Statement by Daniel Hirsch
Before the Radiation Advisory Committee
of the Science Advisory Board
United States Environmental Protection Agency
Regarding Proposed Changes to EPA's Radiation Protection Standards
for the Uranium Fuel Cycle
10 November 2015

Mr. Chairman and Members of the Radiation Advisory Committee, thank you for the opportunity to present my views on the matter before you today. By way of introduction, my name is Daniel Hirsch. I am the Director of the Program on Environmental and Nuclear Policy at the University of California, Santa Cruz. I also am associated with an NGO that joined with dozens of other organizations in submitting comments about the contemplated changes to EPA's radiation protection standards.[1] The opinions expressed here today, however, are my own alone.

I am struck by what was omitted in the presentations by the staff of EPA's Office of Radiation and Indoor Air (ORIA). They say that their effort to revise the nuclear fuel cycle rule is driven by the science and that there is no plan to relax radiation standards, but the science officially accepted by EPA shows radiation to be far more dangerous than assumed when the rule was originally promulgated yet the standards are not being proposed to be tightened accordingly to reflect those new official risk estimates. To the contrary, the proposals considered would in fact, despite claims to the contrary, dramatically increase permissible radiation exposures.

1. Increased Risk Estimates, Yet No Commensurate Tightening of Standards Proposed

The estimates of excess cancer incidence per unit dose of ionizing radiation by the National Academy of Sciences' National Research Council in its most recent report on The Biological Effects of Ionizing Radiation (BEIR VII), and by EPA in its "Blue Book[2]," have increased markedly based on the science. The accumulated scientific evidence accepted by EPA has shown radiation about five-fold more dangerous than when the current standards were adopted four decades ago, but there is no discussion by ORIA of tightening the regulations accordingly.

Furthermore, the study by David Richardson and colleagues recently published in the *British Medical Journal*[3] demonstrates that the long-questioned cancer risk reduction factor known as

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[1] http://yosemite.epa.gov/sab/SABPRODUCT.NSF/7A10BF5BA99FE56E85257EF500549986/$File/Public+comments+submitted+by+D'Arrigo,+Diane-11-5-15.pdf

[2] *EPA Radiogenic Cancer Risk Models and Projections for the U.S. Population*, EPA 402-R-11-001, available at http://www2.epa.gov/sites/production/files/2015-05/documents/bbfinalversion.pdf

[3] *Risk of Cancer from Occupational Exposure to Ionising Radiation: Retrospective Cohort Study of Workers in France, the United Kingdom, and the United States (INWORKS),* BMJ 2015; 351:h5359

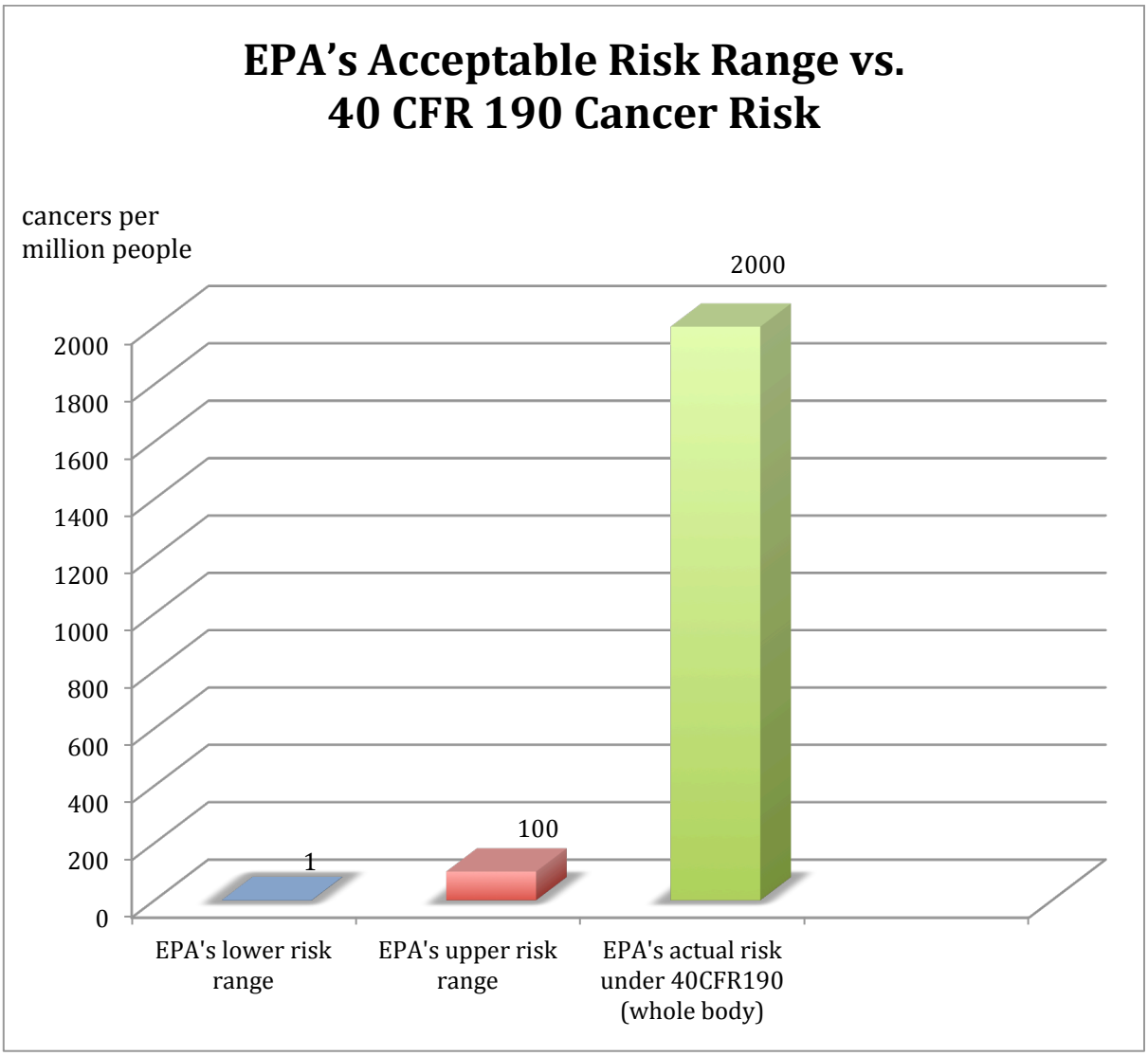
DDREF (Dose and Dose Rate Effectiveness Factor) is technically baseless and needs to be abandoned. This would further increase the risk figures by another 50% or so, a seven- or eight-fold increased risk compared to what was assumed decades ago when 40 CFR 190 was originally promulgated. Yet, again, there is no suggestion by ORIA of tightening radiation protection standards accordingly. To the contrary, their proposal to eliminate organ dose limits would have the effect of significantly increasing permissible exposures to radioactivity, as I will discuss in a moment.

2. Privileged Status Given to Radiation, Allowing Cancer Risks Far Higher Than Allowed for Any Other Carcinogen

EPA historically regulates carcinogens to keep cancer risks within a 10^{-6} to 10^{-4} risk range. This means the goal is a one-in-a-million risk, but if circumstances make that difficult, one can fall back to no more than a 10^{-4} risk, still aiming to get as close to 10^{-6} as possible. **The current EPA whole body dose limit for the nuclear fuel cycle, however, is 20-2000 times outside the EPA acceptable risk range, using EPA's own current official radiation risk estimates.**[4]

[4] The EPA "Blue Book" officially establishes the risk as 1.16×10^{-3} cancer incidence per person-rem of exposure, almost identical to the NAS BEIR VII figure of 1.14×10^{-3}. 25 millirem whole body exposure per year, as allowed under the current 40 CFR 190, would thus produce a lifetime cancer risk of 2×10^{-3} -- i.e., every 500^{th} person would get a cancer from the exposure that they would not have gotten otherwise -- 20-2000 times higher than EPA's acceptable risk range.

This assumes a lifetime exposure, as permitted under the regulation, and which is reasonable, given the many nuclear licensees. But even if one only assumed exposure for the first 26 years of life, as EPA does for CERCLA, based on the assumption that one is unlikely to remain in the same place more than that and unlikely to move to another Superfund site, the risk is not much different, due to EPA's higher risk figures for children. Exposures over the first 26 years of life, according to EPA's Blue Book, produce a risk of about 2×10^{-3} cancers per person-rem, so the 40 CFR 190 whole body dose, even if limited to 26 years, would produce 1.3×10^{-3} risk, still one to three orders of magnitude outside the acceptable risk range.



Source: See footnote 1

In order to bring radiation protection regulations into conformance with the risks permitted for all other carcinogens, one would have to reduce permissible exposures to 0.01-1 mrem/year, based on EPA's own official risk estimates for "low dose" ionizing radiation. By contrast, the current whole body dose limit in 40 CFR 190 of 25 millirem/year is equivalent to 2 x 10^{-3} risk. Thus, if radiation were regulated as are all other carcinogens based on risk and required to comply with the risk range, standards would have to be tightened 20-fold to 2000-fold, because.

However, ORIA makes no such proposal. Indeed, one of the effects of regulating all other carcinogens in terms of risk while, as an outlier, ORIA regulates radiation instead in units of dose is that this "privileged" status granted radiation, allowing risks far outside what is considered acceptable by the agency, is effectively obscured. Indeed, even ORIA's dose

approach is an outlier for radiation regulation within the agency, as the CERCLA program regulates radiation by risk and keeps the risk within the risk range.

3. ORIA's Suggestion of Eliminating Organ Dose Limits and Going Instead to "Effective Dose Equivalent" Would Dramatically Increase Permissible Radiation Exposures

Rather than tighten protections to reflect increased risk estimates, as discussed above, ORIA suggests eliminating the organ dose limits in 40 CFR 190 and moving instead to "effective dose equivalent" (EDE). This would increase permissible exposures to many radionuclides, e.g. 25- or 33-fold for many plutonium isotopes, and would indeed markedly weaken standards. Right now, 40 CFR 190 bars exposures to the thyroid greater than 75 millirem/year and to any other organ greater than 25 millirem/year. By eliminating those limits and using instead EDE, a dose limit of, say, 25 millirem to an organ could be relaxed to a limit dozens of times higher, because of the use of an "organ weighting factor." For example, take a radionuclide that concentrates in the bone surface, for which the organ weighting factor is 0.03. Eliminating the organ limits would increase permissible exposures by 1/0.03, or 33-fold, to an astonishing 825 millirem allowable dose to the bone surface.

4. EDE is Highly Questionable

EDE is a kind of hand-waving or fudge factor to ignore the actual dose to the organ and fictionally reduce it by largely arbitary organ weighting factors. EDE, as David Brenner of Columbia has written, relies on "committee-derived subjective values"[5] such as discounting cancers based on degree of pain and suffering, years of life lost, etc. It is not science but subjective manipulation of actual dose, often allowing higher exposures to radiation.

5. There is a Failure to Enforce 40 CFR 190 Now Anyway

NRC's radiation protection regulations, 10 CFR 20, are based on 100 millirem per year, and in some cases, even higher. 100 millirem/year is about a 10^{-2} risk. EPA has long taken the position that 100 millirem per year is not protective of public health. Yet, despite a brief reference in the NRC regulations saying that licensees also subject to 40 CFR 190 need to comply with it as well, NRC's tables of permissible concentrations of radionuclides do not comply with 40 CFR 190, and there are no NRC tables identifying the limits that fuel cycle licensees must follow to comply with the EPA requirements. Indeed, it appears that fuel cycle licensees aren't even inspected for compliance with 40 CFR 190.

6. Drinking Water Standards Should Not Be Weakened, Despite ORIA Efforts to Do So

Maximum Contaminant Limits (MCLs) for radionuclides are established by the Safe Drinking Water Act and can't be weakened because of the anti-backsliding requirement. Nonetheless, ORIA has been pushing for weakening them by orders of magnitude in the Protective Action Guides. Any suggestion to weaken MCLs by inclusion of higher concentrations for drinking

[5] *Effective Dose: A Concept That Can and Should be Replaced,* British Journal of Radiology 81 (2008), 521-523

water in a revised 40 CFR 190 would be a step backward and run up against the anti-backsliding requirement of law.

7. EPA CERCLA Program's Preliminary Remediation Goals (PRGs) Are a Model for Regulating Radiation Consistent with the Acceptable Risk Range

Unlike ORIA, the EPA CERCLA Program regulates radiation consistently with the way chemical carcinogens are regulated. Its PRG calculator (http://epa-prgs.ornl.gov/radionuclides/) provides concentrations for various environmental media and exposure scenarios equivalent to a 10^{-6} risk.

At the end of the day, with very few exceptions, radiation protection limits end up as concentrations in or on various media (e.g., air, water, soil, building surfaces), whether one is regulating based on dose or risk. So regulating radioactivity to be consistent with the EPA risk range, as is done for all other carcinogens, and as CERCLA does for radionuclides, has no real impediments, and would allow public protection finally consistent with what is required for all other substances that induce and promote cancer.

I would recommend the Radiation Advisory Committee, as it analyzes possible revisions to the ORIA regulations, consider bringing in the EPA staff responsible for the PRGs for a presentation as to how it regulates radioactivity consistent with the way EPA handles carcinogens generally.

8. Risk-Based Standards Give You the Ability to Quickly Upgrade Requirements When the Risk Relationship Changes

One of the benefits of regulating by risk is that if the risk estimates change, as they have repeatedly over the years, one doesn't have to change the regulation to reflect the new science. As the NAS National Research Council put it, in recommending the use of risk rather than the dose: "We recommend the use of a standard that sets a limit on the risk to individuals of adverse health effects from releases....A risk-based standard would not have to be revised in subsequent rulemaking if advances in scientific knowledge reveal that the dose-response relationship is different from that envisaged today. Such changes have occurred frequently in the past, and can be expected to occur in the future."[6] We wouldn't be facing the situation of 40-year old dose limits that now are hugely outside the EPA acceptable risk range if the regulation specified instead compliance with a particular risk level. Right now public protections are decades out of date and woefully weak.

[6] *Technical Bases for Yucca Mountain Standards,* National Research Council, 1995, p. 4. Note that they also indicate that the that use of risk is preferable scientifically to the dose-based approach in 40 CFR 190: "In attempting to make the best use of the scientific understanding that is available, we have arrived at recommendations that differ in important ways from the approach followed by EPA in 40 CFR 190. In particular, we recommend: The use of a standard that sets a limit on the risk to individuals from releases....40 CFR 191 contains an individual dose standard...." p. 2.

Conclusion

In conclusion, the official risk figures for ionizing radiation have markedly increased over the years but the regulations have not been tightened accordingly. By contrast, ORIA proposes to relax them further, by as much as 33-fold, by elimination of organ dose limits and replacement with the subjective, non-scientific, and otherwise questionable "effective dose equivalent." Current regulations allow cancer risks 20-2000 times that allowed by EPA for all other carcinogens. There is no scientific justification for this "privileged status" afforded radiation, nor for failing to now reduce permissible exposures to levels within EPA's longstanding acceptable risk range.