

Environmental Defense Institute

News on Environmental Health and Safety Issues

December 2015

Volume 26 Number 10

EPA Strongly Disagrees with Petitions to Loosen NRC Radiation Protection Standards

The US Nuclear Regulatory Commission has accepted public comments regarding three petitions to eliminate the existing linear-no-threshold (LNT) model for radiation protection.^{1 2} The US Environmental Protection Agency has provided comment to the NRC stating that it strongly disagreed with the petitions to cease using LNT stating:

“Of all the agents demonstrated to be carcinogenic, the evidence for LNT is particularly strong for ionizing radiation. Within limitations imposed by statistical power, the available (and extensive) epidemiological data are broadly consistent with a linear dose-response for radiation cancer risk at moderate and low doses. Biophysical calculations and experiments demonstrate that a single track of ionizing radiation passing through a cell produces complex damage sites in DNA, unique to radiation, the repair of which is error-prone. Thus, no threshold for radiation-induced mutations is expected, and, indeed, none has been observed.”³

Like something out of an absurd fictional horror movie, the petitions to the NRC sought to increase worker dose limits to 10 rem per year, discard ALARA, raise allowable public doses to that of worker doses, and end the differential doses to pregnant women, embryos and fetuses, and children under 18 years of age. It all makes sense when you understand that in order to protect the nuclear industry, radiation protection standards need to be loosened in order to allow unfettered emission of radiation from its operations and waste disposal.

A recent epidemiology study that included a cohort of over 300,000 nuclear industry workers has found clear evidence of solid cancer risk increases despite the average exposure to workers being about 2 rem and the median exposure was just 410 millirem.⁴ Another study has found

¹ See public comments on NRC rulemaking actions <http://www.nrc.gov/public-involve/doc-comment.html>. See specifically [NRC-2015-0057](http://www.nrc.gov/public-involve/doc-comment.html) Linear No-Threshold Model and Standards for Protection Against Radiation.

² Karl Grossman, September 8, 2015, “Radiation is Good for You! and Other Tall Tales of the Nuclear Industry,” <http://www.counterpunch.org/2015/09/08/radiation-is-good-for-you-and-other-tall-tales-of-the-nuclear-industry/>

³ US EPA 2015 <http://www.regulations.gov/#!documentDetail;D=NRC-2015-0057-0436>

⁴ Richardson, David B., et al., “Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), *BMJ*, v. 351 (October 15, 2015), at <http://www.bmj.com/content/351/bmj.h5359> Richardson et al 2015

increasing leukemia risk from radiation exposure of radiation workers.⁵ These studies address only external radiation and do not address the risk of internal radiation or high- versus low-linear-energy-transfer (LET) radiation. Alpha radiation emits high-LET radiation. But clearly, defensible epidemiology does not support the loosening of radiation protection standards being sought by the petitioners.

Incorrectly interpreted epidemiology results have been cited by the petitioners for relaxing the radiation protection standards such as fewer cancers in radium dial workers. The reason for fewer cancers is that so many exposed workers died young from illnesses other than cancer.⁶

The NRC has provided no schedule for reaching any conclusion about whether to pursue rule changes in response to the petitions and no hint of its analysis of the petitions. Read more about why the NRC must deny these petitions in the detailed comments of the Institute for Energy and Environmental Research⁷ and Physicians for Social Responsibility.⁸

What Radiation Workers Need to Know But Aren't Being Told: Studies Are Finding Higher Cancer and Leukemia Risks from Low Doses

The “cold war” may be over; but the Department of Energy radiation workers are still expected to stay quiet about worker risks and excessive radiation exposures. The Department of Energy has yet to modernize its radiation dose limits which remain less protective in the US than in Europe. At a time when the EPA is questioning if it is time to update BEIR VII issued in 2006⁹ radiation workers may not appreciate how little has been done by the Department of Energy to address BEIR VII findings of increased vulnerability to radiation of the unborn, children, and females.^{10 11}

⁵ Klervi Leuraud, PhD, et al., “Ionizing radiation and risk of death from leukaemia and lymphoma in radiation monitored workers (INWORKS): an international cohort study,” *The Lancet*, July 2015.
<http://www.thelancet.com/journals/lanhae/article/PIIS2352-3026%2815%2900094-0/fulltext>

⁶ Christopher Busby, “Aspects of DNA Damage from Internal Radionuclides,” INTECH
<http://www.intechopen.com/books/new-research-directions-in-dna-repair/aspects-of-dna-damage-from-internal-radionuclides>

⁷ Arjun Makhijani, PhD. Comments of the Institute for Energy and Environmental Research to the NRC regarding radiation risk models and permissible maximum radiation exposures to the public and to workers, November 19, 2015. <http://ieer.org/resource/testimony/nrc-comments-radiation-risk-models/>

⁸ Physicians for Social Responsibility, Hormesis Comments, 2015 <http://www.psr.org/resources/hormesis-comments-to-nrc.html>

⁹ BEIR-VII “Health Risks from Exposure to low levels of Ionizing Radiation: BEIR VII – Phase 2.” National Research Council of the National Academies, 2006 at http://www.nap.edu/catalog.php?record_id=11340.

¹⁰ David Pawel, US EPA, “New Information on Radiogenic Cancer Risks Since BEIR VII, Is it time for BEIR VIII?”
ISCORS Meeting November 9, 2015, <http://www.iscors.org/doc/david-pawel-11-9-2015.pdf>

DOE contractors are often at fault for allowing situations that put radiation workers at risk because they cut back on monitoring equipment or took other shortcuts regarding work planning or safety equipment availability. And the same DOE contractors who can be fined for exceeding radiation dose limits oversee the dose assessment (including lung count and bioassay programs) and dose estimate analysis. They do everything they can to lower the estimated radiation dose especially if the dose was excessive.

Workers will get an annual summary of their total radiation dose. However, workers receiving an intake of radioactive material may never see the results of their lung counts or bioassay, let alone have them explained to them. Workers interested in seeing how their radiation dose was estimated must conduct a Freedom of Information Act request. Even then, their request may initially be denied for no legal reason, requiring them to go through the process of an appeal which requires meeting prescribed deadlines for communication and adds weeks to the process. But it's how the DOE plays the game of keeping how it arrived at its radiation dose estimate out of view. Once workers have the documents, it is no small task to read between the lines and understand what may have been done to bias the dose estimate.

Radiation dose estimates of inhaled or ingested material may require a technical analysis by a specialist. But even though methodologies seem prescriptive and are often complex, the analyst has tremendous leeway in making assumptions that lower the dose. And the methods do not assure any degree of consistency or accuracy. In fact, because the methods were not created in order to determine the dose of an actual human being but were intended to broadly estimate the dose to a large population. No attempt is made to describe the enormous uncertainties in an individual's radiation dose estimate or subsequent health risk.

Radiation dose estimates and subsequent predicted cancer rate increases do not include consideration of chemical exposures that often accompany radiation exposures in processes involving dissolved nuclear fuel or operating nuclear facilities. Chemicals such as solvents may weaken the blood-brain barrier or otherwise stress the body, increasing the assault on the human body. This point was brought up by the wife of a deceased radiation worker who learned it from a doctor after her husband died. Even when the chemical hazard is created by the radionuclide, as is the case with uranium, the chemical risk of cancer increase is ignored as the worker's radiation dose is evaluated.

EDI has submitted another appeal to obtain INL drinking water contamination data from the Department of Energy. Our initial Freedom of Information Act request was denied and our appeal denied because DOE tried, after all and succeeded in finding some drinking water data. The problem is that the last twenty years of radionuclide drinking water data isn't publically available. INL drinking water plans require the collection of this data, so the data exists — it just isn't available to the public in its entirety. An appeal to the Office of Government Information Services is pending.¹²

¹¹ Arjun Makhijani, Brice Smith, and Michael C. Thorne, *Science for the Vulnerable: Setting Radiation and Multiple Exposure Environmental Health Standards to Protect Those Most at Risk*. IEER.org at <http://ieer.org/resouce/reports/science-bulnurable-setting-radiation>

¹² Letter from Environmental Defense Institute to Office of Government Information Services, Subject: Freedom of Information Act Request for NON-PUBLICALLY Available Radionuclide INL Drinking Water Contamination

Drinking water at INL was documented more comprehensively for a few years from the late 1980s to 1995, but prior to the late 1980s, there is likely more data available than have been reported. In any event, in order to perform adequate dose reconstruction and to understand the simultaneous chemical exposures from INL drinking water, an analysis will ultimately need to be conducted to forensically estimate the contamination in the drinking water for each year, as derived from later years of monitoring, knowledge of when contaminants entered the aquifer and plume migration assessment. Without such an analysis, NIOSH dose reconstruction and epidemiology is incomplete.

Former INL workers having children with birth defects and subsequently obtaining medical advice as to their genetic predisposition to have children with birth defects did not have and still do not have any information pertaining to their ingestion of chemical and radionuclide contaminants in the water they were drinking at INL. For highlights of contamination in INL drinking water, see our report *The Hidden Truth About INL Drinking Water*.¹³

At INL in-house medical experts see and hear no evil who usually do not see the whole picture of log books, lung counts, nasal swabs, and bioassay. And when INL hired an outside a so-called “doctor” to explain the ramifications of the internal dose that workers received in a mishap, this researcher who was not a medical doctor gave consoling platitudes about how the doses were of no consequence. Yet he has since admitted that he in fact never examined any evidence pertaining to the measurement and estimate of the workers’ doses.

The gaming to lower to recorded doses has additional health disadvantages to workers including no warning being given as to the increased risk of birth defects, the increased damage of any medical radiation exposure because dose and harm are cumulative, the extra harm from medical radiation when your body contains uranium or plutonium, and the inability to provide to your medical practitioner information about your actual realistic radiation history from both external and internal radiation.

The tumor promotion and genotoxicity of uranium internal contamination continues to be studied and it is unclear exactly what portion of the oxidative damage important to tumor promotion and depleted-uranium-induced cellular damage is due to radiation versus chemical processes. The DOE continues to treat depleted uranium as “not a significant radiation hazard” because of its low specific activity despite research and epidemiology showing severe adverse health effects from depleted uranium.¹⁴ Inhalation or ingestion of uranium is not nearly as benign as the DOE and its contractors would have workers believe.

If a worker later gets one of the covered cancers and applies for Energy Employee Illness Compensation under EEOCIPA, the workers radiation dose may need to be reconstructed. Or the

Levels for the Last 20 Years, November 13, 2015. <http://environmental-defense-institute.org/publications/NovemberAppealRev2.pdf>

¹³ Environmental Defense Institute report by Tami Thatcher, *The Hidden Truth About INL Drinking Water*, June 2015, <http://environmental-defense-institute.org/publications/INLdrinkwaterR1.pdf>

¹⁴ Alexandra C. Miller et al., “Depleted uranium-catalyzed oxidative DNA damage: absence of significant alpha particle decay,” *Elsevier J of Biochem* 91 (2002) 246-252. <http://pbadupws.nrc.gov/docs/ML0529/ML052910315.pdf> (This is just one example of the research that shows the harm from depleted uranium is underrepresented by conventional ICRP dose and cancer rates estimation.)

specific facility or task may need to be known and years worked, in order to qualify for a special cohort that was likely to have been overexposed.

In the past, NIOSH dose reconstruction has not always been provided complete and accurate worker records for various reasons which would lead to the dose reconstruction underestimating the claimants dose. At Rocky Flats, one witness recounts having been required to destroy radiation dose records.^{15 16 17 18}

My advice to current radiation workers: Don't rely on DOE's radiation protection program to protect you or your unborn children. DOE isn't tracking birth mortality and birth defects or performing the needed epidemiology and it is not because these effects have not happened or are not happening.

To help reconstruct your radiation dose following illness that might be compensated, keep track of the facilities and buildings you perform radiation work with significant dose or internal contamination potential and the type of radiation hazard. Keep track of lung count results and dates taken, and bioassay results. You and your family don't want to have to track down this information years later when you are fighting cancer.

The DOE has a habit of actively ignoring the science if it would cause a higher dose to be calculated. For example, DOE does not require and DOE contractors therefore rarely use the highly insoluble "Super S" class for plutonium which causes the material to be retained longer in the lungs than S or M class. A NIOSH report discusses "Super S" and the fact that it's not just applicable to plutonium that has been in a building fire as was the case sometimes at Rocky Flats. Super S class has been found applicable for plutonium oxide build-up at room temperature.¹⁹

Workers doses for plutonium from the WIPP accident probably don't know that they ought to question what solubility class was assumed in estimating their dose — a factor of 10 increase means ten times the estimated cancer risk. And the official estimated cancer risk for internal emitters may be an underestimate. Known discrepancies in lung clearance times from the models they use exist as autopsies have found more plutonium in lungs than models predicted. It is unclear just how individual lung clearance rate matter as well as the form of the plutonium inhaled. And lung clearance rates are individual. The degree of conservatism in results of the dose estimate is variable and without seeing the assumptions made, a worker has no idea whether the dose estimates are rather conservative or actually not conservative at all.

¹⁵ NIOSH Radiation dose reconstruction at <http://www.cdc.gov/niosh/ocas/> and <http://www.cdc.gov/niosh/ocas/ineel.html>

¹⁶ The NIOSH Advisory Board and Public meetings for July 2015 at <http://www.cdc.gov/niosh/ocas/pubmtgs.html>

¹⁷ See meeting transcripts at the Center for Disease Control, National Institute of Occupational Safety and Health website at <http://www.cdc.gov/niosh/ocas/pdfs/abrwh/2015/tr072315.pdf> Topics include NIOSH's lack of consideration of contaminated INL drinking water and prevailing tendency to ignore dose falsification at INL and Rocky Flats.

¹⁸ See NIOSH dose reconstruction website for the Idaho National Laboratory, including 2015 written comments to NIOSH by Tami Thatcher <http://www.cdc.gov/niosh/ocas/ineel.html>

¹⁹ See NIOSH <http://www.cdc.gov/niosh/ocas/pdfs/arch/tibs/or-t49-r0.pdf>

Workers need to know that the biological damage from plutonium is quite different from gamma exposure, an airplane ride, or external radiation. The damage to the cells is replicated and can be detected years after the initial intake.²⁰ And this is from DOE's funded studies that they aren't discussing when WIPP releases plutonium for example.

And even though radiation workers medical doses are not tracked, all radiation doses are cumulative. Radiation from medical diagnostics or treatments should be understood by the worker to add to his lifetime dose.

Workers who were first told that they will not be harmed by radiation work and are later told that sacrifices have to be made for the good of the country should not accept the "red-white-and-blue-washing" of radiation exposure and harm to their health.

Worker radiation training concerning the risks of radiation appears to be stagnated, continuing to use incorrect and decades-old information. Workers and the public continue to be told that radiation from internal intake of radionuclides is no different than say, eating a banana or taking a plane ride across the country.

A recent epidemiology study that included a cohort of over 300,000 nuclear industry workers has found clear evidence of solid cancer risk increases despite the average exposure to workers being about 2 rem and the median exposure was just 410 millirem.²¹ Given the decades of statements to radiation workers that no health effects are discernable under 10 rem (which has been a known falsehood for years), radiation workers should take note of this 2015 epidemiology report — radiation workers cannot rely on its Department of Energy contractors or the Department of Energy to provide up-to-date information about increased health risks from radiation.

Department of Energy Continues Use of ICRP Model Known to Underestimate Dose from Plutonium Inhalation

A 2012 Department of Energy Study finds the International Commission on Radiological Protection (ICRP) model significantly underestimates lung retention and radiation dose from inhaled plutonium.²² The study of an accidentally exposed nuclear worker and experimentally exposed beagle dogs were found to have much higher lung retention of plutonium than predicted by current ICRP biokinetic models currently used to estimate radiation dose for inhaled soluble forms of plutonium. The good news for plutonium workers is that this worker had inhaled over a microCurie of plutonium and lived another 38 years before dying of prostatic cancer.

²⁰ C. R. Mitchell, T. V. Azizova, et al., "Stable Intrachromosomal Biomarkers of Past Exposure to Densely Ionizing Radiation in Several Chromosomes of Exposed Individuals," 2004.

<http://www.columbia.edu/~djb3/papers/radres10.pdf>

²¹ Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), *BMJ*, v. 351 (October 15, 2015), at <http://www.bmj.com/content/351/bmj.h5359> Richardson et al 2015

²² Christopher E. Nielsen et al., "Microdistribution and Long-term Retention of ²³⁹Pu (NO₃)₄ in the Respiratory Tracts of an Acutely Exposed Plutonium Worker and Experimental Beagle Dogs," *Cancer Res* 2012. <http://cancerres.aacrjournals.org/content/72/21/5529.full.pdf>

But the bad news is the report concluded:

“It is evident that the human respiratory tract model adopted by the ICRP significantly underestimates lung retention and dose from soluble material. Prolonged retention may increase the average absorbed lifetime dose to the lung by several orders of magnitude than would be expected following current ICRP models; these models assume there is no Pu retained in the lungs.”

The report does not discuss the implications to modeling errors for insoluble and highly insoluble plutonium. The more soluble the plutonium, the more plutonium that reaches the blood stream which may be stored in the bone, liver or gonads like iron or may be excreted. Higher lung retention could mean less plutonium in the blood stream and higher lung dose. The ICRP models are often used to infer intake from amount of plutonium excreted in urine and fecal samples assessed in bioassay programs and higher lung retention than previously thought could result in the underestimation of plutonium intake. Lung scans basically cannot detect plutonium but use instead the ability to detect americium-241 which is present in some plutonium material to infer plutonium intake in the lungs. Therefore, the estimate of plutonium intake, whether by lung scan or by bioassay is prone to error as is the estimate of retention in the body and subsequent estimation of radiation dose.

Other studies involving the US Transuranium and Uranium Registries have found that highly insoluble plutonium had higher than expected lung retention as well. While included in some Hanford studies and in dose reconstruction by NIOSH,²³ the highly insoluble “super S class” has yet to be incorporated into ICRP or methods used by the DOE to estimate worker doses. Yet, the DOE mostly ignores the potential for super S class plutonium decades after finding that increased lung retention in autopsied nuclear workers. The DOE prefers instead to describe plutonium inhalation as being analogous to a plane ride’s exposure to cosmic radiation and DOE continues using flawed models and assumed soluble or moderately insoluble plutonium coefficients in dose estimates that underestimate lung dose and overall radiation dose.

Radiation workers should understand that, even when bioassay and lung scan data are properly handled, the models used by the DOE to estimate their dose and subsequent cancer risk from inhaled plutonium are highly flawed and in ways that underestimate organ dose, whole body dose, and damage to DNA.

²³ Roger B. Falk et al., “Estimating Doses for Plutonium Strongly Retained in the Lung,” ORAUT-OTIB-0049, February 6, 2007, <http://www.cdc.gov/niosh/ocas/pdfs/arch/tibs/or-t49-r0.pdf> In 1994, the ICRP 66 model replaced the ICRP 30 model to include higher lung retention..Yet, many cases have been found to exceed the ICRP 66 lung retention. These cases are described in Attachment A of ORAUT-OTIB-0049, a document used in NIOSH radiation dose reconstruction.

Testing Continues at the INL's Integrated Waste Treatment Unit

Doubts remain about whether the Idaho National Laboratory's Integrated Waste Treatment Unit (IWTU) will ever be deemed operational for solidifying liquid sodium-bearing waste from nuclear fuel reprocessing operations. The latest status on the plant at the October INL Citizens Advisory Board described continued testing, fixes for past problems and the identification of several new problems. DOE's deputy manager of the Idaho Cleanup Project said that DOE will be examining alternative treatment methods for the 900,000 gallons of liquid radioactive waste that remains stored in decades old stainless steel tanks. The treatment was supposed to have been completed in 2012.

The number of serious design problems is systemic to the IWTU. The engineering-scale test demonstration conducted using a specifically designed pilot plant in Golden Colorado was supposed to confirm and optimize the design.²⁴ The small scale testing actually uncovered a multitude of problems but authors concluded, in techno jargon, that operation might work although clogging up appeared to be a challenge. The joke is on the tax payer as cost overruns for the IWTU continue.

It is interesting to note the fallacy of the economic worth of the reprocessed enriched uranium that was the reason for generating the liquid waste. The impurities in the recovered enriched uranium rendered it suitable only for the now-closed plutonium production reactors operated by the Department of Energy. Once the Savannah River plutonium production reactors were shut down, there was no use for the recovered enriched uranium from the Idaho fuel reprocessing facility. And any stockpiles of the material are basically an unusable waste that the Department of Energy must store and ultimately dispose of.²⁵

The Idaho Department of Environmental Quality oversees hazardous waste emissions permitting and numerous chemicals will be emitted that have the potential to exceed screening levels, including arsenic, cadmium, and mercury. Filters will not be able to reduce tritium and iodine-129 airborne releases, however. Iodine-129 has a half life of 15.7 million years. The quantity of plutonium-239 to be treated is 456 curies (or 6.8 kilograms, almost enough for an atomic bomb). Planned offgas and filtering systems are predicted to reduce Pu-239 emissions to nanocurie amounts in a single year of treating all the tank waste. Effective filtering of the offgas will be needed for the difficult to monitor alpha emitters such as plutonium. However, in the event of an accident such as a deflagration at the powdered coal facility, various chemical and radionuclide

²⁴ <http://www.osti.gov/scitech/biblio/21294788-steam-reforming-technology-demonstration-program-treatment-doe-sodium-bearing-tank-wastes-idaho-national-laboratory>

²⁵ Statement of Admiral Bruce DeMars, US navy Director, Naval Nuclear Propulsion before Nuclear Deterrence, Arms Control and Defense intelligence Subcommittee of the Senate Armed Services Committee on Nuclear spent Fuel Shipments, July 28, 1993. "During the cold war highly enriched uranium was a precious resource, recovered through chemical reprocessing at the Idaho National Laboratory for subsequent use as fuel for the weapons production reactors. . . . However, reprocessing involves chemical dissolution of the spent fuel, release of fission products, and a seven fold increase in the amount of high level waste at [INL]."

contaminants could be released. ²⁶ Plutonium is released for various INL facilities, even those that use filters, and amounts released have exceeded 5 millicuries annually at RWMC cleanup projects alone. ²⁷ See additional air emissions reporting in annual environmental monitoring reports prepared for the Department of Energy. ²⁸

INL Citizens Advisory Board Treated Like Mushrooms and Kept In the Dark Concerning Waste Burial at INL

The October Idaho National Laboratory Citizens Advisory Board was treated to a presentation on soil cap research regarding the needed soil cap over the Radioactive Waste Management Complex at INL. ²⁹ The presentation by the Idaho Department of Environmental Quality was informative and it described past and ongoing research and how soil caps can last up to a 1000 years.

Soil caps over buried waste facilities may reduce water infiltration thus slowing the migration of contaminants to the Snake River Plain aquifer and in the case of RWMC are needed to keep shallowly buried plutonium, uranium, and americium bearing sludges from blowing in the wind.

The problem is that the wastes are radioactive for hundreds of thousands of years and they do migrate to the aquifer and then flow in the aquifer downstream to Thousand Springs. So most analyses to characterize the migration of contaminants do not take credit for soil caps.

Even at INL's proposed replacement for RWMC, the Remote-handled Low-level waste facility, no credit was taken for cap performance in the long run. ³⁰

²⁶ Idaho Cleanup Project, "Mass and Energy Balance for Sodium Bearing waste Integrated Waste Treatment Unit – Modified to Support Emissions Permitting," EDF-6495, February 18, 2009.

²⁷ "Phase 1 Interim Remedial Action Report for Operable Unit 7-13/14 Targeted Waste Retrievals," October 2014, Prepared for the US DOE Idaho Operations Office, DOE/ID-11396 Rev. 3, Air Emissions table on p. 70 at <https://ar.icp.doe.gov/images/pdf/201411/2014110300960BRU.pdf>

²⁸ Gonzales-Stoller Surveillance, LLC, INL Annual Site Environmental Reports at <http://www.gsseser.com> Just don't expect these reports to be accurate. For one thing, the air emissions are usually based on estimates, not measurements. And there is no regulatory review of the adequacy of these estimates. For another thing, I found plutonium air emissions from RWMC to be vastly understated in the 2013 report, an error that they have since corrected.

²⁹ See the Idaho National Laboratory's Citizens Advisory Board meeting presentations for October 2015 at <http://inlcab.energy.gov/pages/meetings.php>

³⁰ US Department of Energy, "Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site," Final, DOE/EA-1793, December 2011. <http://energy.gov/sites/prod/files/EA-1793-FEA-2011.pdf>

But analysts for the RWMC decided to take credit for perfect soil cap performance for millennia in order to reduce the radiation ingestion dose from 100 mrem/yr to 30 mrem/yr.^{31 32} And I checked with IDEQ: the presenter had no idea what assumptions had been made in the DOE's performance analysis for the RWMC. Either way, 1000 years or millennia, it seems to me that all that matters to these people is that they will be retired and gone in a couple decades and they will not have incurred any problems for rocking the boat for the nuclear industry.

Flooding over hundreds of thousands of years? No problem: DOE just assumes geologic stability for millennia. Need maintenance of the diversion dam built around RWMC after flooding occurred? No problem the Department of Energy stresses: we will conduct five-year reviews, FOREVER. It would be laughable if it weren't so devastating to the health of the unsuspecting people exposed and harmed in the future.

The problem is compounded by the fact that after DOE agreed it would no longer bury waste from Rocky Flats, here's what DOE did: DOE stacked about 18,000 barrels and about 2000 4 ft by 4 ft by 7 ft wooden boxes of depleted uranium and nitrate waste on an asphalt pad called Pad A.³³ This roughly 20 ft high pile of radioactive trash is supposedly going to be protected by the soil cap for millennia. Yet the INL CAB is fed sweet statements about soil caps being adequate because they could last about 1000 years.

In addition to what the INL CAB is being told about the proper context of the adequacy or inadequacy of soil caps, the INL CAB was informed that the Department of Energy would not provide to the CAB or citizens any draft documents concerning the Five Year CERCLA cleanup review prior to its being finalized early next year.

Only a fraction of the plutonium-laden transuranic waste from Rocky Flats buried at RWMC will be exhumed and none of the buried spent fuel debris and other mobile and long-lived radionuclide contaminants like technetium-99 and iodine-129 are being exhumed. An enormous amount of americium-241, enough to contaminate about 6 Snake River Plain aquifers, was buried but they may never know where, even if they were trying to exhume it. The grout pumped under some of the waste may have been prudent but it will not provide any assurance of slowing

³¹ U.S. Department of Energy, 2007. Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11243. Idaho National Laboratory, Idaho Falls, ID and U.S. Department of Energy, 2008. Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11244. Idaho National Laboratory, Idaho Falls, ID. (<https://www.inel.gov/about-inel/general-information/research-library/>) Search the DOE-ID Public Reading Room for the reports.

³² See that the publically available administrative record for RWMC cleanup does not contain the assessment of radionuclide migration and radioactive doses after 10,000 years. The pre-10,000 year contaminant migration is artificially suppressed for the first 10,000 years and then rapidly escalates and stays elevated for hundreds of thousands of years. See the Administrative Record at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents for documents associated with this cleanup action, including "Record of Decision" documents and EPA mandated Five-year Reviews at <http://ar.inel.gov> or <http://ar.icp.doe.gov>

³³ EPA/ROD/R10-94/073 "EPA Superfund Record of Decision: Radioactive Waste Management Complex, Idaho Falls, ID 1/27/1994" January 1994.

radionuclide migration. The low doses that were presented to the INL CAB and the public were said to be below EPA 4 millirem/yr standards for 10,000 years. But that's not the end of the story: the low ingestion rates occur due to modeling assumptions that limit migration for the first 10,000 years. After 10,000 years, the doses sky rocket and stay elevated for millennia. And nonsensical credit for a soil cap for millennia means that the doses are underestimated at least three-fold. Without an intact soil cap, some of the shallowly buried debris waste at Pad A will be blowing in the wind as well as migrating toward the aquifer.

Articles by Tami Thatcher, December 2015.