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## Internal Radioactive Emitters – Invisible, Tasteless, and Odorless

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Huge quantities of radioactive elements, more than anyone has been able or willing to measure, have been continuously released into the air and water since the multiple meltdowns at the Fukushima Daiichi Complex in Japan on and around March 11, 2011.

This accident is enormous in its medical implications. It will induce an epidemic of cancer the likes of which the world has only rarely experienced, as people inhale the radioactive elements, eat radioactive vegetables, rice & meat, and drink radioactive milk & teas.

As radiation from ocean contamination bio-accumulates up the food chain, radioactive fish will be caught thousands of miles from Japanese shores. As they are consumed, they will continue the cycle of contamination, proving that no matter where you are, all major nuclear accidents become local.

In 1986, a single meltdown and explosion at Chernobyl covered 40% of the European land mass with radioactive elements. Already, according to a 2010 report published by the New York Academy of Sciences, almost one million people have perished as a direct result of this catastrophe, yet this is just the tip of the iceberg.

There is confusion and misunderstanding in the media, and amongst politicians and the general public, about what nuclear accidents, particularly the accident at Fukushima, will mean medically.

It will be useful to explain how radiation induces disease and what sort of radioactive material is contained in a nuclear power plant.

### Fact number one

According to every version of the BIER study by the National Academy of Sciences, up to and including the most recent in 2007 – The Biological Effects of Ionizing Radiation No. V11 (BIER VII), no dose of radiation is safe. Each dose received by the body is cumulative and adds to the risk of developing malignancy or genetic disease.

### Fact number two

Children are ten to twenty times more vulnerable to the carcinogenic effects of radiation than adults. Fetuses are thousands of times more so. Immuno-compromised patients, and the elderly, are also extremely sensitive.

### Fact number three

Ionizing radiation from radioactive elements, including radiation emitted from X ray machines and CT scanners, damages living cells. This can result in cancer.

How? Simply speaking, there is a gene in every cell called the regulatory gene. It controls the rate of cell division. If this specific DNA sequence is hit by radiation the cell will either be killed or, alternatively, the regulatory gene can be bio-chemically altered. This is called a mutation. It is impossible to know if this damage has taken place in your body. The cell will sit silently for many years until one day, instead of dividing in a controlled fashion, by mitosis, to form two daughter cells, it begins to reproduce uncontrollably, producing trillions of cells. That is a cancer. A single mutation in a single gene can kill you. This process is accelerated in children.

#### Fact number four

The latent period of carcinogenesis.

The incubation time for leukemia is five to ten years, but for solid cancers (such as breast, lung, thyroid, bone, kidney, and brain) the incubation period ranges from 15 to 70 years. All types of cancer can be induced by radiation.

#### Fact number five

The reproductive cells in the body, the eggs and sperm, are even more important genetically than normal body cells. Each egg and sperm has only half the number of genes as those in a normal cell so that when they unite, a new normal cell is produced which goes on to form an embryo, then a fetus, then a fully formed baby. Every gene in an egg or sperm cell is precious because these genes control the characteristics of the new individual. Therefore, if normal genes are mutated by radiation the new baby could be born with a genetic disease, or will carry abnormal genes for diseases like cystic fibrosis and diabetes, or inborn errors of metabolism to be passed on to future offspring. There are over 2600 genetic diseases now described in the medical literature.

We all carry several hundred genes for genetic disease but unless we mate with someone carrying the same gene (such as cystic fibrosis) the disease will not become manifest. These abnormal genes have been formed over eons by background radiation in the environment.

As we increase the level of background radiation in our environment from medical procedures, X ray scanning machines at airports, or radioactive materials continually escaping from nuclear reactors and nuclear waste dumps, we will inevitably increase the incidence of cancer as well as the incidence of genetic disease in future generations. Mutated, or abnormal genes are passed down from generation to generation in perpetuity.

#### Fact number six

There are basically five types of ionizing radiation:

1. X rays (usually electrically generated), which are non-particulate, and only affect you the instant they pass through your body. You do not become radioactive but your genes may be mutated.
2. Gamma rays, similar to X rays, emitted by radioactive materials generated in nuclear reactors and from some naturally occurring radioactive elements in the soil.
3. Alpha radiation, which is particulate, and composed of 2 protons and 2 neutrons, emitted from uranium atoms and from other dangerous elements generated in reactors (such as plutonium, americium, curium, einsteinium, etc- all known as alpha emitters). Alpha particles travel a very short distance in the human body. They cannot even penetrate the layers of dead skin in the epidermis to damage living skin cells. But, if these radioactive elements get into the lung or the liver, bone or other organs, they transfer a large dose of radiation over a long period of time to a very small volume of cells. Most of these cells are killed, but some on the edge of the tiny radiation field will survive. Their genes will be mutated, and cancer may later develop. Alpha emitters are among the most carcinogenic materials known in medicine.
4. Beta radiation, like alpha also particulate, is a charged electron emitted from radioactive elements such as strontium 90, cesium 137, iodine 131 etc. The beta is light in mass, it travels further than an alpha particle but does the same thing, mutates genes.
5. Neutron radiation is released during the fission process in a reactor or a bomb. Reactor #1 at Fukushima is still periodically emitting neutron radiation as sections of the molten core become intermittently critical. Neutrons

are large radioactive particles that travel many kilometers, and they pass through everything including concrete, steel etc. There is no way to hide from them and they are extremely mutagenic.

So, let's describe just four of the radioactive elements that are continually being released into the air and water at Fukushima. Remember, though, there are over 100 such elements each with its own characteristics and pathways in the human body. All are invisible, tasteless and odorless.

**Cesium 137** is a beta and gamma emitter with a half-life of 30 years. That means in 30 years only half of its radioactive energy has decayed, another 30 years to decay again to half, so it is detectable as a radioactive hazard for some 600 years. For the first 300 years (the standard 10 times the half-life calculation) the levels remain of regulatory concern, but for 300 more years the radiation is still detectable. As there is no safe dose, these levels are still significant and still a hazard. When it lands on the soil it bio-concentrates in grass, fruit and vegetables to many times background levels. It then bio-concentrates tens to thousands of times more, in meat and milk, as animals eat the fruit and vegetation. It concentrates the highest in the human body, the top of the food chain. It is very worrying that it is not, in fact, the adult human body, but that of the newborn infant, which is at the very top of this chain. Because cesium resembles potassium, which is ubiquitous in every cell in our body, it tends to concentrate most highly in brain, muscle, ovary and testicles. There it can cause brain cancer, muscle cancers (rhabdomyosarcomas), ovarian or testicular cancer and, most importantly, mutate genes in the eggs and sperm to cause genetic diseases in future generations.

**Strontium 90** is a high-energy beta emitter, half-life 28 years, detectably radioactive for 600 years. As a calcium analogue, it is known as a bone-seeker. It concentrates in the food chain, specifically milk (including breast milk), and is laid down in bones and teeth in the human body, where it can irradiate a bone forming cell, or osteoblast, causing bone cancer; or mutate a white blood cell in the bone marrow which can initiate leukemia, a cancer of the white blood cells.

**Radioactive iodine 131** is a beta and gamma emitter with a half-life of 8 days, so it is a hazard for twenty weeks. It bio-concentrates in the food chain, in vegetables and milk, and specifically concentrates in the human thyroid gland where it is a potent carcinogen inducing thyroid disease and thyroid cancer.

**Plutonium**, one of the most deadly, is an alpha emitter. So toxic that one millionth of a gram will induce cancer if inhaled into the lung. It is transported from the lung by white blood cells, then laid down in thoracic lymph nodes where it can induce Hodgkins disease or lymphoma. Because it is an iron analogue it combines with the iron transporting protein transferrin and concentrates in the liver, a cause of liver cancer; the bone marrow in the hemoglobin molecule, a cause of bone cancer, leukemia, or multiple myeloma. It concentrates in the testicles and ovaries where it can induce testicular or ovarian cancer, and/or mutate genes to induce genetic disease in future generations. It is one of the few toxic substances that can cross the placental barrier which protects the embryo. Once lodged within the embryo, the alpha particle could kill a cell that would form the left side of the brain, or the right arm- like thalidomide, the morning sickness drug, did years ago.

The half-life of plutonium is 24,400 years, so it can cause harm for 500,000 years; inducing cancers, congenital deformities, and genetic diseases for the rest of time. Not only in humans, but in all life forms.

Plutonium is also fuel for atomic bombs. Five to ten pounds will fuel a weapon which would vaporize a city. Each reactor makes 500 pounds of plutonium a year. It is postulated that one pound of plutonium, if adequately distributed, could kill every person on earth from cancer.

#### Fact number seven

In summary, the radioactive contamination and fallout from nuclear power plant accidents will have medical ramifications that will never cease. It will affect future generations, in human terms, forever; inducing epidemics of cancer, leukemia and genetic disease.

A future post will address the medical effects of leaking radioactive waste, which will contaminate the environment for the rest of time.

## Last thoughts:

This is a pivotal time in human history. We watch radiation slowly blanket Japan, a country with 4 reactors in trouble, in the midst of the worst industrial accident in history, facing an uncertain future of terrible health effects, and catastrophic environmental damage. We watch, helpless, as Fukushima fallout traverses the Northern Hemisphere, turning up in milk, food, and water; on tourists in airports; and products in shipping bays around the world. We are seeing, and understanding, that all fallout is local.

There is a reactor in the U.S. in the middle of the flooding Missouri River and another just downstream, also in danger should major dams fail. Wildfires recently raged within 2 miles of the Los Alamos National Labs grounds, a storage place for high and low level nuclear waste from the Cold War, an area where miles and miles of burning land is contaminated by legacy fallout from atomic testing. Similar wildfires raged over contaminated land in Russia last summer. With aging nuclear reactors and weapons becoming both more volatile, and more vulnerable, it is time to ask again, this time more forcefully: what is peaceful about nuclear power?

We are staring global warming in the face. Water shortage, famine, rising temperatures, wild weather, and climate refugees in numbers unseen in history are staring back at us.

You can't stare down climate change as the nuclear industry would like to, instead we need to power down our old, wasteful and expensive, dangerous sources of energy and start plugging in to a renewable, sustainable, energy future. We have the money, we have the technology, and we have the time- just barely. If politicians lack the political will, then now is the time for the will of the people to speak louder. There is no other world suitable for life. We either change, or we see the end of this world as we know it.

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