Environmental Defense Institute

News on Environmental Health and Safety Issues

July 2014 **Volume 25 Number 7**

Why You Shouldn't Rely on the Nuclear Industry for Straight Answers about Radiation Health Risks

Despite Compelling Human Evidence That There Is No Threshold The "Linear No-Threshold" Debate Continues

You might have thought that by now, after millions of dollars spent every year since the 1940s to study radiation health effects, that there would be no doubt that ionizing radiation, even at low doses, involves risks to health, including increased likelihood of cancers, leukemia and genetic effects. Prominent scientific bodies have concluded, repeatedly, that there is no threshold: even a low dose causes some increased risk, and higher doses cause more risk.[1] [2]A single photon or a single high-speed particle can cause unrepairable damage to our cells, including genetic damage. Despite this, among nuclear industry promoters, and their pet researchers and educators, hope springs eternal for that elusive threshold of radiation dose that does not cause harm.[3]

The debate about "linear no-threshold" low dose radiation modeling is raised by nuclear promoters who think that the existing regulations that use the linear no-threshold model are too restrictive. While nobody thinks the "linear no-threshold" model represents all the complexity of radiation effects, these nuclear promoters keep repeating the myth that radiation causes no harm below 5 or 10 rem whole body doses. See Health Physics department university websites[4] for an alarming amount of misinformation that ignores much of the evidence of harm by radiation. Much of this human evidence came from well-intended medical diagnostic use of x-rays and is documented, but ignored by these nuclear promoters.

---

[1] BEIR 1990 (see BEIR 1980), *Health Effects of Exposure to Low Levels of Ionizing Radiation*." 421 pages. ISBN 0-309-03995-9. National Academy of Sciences, Washington DC.

[2] UNSCEAR 1993 (see UNSCEAR 1988), *Sources and Effects of Ionizing Radiation: Report to the General Assembly with Scientific Annexes*. 922 pages (no index). ISBN 92-1-142200-0.

[3] "Radiation Standards – Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues," GAO/RCED-00-152, June 30, 2000. http://www.gao.gov/products/GAO/RCED-00-152

[4] Taylor, Lauriston, S., "What You Need to Know About Radiation," 1996. http://www.physics.isu.edu/radinf/lstintro.htm

Key Studies of Humans Exposed to Low Dose Radiation Prove That There Is No Threshold

Nuclear proponents of the existence of a threshold are ignoring the epidemiological findings of excess cancers in independent and diverse studies. Important summaries of key low dose external radiation studies are provided by John W. Gofman, M.D., Ph.D., and by Wolfgang Kohnlein, Ph.D. and Rudi H. Nussbaum, Ph.D.[5] [6]

Nuclear promoters express that their views are "scientific" and "reliable" and that anyone who thinks differently has an irrational case of radio-phobia and is uninformed of the actual risks of radiation. The risk of cancer from radiation exposure doses, as presented by the industry, does make the risk of cancer appear relatively small in many cases — the problem is that these predictions are based on biased studies and the risks are higher than the widely accepted International Commission on Radiological Protection (ICRP)[7] model predicts, at least by a factor of 100.

DOE's Low Dose Radiation Research Program Unable to Raise Allowable Doses

The DOE Low Dose Radiation Research Program conducted research from 1998 until completely defunded in 2011. The low dose program emphasized only the positive effects of radiation, emphasizing any finding of cell repair and laboratory cell studies showing hormesis (beneficial effects of radiation), but kept quiet about the negative effects of radiation. The research largely focused on external radiation, leaving aside the unique problems of internal radiation where the biological retention and distribution of radionuclides greatly impacts the health effects.

The Low Dose Research Program website,[8] a brief summary of DOE's low dose program[9] and a detailed draft report[10] by the program's lead scientist, Antone Brooks can be found online. At a

---

[5] Gofman, John W., M.D., Ph.D., "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis, 1990, Committee for Nuclear Responsibility, Inc., http://www.ratical.org/radiation/CNR/RIC/chp21.txt

[6] Kohnlein,W, PhD., and Nussbaum, R. H., Ph.D., "False Alarm or Public Health Hazard?: Chronic Low-Dose External Radiation Exposure, Medicine & Global Survival, January 1998, Vol. 5, No. 1. http://www.ippnw.org/pdf/mgs/5-1-kohnlein-nussbaum.pdf

[7] International Commission on Radiological Protection, "Compendium of Dose Coefficients Based on ICRP Publication 60," ICRP Publication 119, Volume 41 Supplement 1 2012.

[8] Department of Energy's Low Dose Research Program website: http://lowdose.energy.gov/timeline.aspx

[9] US Low Dose Radiation Research Program – Slide presentation by N. F. Metting, 2010. http://www.iscors.org/doc/Public-Meeting_11-09-10/Low%20Dose%20Update-ISCORS2010.pdf

[10] Brooks, Antone L., A History of the United States Department of Energy (DOE) Low Dose Radiation Research Program: 1998-2008, September 2012. http://lowdose.energy.gov/pdf/albRoughDraft/doeHistoryComplete09262012.pdf

2002 workshop "Cancer Risk Assessment: Should new Science be Applied?,[11] presentations on the DOE Low Dose programs cellular research met with this response, as summarized on DOE's own website: "the new data was interesting but not sufficiently well developed to impact current risk estimates or regulations."

The unwelcome insight from the DOE's Low Dose research program seems to be that they can't just study radiation effects in animals and cell cultures — that they need human epidemiologic evidence. But, few people know DOE's history of concealing unfavorable epidemiology results in the past. DOE's misbehavior resulted in congressional hearings and a special panel convened by former Energy Secretary Wakins, ending DOE's direct control of epidemiologic studies.[12] [13]

In trying to find a threshold dose of radiation, the DOE's Low Dose Radiation Research program was heartened by conclusions reached by Maurice Tubiana who led the French Academy of Science to the conclusion that the risks per unit of dose are less at low doses than at high doses, suggesting that repair or protective effects at low doses argue against the Linear No-Threshold Hypothesis.[14] Another article with Tubiana as lead author "The Linear No-Threshold Relationship Is Inconsistent with Radiation Biologic and Experimental Data" from 2009 concludes that "the concept of a practical threshold for carcinogenesis is plausible" but it does so only by throwing out strong existing human epidemiologic evidence to the contrary.[15]

Dr. Alice Stewart's Study of Children In Utero Cannot Be Thrown Out

Tubiana and others are incorrect when they say Dr. Alice Stewart's 1956 Oxford survey was wrong. The exposures in Stewart's study were less than one track per nucleus—and doses don't get lower than that. The Oxford study results showing that x-rays to children in utero increased the likelihood of death by childhood cancer and leukemia was controversial for years[16] [17] [18]

---

[11] Conference: Cancer Risk Assessment: Should New Science Be Applied? Arlington, VA July 17-19, 2002. OAK-B135 publication by Bull, Richard J., and Brooks, Antone L., December 15, 2002. http://www.osti.gov/scitech/servlets/purl/820795

[12] Geiger, H. J., "Dead Reckoning – A Critical Review of the Department of Energy's Epidemiologic Research," Physicians for Social Responsibility, 1992.

[13] Wing, S., "A Critical Review of the Department of Energy Efforts to Investigate the Human Health Effects of Plutonium," 1992. *rmpjc.org/wp-content/uploads/2012/02/Wing-Pu.doc*

[14] Tubiana M. Dose-effect relationship and estimation of the carcinogenic effects of low doses of ionizing radiation: the joint report of the Academie des Sciences (Paris) and of the Academie Nationale de Medecine. Int J Radiat Oncol Biol Phys 2005;63:317-9. http://www.ncbi.nlm.nih.gov/pubmed/16168825

[15] Tubiana, M., MD, Feinendegen, L. E., MD, Yang, C., MD, Kaminski, J. M., MD, "The Linear No-Threshold Relationship Is Inconsistent with Radiation Biologic and Experimental Data, *Radiology*: Volume 251: Number 1, April 2009. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2663584/

[16] Stewart, Alice M., et al, "Preliminary Communication: Malignant Disease in Childhood and Diagnostic Irradiation In-Utero," *Lancet* 2: 447. 1956.

[17] Stewart, Alice M. et al, "A Survey of Childhood Malignancies," *British Medical Journal* 2: 1495-1508. 1958.

because neither the nuclear industry nor the medical industry wanted to accept her findings. But several subsequent studies verified her results. In the study by Elizabeth Harvey,[19] twins had been x-rayed in utero, not because the mother was sick, but as precautionary measure because of the anticipated difficulty of giving birth to twins. Those twins that were x-rayed in utero had an increased likelihood of childhood deaths from cancer and leukemia, just like the babies x-rayed in utero with doses often less than 500 mrem [20] as Stewart found. Diagnostic x-rays gave higher doses decades ago than now. Currently, doses might be approximately 70 mrem for a dental x-ray, 14 mrem for a chest x-ray), and 2 to 10 rem for CT scans. [21]

The Tubiana article suggests that maybe the women had x-rays because they were less healthy and that's why their babies had a higher risk of cancer. The study of twins by Harvey should have put this excuse to rest. Tubiana notes that mothers with high socioeconomic status were found to be associated with an increased risk of childhood cancer, but they seem to rule out the possibility that this may be due to the increased use of medical x-rays. Another book by Gofman details the increased cancers caused by diagnostic x-rays.[22]

More discussion of the many flaws in the article by Tubiana and others can be found in the same journal volume by Mark Little and Richard Wakeford,[23] yes, pro-nuclear industry and anti-Chris Busby Richard Wakeford. Little and Wakeford also describe the medical use of x-rays that has provided strong human epidemiologic evidence of the harm of low dose radiation in causing breast cancer and thyroid cancer.

Worker 5 Rem per Year Permissible Limit is Not Protective

Comparisons of doses to the DOE and NRC annual dose limit of 5 rem for workers are misleading. First of all, the 5 rem/yr dose is not protective of workers although in comparisons it is made to appear as a harmless dose. The permissible dose to the public from routine emissions of 100 mrem annually is a health compromising dose and a huge impact for people exposed for multiple years. While comparisons imply that people could safely attain 5 rem doses each year, it

---

[18] Stewart, Alice M. and George W. Kneale, "Radiation Dose Effects in Relation to Obstetric X-Rays and Childhood Cancers," *Lancet* 1: 1185-1188. 1970.

[19] Harvey, Elizabeth B., John D. Boice Jr., Merton Honeyman, John T. Flannery, Feb. 28, 1985. "Prenatal X-Ray Exposure and Childhood Cancer in Twins," New England Journal of Med. 312 (No.9): 541-545.

[20] Gofman, John W., M.D., Ph.D. and Arthur R. Tamplin, Ph.D., "Poisoned Power – The Case Against Nuclear Power Plants Before and After Three Mile Island," Rodale Press, 1979.

[21] US Low Dose Radiation Research Program – Slide presentation by N. F. Metting, 2010. p. 29, 30. http://www.iscors.org/doc/Public-Meeting_11-09-10/Low%20Dose%20Update-ISCORS2010.pdf

[22] Gofman, John W., M.D., Ph.D., "Preventing Breast Cancer: The Story of a Major, Proven, Preventable Cause of This Disease," Committee for Nuclear Responsibility, Inc., Second Edition, 1996.

[23] Little, M. P., DPhil, Wakeford, R. Ph.D, Tawn, E. J., Ph.D, Bouffler, S. D., PhD, de Gonzalez, A. B., DPhil, "Risks Associated with Low Doses and Low Dose Rates of Ionizing Radiation: Why Linearity May Be (Almost) the Best We Can Do," *Radiology*: Volume 251: Number 1, April 2009. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2663578/

is known that such doses would greatly increase cancer and other health risks. Therefore, the industry has applied various limits to radiation workers such as a limit on the cumulative dose in any 10 year period and the lifetime cumulative dose a worker may receive. The lifetime average dose is restricted to 1.5 rem/yr (1993 NCRP) or less than 10 rem (ICRP 1990).[24]

It is important to note that the **permissible** 5 rem annual whole body dose is not recognized as a **safe** dose and adverse health effects have been found for nuclear workers receiving doses far below 5 rem annually. It is natural to think that radiation permissible limits are "safe" levels of radiation, but that has never been the case. Post-1960 permissible limits were set with the knowledge that there was no safe dose; they stated that **it was hoped** that the benefits of the nuclear industry would outweigh the health risks. The permissible limits are set less on biological facts than on what appeared to be reasonable at the time in order to not hamper the nuclear industry.[25] [26]

It is also important to remember just how low the doses are in studies of nuclear workers that have found an increased risk of cancer and leukemia. Epidemiologic studies have found the increased risk of cancer in nuclear workers even though the cumulative doses were less than 2 rem and usually accumulated in less than 40 mrem increments.[27]

There Is Ample Evidence of Adverse Health Effects from Nuclear Power Plant Emissions

Is the 100 mrem dose to the public ever received? Yes. For example, around the US Dresden Boiling Water Reactor, the average public dose has at times been as high as one third of the 100 mrem annual limit.

But is there evidence of harmful health effects from these levels of emissions? Yes. In one example, Illinois public health cancer data collected by Joseph Sauer shows the increased rates of cancer near the Braidwood and Dresden nuclear reactors, increased by 18 percent near the plants. Sauer became interested in cancer effects from nuclear power plants after his daughter Sarah was diagnosed with brain cancer when she was seven. See the IEER article for details.[28] And it is also important to recognize that the annual permissible dose to the public does not apply to accident releases, only normal operation.

---

[24] Inkret, William C. et al., Protection Standards, Radiation and Risk—A Hard Look at the Data, Los Alamos Science Number 23, 1995.

[25] Gofman, John W., M.D., PhD. and Tamplin, Arthur, R., Ph.D., "Poisoned Power – The Case Against Nuclear Power Plants Before and After Three Mile Island," Rodale Press, 1979. p. 85.

[26] EPA-520/1-88-020, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion," Federal Guidance Report No. 11, September 1988. http://pbadupws.nrc.gov/docs/ML1015/ML101590171.pdf

[27] Little, M. P., DPhil, Wakeford, R. PhD, Tawn, E. J., PhD, Bouffler, S. D., PhD, de Gonzalez, A. B., DPhil, "Risks Associated with Low Doses and Low Dose Rates of Ionizing Radiation: Why Linearity May Be (Almost) the Best We Can Do," *Radiology*: Volume 251: Number 1, April 2009.

[28] Science for Democratic Action, An IEER Publication, Volume 17, No. 1, June 2013. http://ieer.org/wp/wp-content/uploads/2013/06/17-1.pdf

Studies around nuclear plants that mix children and adults and mix those living near the plants from those living far away do not detect health issues. But adequately designed studies such as the German KiKK studies show elevated childhood leukemia rates near nuclear plants.[29]

Genetic Effects of Radiation in Humans

In 1956, the World Health Organization warned: "Genetic heritage is the most precious property for human beings . . . we affirm that the health of future generations is threatened by increasing development of the atomic industry and sources of radiation." Helen Caldicott explains why the WHO has not issued forthright statements on radiation risks since. In 1959, the WHO granted the right of prior approval over any research it might report on to the International Atomic Energy Agency (IAEA), a group that is a strong advocate for the nuclear power industry.[30]

By 1927, H.J. Muller had established that ionizing radiation induced heritable mutations in the fruit fly.[31] Radiation worker training has long stated that while "radiation induced genetic effects had been observed in studies of fruit flies and animals," it was always emphasized that "no radiation induced genetic effects had been observed in humans."

While the nuclear industry continues to deny the genetic effects of radiation in humans, studies of the Chernobyl nuclear accident have included congenital trans-generational diseases, and studies of the population of Fallujah Iraq exposed to Uranium from weapons have shown high rates of congenital malformations at birth. [32] [33]

Unfortunately, when it comes to being informed about the health risks of radiation, neither radiation workers nor the public should be relying on the nuclear industry for straight answers.

Article by Tami Thatcher, former nuclear safety analyst at INL and a nuclear safety consultant

[29] P. Kaatsch et al., Leukemias in Young Children Living in the Vicinity of German Nuclear Power Plants, Int J Cancer 122, pp. 721-726, 2008. (Known at the KiKK study.)

[30] Helen Caldicott, MD, "Nuclear apologists play shoot the messenger on radiation," April 29, 2011. http://www.helencaldicott.com/2011/04/nuclear-apologists-play-shoot-the-messenger-on-radiation/

[31] Muller, H. J. (1928). "Artificial transmutation of the gene." Science, *66*, 84–87. Note, H.J. Muller wins the Nobel Prize for showing that radiation can induce heritable mutations in fruit flies (*Drosophila melanogaster*) in 1946.

[32] Busby, C., M. Hamdan and E. Ariabi, "Cancer, Infant Mortality and Birth Sex-Ratio in Fallujah, Iraq 2005-2009, Int. J. Environ. Res. Public Health 2010, www.mdpi.com/1660-4601/7/7/2828/pdf

[33] Busby, C., "Aspects of DNA Damage from Internal Radionuclides," *InTech*, 2013. http://www.intechopen.com/download/get/type/pdfs/id/44596

New federal lawsuit filed in INL plutonium accident

Nate Sunderland reports 6/12/14 in the Idaho Falls *Post Register*; "A new lawsuit was filed against Battelle Energy Alliance over the Nov. 8, 2011, exposure of 16 Idaho National Laboratory employees to plutonium. [34]

The latest legal complaint was brought by Jodi Stanton, the wife of former INL nuclear operator Ralph Stanton.

Stanton and fellow nuclear operator Brian Simmons were among those exposed and filed a whistle-blower complaint with the U.S. Department of Labor in April 2013 against the INL contractor. It alleges Battelle created an unsafe work environment and then retaliated against them after they raised health and safety concerns.

Another lawsuit, filed in federal court by Stanton and Simmons in August 2013, seeks videotape evidence of the accident, denied by the Department of Energy.

The new lawsuit, filed by Jodi Stanton in federal court Tuesday, alleges many of the same claims in the 2013 complaints, including that both men were exposed to plutonium due to inadequate safety practices.

It also includes claims about possible radioactivity within the Stanton home as a result of the accident. The complaint alleges INL withheld medical information or intentionally provided false information about Stanton's medical condition following the accident. The lawsuit seeks a jury trial and an undisclosed amount in damages.

Both the Stanton's and their attorney, Jack Sheridan, declined to comment on the latest lawsuit.

INL spokeswoman Nicole Stricker issued the following statement on behalf of the contractor: "INL's general counsel has not yet received this lawsuit and so the company cannot comment on its claims."

The November 2011 accident happened when INL workers opened a storage container with a plutonium fuel plate wrapped in plastic and tape. When workers tried to remove the wrapping, a plutonium powder spilled out exposing the surrounding workers to the radioactive element.

Reported June 12, 2014 By NATE SUNDERLAND nsunderland@postregister.com

[34] A copy of Jodi Stanton's lawsuit is available at ; http://environmental-defense-institute.org

Lessons from New Mexico

Those running the Idaho National Laboratory can learn from two accidents that took place at the WIPP facility in February. Article in the Idaho Falls Post Register July 1, 2014.

The Department of Energy's strategy of "start clean, stay clean" for 2150 ft. deep underground Waste Isolation Pilot Plant ended with the two preventable accidents last February. The New Mexico WIPP facility for disposal of nuclear weapons-related transuranic radioactive waste had been in operation for 15 years.

The two accident investigation reports, available at wipp.energy.gov,[35] put on display a very different picture of WIPP operations than Joe Franco, Carlsbad Field Office DOE Manager, had provided just one year ago at the INL Citizens Advisory Board meeting in Idaho Falls.

The first accident investigation described the poorly maintained salt truck that caused the underground fire.[36] With the difficulty of controlling the fire, one quarter of the underground phones non-functional and a paging system few people could hear, they were lucky no one was injured.

The report found inadequate fire hazard analysis, excess combustible materials, equipment out-of-service for extended periods of time, and inadequate worker training. Numerous warnings from past audit findings that could have prevented the accident were ignored. A survey had also identified a chilled work environment where reporting safety problems and non-compliances were discouraged as well as cumbersome.

Any of this sound familiar?

The second accident on February 14 which released americium and plutonium is still being investigated; however, structural problems initially suspected have been ruled out.[37] Of the more

[35] Department of Energy website for the Waste Isolation Pilot Plant, www.wipp.energy.gov. The accident investigation reports are located under "accident description" at http://www.wipp.energy.gov/wipprecovery/accident_desc.html

[36] US Department of Energy, Office of Environmental Management, Accident Investigation Report, "Underground Salt Haul Truck Fire at the Waste Isolation Pilot Plant February 5, 2014," March 2014 http://wipp.energy.gov/Special/AIB%20Report.pdf

[37] US Department of Energy, Office of Environmental Management, Accident Investigation Report,"Phase 1: Radiological Release Event at the Waste Isolation Pilot Plant on February 14, 2014" April 2014. http://wipp.energy.gov/Special/AIB_Final_WIPP_Rad_Release_Phase1_04_22_2014.pdf

than 171,000 waste containers stored,[38] it appears that a chemical reaction in one waste drum spread radioactive contamination throughout the underground mine and to the environment. The HEPA filtration system activated. Had the HEPA system not activated, doses to workers even above ground could have far exceeded regulatory 5 rem worker limits.

But this HEPA system had in recent years been deemed by DOE as unnecessary and not required to be operable. And leakage of unmonitored contamination upstream of the HEPA filters continued through two dampers until March 6.

In the past, WIPP's safety basis had received extensive scrutiny, more than any other DOE facility. But this did not stop the rapid unraveling of protective barriers with recent cost-saving safety basis changes. These unjustified changes along with various errors had all been reviewed and approved by DOE.

Bioassay of workers for contamination was initially and erroneously thought to be unnecessary. But, even performed days late found 21 above ground workers with internal contamination.[39] [40]

The DOE accident investigation concluded that WIPP had an ineffective safety basis program, ineffective radiological program, ineffective emergency management program and ineffective DOE oversight.

The INL needs to send more waste to WIPP; waste buried "temporarily" at INL from DOE's Rocky Flats Weapons plant.[41] But even more importantly, INL needs to prove that it takes

---

[38] Robert Alvarez, "The WIPP problem, and what it means for defense nuclear waste disposal," Bulletin of the Atomic Scientists, March 23, 2014. http://thebulletin.org/wipp-problem-and-what-it-means-defense-nuclear-waste-disposal7002

[39] Calculations sheets from the WIPP.Energy.gov website, "February 14th Contamination Release Consequence Assessment, Rev. 1, March 10, 2014. http://www.wipp.energy.gov/Special/Modeling%20Results.pdf The estimates posted by WIPP do not clarify the unfiltered release resulting from the leaking dampers. Nor do they correspond to the DOE accident investigation report discussion. The information is not complete enough to calculate what the release would have been without filters which theoretically were two stages, each 99.95 percent efficient. But, it would appear that the release could have been orders of magnitude higher than the estimated here as 10 mrem above ground near WIPP in these calculation sheets. Given the inadequate availability of constant air monitors at WIPP and their history of false alarms, and the many hours that elapsed before a radiological event was confirmed partly because of the difficulties of detecting alpha contamination, the worker doses could have been much, much higher.

[40] Note that doses from alpha internal contamination from inhalation are easily at least 100 times more damaging to health than the ICRP cancer risk coefficients predict according to problems acknowledged by former ICRP Scientific Secretary, Dr. Jack Valentin, regarding ICRP model results for internal radiation. (see Chris Busby http://www.llrc.org/fukushima/ecrradvice.htm and www.vimeo.com).

seriously lessons from the two WIPP accidents regarding the risks of inadequate safety analysis, inadequate fire protection and inadequate emergency onsite and offsite response.

This article was written by Tami Thatcher, a former nuclear safety analyst at INL and a nuclear safety consultant.

[41] Contact-handled TRU waste from Rocky Flats weapons facility is shipped to WIPP from INL's Advanced Mixed Waste Treatment Project. But remote-handled TRU waste, which can exceed 200 rem/hr at the container surface, is shipped to WIPP from INL's INTEC facility and is waste generated from both the Naval Nuclear Propulsion Program and the Department of Energy's Office of Nuclear Energy. Shipments of both INL contact-handled and remote-handled waste shipments to WIPP are needed to meet the 1995 Idaho Settlement Agreement milestone to ship transuranic waste out of Idaho by December 31, 2018. http://energy.gov/em/idaho-national-laboratory