

What we sacrifice for nuclear technology

Cindy Folkers, May 2021

The historical through line of the nuclear industry is one of sacrifice — sacrifice of lives and lands; and reliable, robust science. Throughout our nuclear history, research institutions and regulatory authorities have devalued the health of women, children and pregnancy, in service of maintaining and expanding nuclear technology. This practice continues and is documented in my most [recent paper](#): “Disproportionate Impacts of Radiation Exposure on Women, Children, and Pregnancy: Taking Back our Narrative” published online in the *Journal of the History of Biology*.

Women, children and pregnancy are less resistant to radiation damage than the adult male. Yet, “Reference Man” is still maintained by most countries as the basis for radiation exposure standards. “[Reference Man](#) is a nuclear industry worker 20-30 years of age, [who] weighs 70 kg (154 pounds), is 170 cm (67 inches) tall...is a Caucasian and is a Western European or North American in habitat and custom.”

This matters because society is now making crucial and long-lasting decisions about the energy sources we might use to address the climate crisis. The serious consideration of nuclear power as one of these sources needs to be informed by a research and policy focus on radiation’s disproportionate impacts.

The history of disproportionate impacts, suspected and disregarded

Early in the nuclear weapons age, researchers (Alice Stewart, Liane Russell, and Nobel Prize recipient Hermann Muller among them) suspected that children and pregnancy might be more susceptible to radiation exposure than the adult males who were the focus of radiation protection in the 1940s and ‘50s; and that radiation damage might be heritable.

While publicly condemning research indicating disproportionate impacts, [weaponeers](#) (a person who designs, uses or maintains weapons, especially nuclear weapons) instituted a world-wide, covert program to snatch the body parts of dead babies and conducted secret, harmful, and gruesome experiments to “explore this susceptibility, and to determine what doses had *observable impacts (emphasis added)*.”

This suggests that if there were health impacts that were unable to be observed immediately, but present and ultimately damaging, they could escape consideration. Fast forward and we see a similar focus on “catastrophic” health impacts from large nuclear disasters like Three Mile Island, Chernobyl and Fukushima, rather than a focus on longer term, compounding health damage that can take decades or generations to manifest.

While there was early recognition that there were disproportionate impacts and that even low doses could cause genetic damage, regulators and nuclear technology’s supporters concluded that the industry could not survive unless it was allowed to pose risk to workers and the public. They made an early official decision that non-health components (such as economic benefit) would need to be factored into exposure assessment, in order to quell criticism, and demonstrate to the public that continuing the industry was worth it.

The recognition of the need for a “Standard Child” (rather than “Standard Man” — later dubbed Reference Man), was briefly considered in 1960 by the Federal Radiation Council (later subsumed into EPA). This provided hope that regulators would account for at least *some* disproportionate impacts in radiation exposure regulations. Hopes dashed, Standard Child was not mentioned again in follow-up reports, and was never officially implemented.

Instead, Reference Man became the official universal standard for radiation exposure and damage. He was accompanied by the concept of an “*acceptable* injury limit,” now called “allowable exposure—” in other words, a sacrifice. As more research revealed the true damage to children and pregnancy, especially of lower doses, scientists responsible for that research were berated and suffered career setbacks. Research showing harm from low doses was, and remains, a particular danger, since it jeopardizes the currently operating regulatory structure that depends on having an “acceptable injury limit.”

The U.S. Government and nuclear industry enthusiasts chose to ignore the ubiquitous radioactive pollution being released to our environment from nuclear bombs, nuclear power facilities, uranium mining, and other related operations, and the damage these compounding releases might pose to future generations. Even decades later, everyone is still exposed to cesium 137 from the atomic bomb tests and additionally from civilian nuclear routine releases and catastrophes. With a hazardous life of 10-20 times its half life of approximately 30 years, The U.S. Environmental Protection Agency recognizes that cesium 137 is “impossible to avoid” (USEPA 2011). Studies have also found radiostrontium and plutonium in children’s teeth (Mangano 2006; Barnett 2003)

Sacrifice continues

Decades of research indicate that disproportionate impacts should necessitate enhanced radiation protection for some. Yet little has changed. Even the most protective standards in the U.S. continue to average men with those less resistant to radiation damage, when calculating cancer risk. Protections for non-cancer and pregnancy impacts are mostly considered unnecessary with the exception of certain special cases such as protecting pregnancy from x-rays.

Worldwide, the governments, global institutions, and industries that have favored the nuclear industry since its inception, continue to politicize and obscure research (and researchers) that finds evidence supporting disproportionate impacts. Advocates of these institutions and the structures they have established, continue to use uncertainties in radiation science to sow doubt, rather than either exercise precaution or direct funding to applicable research questions that could help clarify the uncertainties.

When studies do indicate an impact from radiation exposure, researchers within these structures don’t believe the effect is genuine, even if it is their own data indicating so. They then begin giving a list of unproven causes as scapegoats for radioactivity including viruses, population mixing, sampling bias, etc. Yet, in the end, the most likely culprit is still radioactivity.

Ultimately, this leads to poorly conducted radiation science and an incomplete accounting of radiation’s impacts on human and non-human animal health and the environment. This maintains the chasm between what is considered an “allowable exposure” and *actual* health detriment for women and children — a chasm that is wide, slow to change, and extends for generations. Women, children and pregnancy pay the greatest price in health outcomes. For underserved or marginalized communities, this impact is even greater.

Even when the dangers to pregnancy are known, exposure recommendations fail to account fully for several significant processes, including damage to the placenta, formation of stem cells, and blood and organ forming tissues. As in the early U.S. reports, these shortcomings are often recognized by those issuing the recommendations, but excuses are offered in place of action.

Studies indicate both cancer and non-cancer health impacts result from even very low doses of radiation. We see increases in childhood cancers, including thyroid, leukemia, reproductive, and central nervous system cancer, in areas with higher background radiation (both natural and

man-made). Studies indicate that living in environments of elevated radiation will increase mutations and disease; that inhaled and ingested radionuclides pose unique and increased risks that are very poorly represented; that the ability to withstand radiation doses appears to diminish as continually-exposed generations progress; and that doses from catastrophic releases should be accounted for across generations, not just in the generation initially exposed.

Through silencing and shaming, science suffers

The silencing and shaming of concerned voices helps to obscure research on disproportionate impacts even further. Women are often the ones who raise the alarm about radiation contamination, particularly with regard to their children's safety. The pushback for raising this issue can be severe, from social shaming to ostracizing, to accusations of mental illness, one of which is the concept of so-called radiophobia.

"Radiophobia" has had a number of labels over the decades such as "nuclear neurosis" (above-ground bomb tests), "Chernobyl syndrome", and "radiation brain mom"(Fukushima). But they are all defined as unnecessary fear of radiation; and this fear is often blamed for health impacts rather than exposure to radioactivity itself. This ignores the fact that some of the symptoms of "radiophobia" mirror symptoms of radiation exposure.

These labels have been used as a way of targeting and silencing women to keep them from sharing their lived experiences and observations, particularly regarding health impacts. And while the illegitimate use of these "radiophobia" labels is often obvious, related methods and concepts have popped up to keep doubters silent — particularly those whose voices have been marginalized already.

Concepts such as "resilience" and "reputational damage" focus on recovering from a nuclear disaster. They try to sell living in contamination as "normal" — even getting women to feed their children contaminated food — all while discouraging health questions and failing to address continuing health detriments.

This silencing seeps into the structures of scientific research leading to nonsense claims. One such contends that merely studying health impacts can cause "worry" among those exposed — a circumstance to be avoided. This is clearly ridiculous since many women *want* to know the health condition of their children; but it is convenient for industry and governments who don't want to have the true health consequence of radioactive contamination revealed to the public in an official capacity.

All of these techniques warp radiation science by fostering disregard of questions designed to investigate the disproportionate impacts of living continuously in low radiation doses.

Framing the scientific questions of radiation exposure in mostly psychological terms, leaves out even health impacts that might otherwise be obviously related to radiation. This cuts off opportunity for many researchers to study health detriment as a radiological exposure event impacting physiology, biology, and genetics.

It also serves to create an early narrative of "no, or insignificant, health impacts" from radiation, as does consideration only of immediate, catastrophic health impacts. This is a false narrative as later research indicates — but once this narrative is established, it is difficult to correct.

Correcting the narrative

“... [P]rotecting those most susceptible to radiation will heighten protection for everyone. As manmade radioactivity continues to contaminate the environment, an increasingly radiosensitive population could likely suffer increased rates of disease.”

Regulators need to treat radioactivity as any other pollutant, by making allowable risks equivalent between radiation and other toxins, and including risks from non-cancer and pregnancy impacts.

International bodies such as the United Nations Office of the High Commissioner on Human Rights should continue their persistence in the questioning and revelation of the impact of radioactivity and catastrophic nuclear releases on women and children.

Countries need to fund independent research that uses actual biological data, rather than risk models and reconstructed doses that are mostly *assumed* to be correct instead of being measured. This would clarify the uncertainties that have, to date, allowed regulatory agencies to disregard disproportionate impacts and claim low radiation doses are less risky than the robust science and lived experience indicates.