and uneducated Cooper — are 'mildly radioactive', unwanted but not dangerous, in any case, that they are being screened for dangerous radonuclides by the Japanese reactor experts, and "it's not going to be a major health threat."

Nonsense! Here is a simultaneous catastrophe beyond human comprehension: At least six nuclear reactors in various states of collapse, out-of-control, and in partial meltdown, and at least one even more deadly spent fuel pool overheating and burning, amidst the apocalypse from the original Richter 9.0 earthquake, the Richter 5.0 and 6.0 aftershocks, the Tsunami, the massive death toll, the lack of emergency vehicles and spreading radioactivity, the fires, the melting Spent Fuel Pools — they are not "screening" radioactive releases which, in any case, are now uncontrolled.

Of course, according to his own biography, CNN's nuclear consultant, Dr. Jim Walsh, an expert in international security and a Research Associate at the Massachusetts Institute of Technology's Security Studies Program (SSP) — which also shares U.S. special forces as 'research fellows'. He is published and selected as the chosen expert by the major U.S. and European media. Dr. Jim Walsh is the former Executive Director of the Managing the Atom project at Harvard University's John F. Kennedy School of Government, and a visiting scholar at the Center for Global Security Research at Lawrence Livermore National Laboratory — one of our Department of Energy SUPERFUND sites, deep down the dark [nuclear] rabbit hole. Dr. Jim Walsh is another government spook.

For another example, "[T]he most urgent worries concerned the failures at two reactors at the Fukushima Daiichi nuclear power plant," the New York Times wrote, in Death Toll Estimate in Japan Soars as Relief Efforts Intensify, "where engineers were still struggling to avert meltdowns and where some radiation had already leaked. An explosion at one of the reactors on Monday did not appear to have harmed it, Japanese officials said."

In one sentence we are told that a nuclear meltdown may be imminent, and in the next sentence, same paragraph, Japanese officials assured the public (the New York Times backed them up) that an explosion occurred but the reactor was not harmed. Is this believable? When the Japanese nuke experts took the drastic measure of pumping seawater into the reactors they knew that the reactors would be ruined forever. Given the economics

of such a choice — billions upon billions of Japanese yen destroyed forever — we can infer that the situation is beyond grave: the Fukushima area is now a permanent sacrifice zone: people, wildlife, land has been sacrificed to the Gods of nuclear technology.

"We have no evidence of harmful radiation," deputy Cabinet secretary Noriyuki Shikata told reporters after one of the recent reactor building explosions.

Environmental activists in the area of the Fukushima reactors began to cry foul after finding that radiation monitoring stations were not operating. At the top of the Tokyo Electric Power Company (TEPCO) Monitoring Website it said "monitoring goes on around the clock year round" and at the bottom it said "THIS SYSTEM IS CURRENTLY SHUTDOWN." Activists believed that TEPCO was downplaying radioactive releases. At the same time, TEPCO was announcing that it planned to vent the containment [vessel] to relieve the pressure, which caused releases of radioactivity into the air.

On Wednesday March 16, National Public Radio reported that "the chief of the U.S. Nuclear Regulatory Commission said that all the water is gone from one of the spent fuel pools at Japan's most troubled nuclear plant, but Japanese officials denied it." Of course, National Public Radio has been heavily subsidized by the nuclear power industry and has consistently advanced the nuclear industry agenda.

More nonsense: Radiation from Japan's troubled nuclear reactors has virtually no chance of reaching the U.S. — the West Coast, Alaska or other locations — the Nuclear Regulatory Commission said Tuesday March 15. (Note that they don't want to disturb the tourist industry, so they say nothing about Hawaii.) The statement from the NRC said that "the 'small' radiation releases so far [sic] from the Japanese reactors has been blown out to sea, away from populated areas."

On Wednesday March 16, the United Nations Comprehensive Test Ban treaty Organization reported that a radiation plume from Japan nukes would hit Southern California late Friday. Of course, health and NRC officials say it poses very little risk.

DISTANCING U.S. NUKE INDUSTRY FROM JAPAN

NBC News on Wednesday evening (March 16) ran several short 'news' clips about Japan's nuclear crises. One of these was clearly intended to distance General Electric and the nuclear Regulatory Commission from Japan, a sort of betrayal of the culture of secrecy and their historically incestuous relationship. Why? To perform damage control, improve investor confidence, assuage public fears of a similar catastrophe at one of the 110 reactors in the U.S.

The NBC broadcast began by pointing out that the U.S. Nuclear Regulatory Commission (NRC) has advised U.S. citizens who are within 50 miles (80 kilometers) of the Fukushima reactors to evacuate or stay indoors. The U.S. set a higher standard, and the news went on to promote the idea that Japanese officialdom cannot be trusted, but U.S. officialdom can.

Then the NBC News reporter, Lester Holt, was shown being scanned for radiation after returning from the Sendai area: no contamination on his body, but his "shoe bottoms [soles] contained slightly elevated amounts of radiation, but of no danger to us," he said. Again, the standard tactic of reporting that contamination has occurred — this time it is on his shoes —

but that it is of no danger. Furthering the myths about radioactivity and its deadly means of spreading disease, the shoe bottom problem was nothing a little soap and elbow grease couldn't fix. And so, later in the hour, they showed the shoes being scrubbed and everything being returned to [business as] normal.

NBC followed the news tidbits about radioactive shoes with pictures of Fukushima reactors — buildings with their roofs blown apart — accompanied with assertions that there is a POSSIBLE breach of containment at the Fukushima Reactor No. 2, and that a breach of Reactor No. 3 containment vessel is CONFIRMED.

View image

Cut to the U.S. Congress, where NBC brings us a very, very short clip from a special Senate hearing held on Wednesday March 16. Suddenly the Nuclear Regulatory Commission (NRC) is awake, and they care, and they are telling an equally awake and suddenly concerned U.S. Congress that they believe that Japan has covered up the extent of the nuclear disaster.

"Radiation levels are extremely high," proclaims NRC chief Dr. Gregory B. Jaczko. The spent fuel pools are dry. Secondary containment at the reactor [No. 3] has been breached, but Tokyo is denying this."

Finally, NBC informs its viewers, in passing, that General Electric — the designer and salesmen of the GE Mark I Boiling Water reactors that General Electric dumped on Fukushima back in the 1970s — is a part owner of MSNBC. Full disclosure, of course.

Suddenly the 'news' shifted to big bold banners flashed across the TV screen in big blue

fonts. These banners remind good, tax-paying and law-abiding citizens — good people watching the evening news after a hard day's work — that GE has reviewed the safety concerns that were previously raised about GE BWR reactors, and so reactors in the U.S. are safe. It was no longer news: it was a public relations ploy, a photo op for GE to improve its image, right out of George Orwell's 1984.

The latest psychological operation underway is to convince and reassure the U.S. public and English-language speaking world that General Electric is not responsible for what is happening in Japan; that U.S.-based G.E.-designed reactors elsewhere, being of the same age and design, are not going to have the same problems as reactors in Japan. The message is also that the Nuclear Regulatory Commission runs a tight ship, that oversight is comprehensive and thorough, people are doing their jobs, and that the nuclear industry in the U.S. is nothing like the secretive and bungling industry in Japan.

While the message is racist at its [nuclear] core, nothing could be further from the truth. It can happen here. San Onofre. Diablo Canyon. Vermont Yankee. There have been all kinds of warning signs. It won't be a tsunami, on the back of an earthquake, or maybe it will. It will be a BLACKOUT scenario of some kind, as it is in Japan.

In the Congressional Hearing, Senator Barbara Boxer was suddenly awake, and suddenly concerned, and suddenly the U.S. Congress is going to straighten this all out and protect us. The U.S. Senate Hearings began with some grandstanding by U.S. Senator Barbara Boxer (D-CA), whose jabs were directed at Republicans, but in the end she asked a few questions.

The next speaker, Senator James Inhofe (R-Okla) reads a garbage speech about how wonderful the NRC is and how safe are U.S. reactors. Our first and foremost concern is safety, he says, and we must continue to develop and site and license and operate new reactors world wide. "We've delayed for 30 years now. So I think that we certainly don't want to slow down, let's keep going."

The hearing was completely corporate, one Senate official citing recent New York Times stories that have suddenly awoken them (the Senators) to the many warnings that had previously occurred. *My God, we didn't know.* Meanwhile, the NRC Chairman testified that the NRC can not attribute a single death to the nuclear accident at Three Mile Island.

A few months ago, President Obama signed some 8.5 billion dollar loan guarantees for a nuclear reactor construction project for U.S. nuclear corporation Southern Company, in partnership with the Tokyo Electric Power Company (TEPCO).

Of course, the Price Andersen Act, passed in 1957, indemnifies nuclear utilities and reactor operators from all lawsuits, financial liability or related responsibility.

Everything suggests that it will be business as usual. Destabilization, destruction, war and catastrophe have always been turned into a big business for the United States of America. Across the ocean tens of thousands of people are protesting in Germany and France and Briton. Here, even the discussion is off course. The wrong questions are being asked and the wrong people are answering them. Instead of talking about limits to growth, the focus is on expansion, profits, trade and so-called progress. Why would this situation be any different? As Senator Barbara Boxer eventually said: we should be humbled.

Perhaps the worst horror of all is that people trapped in the contaminated zones are now

being shunned by outsiders, including aid organizations. Radiation fears, mingled with a sick sense of abandonment, reported the Los Angeles Times, as people are afraid to help them. People in the evacuation zones – elders and those without fuel or transport — are geting no help, and no information. We should be humbled.

Keith Harmon Snow *is a war correspondent, photographer and independent investigator, and a four time (2003, 2006, 2007, 2010) Project Censored award winner. He is also the 2009 Regent's Lecturer in Law & Society at the University of California Santa Barbara, recognized for over a decade of work, outside of academia, contesting official narratives on war crimes, crimes against humanity and genocide while also working as a genocide investigator for the United Nations and other bodies. From 1985 to 1989, he worked as Engineer, and then Manager, GE Aerospace Electronics Laboratories, Syracuse NY. He has three papers published in the journals of the Institute of Electrical and Electronics Engineers (IEEE).*

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