IEER on "Analysis of Cancer Risks in Populations near Nuclear Facilities, Phase I"

IEER's Official Comments (http://ieer.org/wp/wp-content/uploads/2012/06/ieer-analysis-cancer-risks-populations-comments-june2012.pdf) (June 5, 2012; pdf) | IEER's Statement (http://ieer.org/wp/wp-content/uploads/2012/03/NAS_Analysis_of_cancer_risks_prepub-IEERstatement.pdf) (March 29, 2012; pdf) | *Analysis of Cancer Risks in Populations near Nuclear Facilities: Phase I* (http://www.nap.edu/catalog.php?record_id=13388)

Comments of the Institute for Energy and Environmental Research (IEER) on Analysis of Cancer Risks in Populations near Nuclear Facilities:
Phase I, Prepublication copy [1]

Arjun Makhijani

June 5, 2012

These comments are being submitted a few days after the deadline of May 30, 2012, but we hope that they will be taken into account in the preparation of the final report. I am keeping my comments short and am covering only the points relevant to the follow-up studies that are proposed in the report.

Overall, this is a thoughtful and careful report regarding the difficulties and complexities of conducting successful epidemiologic studies to detect whether there is excess cancer in the neighborhood of commercial nuclear facilities. It has compiled the available data and noted the limitations of the data. The report's emphasis on carbon-14 emissions and their importance is especially refreshing. The recommendation that a method should be developed for estimating carbon-14 discharges and emissions is especially important.

A. Critical data gaps

The following represents a list of critical data gaps that should be addressed. They are especially important for non-cancer effects as well as cancer risks as a result of in utero and/or early childhood exposure. These data gaps are especially important for the case-control study for children born near nuclear power plants.

1. *Tritium releases to the atmosphere*: There is no discussion in the report about tritium (http://ieer.org/wp/mcm_glossary/tritium/) releases to the atmosphere. Light water reactors routinely release tritium (http://ieer.org/wp/mcm_glossary/tritium/) to the atmosphere in the form of tritiated water vapor. Tritiated water comes down mixed with ordinary rainwater, contaminating land, locally grown produce, and groundwater. This is

a serious omission, especially in view of the fact that private water wells are not covered or monitored under the drinking water act. The Nuclear Regulatory Commission does not require or recommend that licensees monitor drinking water from private wells, even if should the owners so desire. Under certain circumstances, the concentration of tritium in rainwater can far exceed the drinking water limit. There are multiple pathways of exposure to tritiated rainwater including absorption through the skin, various food pathways that include exposure to organically bound tritium, irrigation with contaminated well water, consumption of contaminated well water for drinking and cooking, inhalation of contaminated water during showers, and absorption of tritiated water via the skin.

2. *Tritium discharges to surface waters*: Sampling for tritium is periodic rather than continuous. Since discharges are part of primary water discharge, it is critical to know that measurements of concentrations in primary water have been made and to validate the surface water sampling results with primary water sampling data, if they exist. If they do not exist, it will be important to make estimates by independent methods, such as knowledge of reactor operation and primary water discharge protocols.

3. *Tritium minimum detectable amounts (MDAs)*: The MDA's for tritium are often on the order of 2,000 pCi/liter. This is far too high. An effort should be made to determine the concentration levels by estimating it from knowledge of amounts of tritium created in the reactor and discharged.

4. *Strontium-90*: I recognize that official data indicate that strontium-90 emissions and discharges during routine operation would be low. However, as the report recognizes, early data have gaps and older reactors with problematic fuel rods could have resulted in strontium-90 discharges to surface waters when primary water was discharged. In utero exposure as well exposure during infancy to strontium-90 could compromise immune system stem-cell development, creating greater vulnerability to cancer as well as a host of other diseases.

B. Analytical issues

1. *Exposure to tritium during the first eight weeks*: The proposed case control study is focused on health outcomes of children whose mothers lived near nuclear plants during pregnancy. It is therefore necessary to be able to calculate doses to the embryo/fetus during all stages of the pregnancy. ICRP 88 proposes that the doses during the embryonic stage – the first eight weeks – should be "taken to be the same as the dose to the uterus wall." [2] While this may be appropriate for photon (http://ieer.org/wp/mcm_glossary/photon/) and high energy beta emitters, it is not suitable for the low energy beta of tritium or for alpha-emitting radionuclides. The recommendation that the case control study focus on the area where the mother lived during pregnancy is important. But for the study to be valid in regard to vulnerabilities acquired during the first eight weeks of pregnancy when most of the organs are formed, a better method of estimating doses during this period will be needed, especially for tritium. The validity of the method for carbon-14 and strontium-90 should be examined.

2. *Exposure to multiple nuclear facilities*: The study focuses on getting dose estimates from single facilities. But in certain cases, such as that of the Braidwood plant, many of the affected people are also affected by the Dresden plant. It will be important to consider exposures to the affected population from all nuclear fuel cycle facilities, including other nuclear power plants, of course.

3. *Exposure to carcinogens from other facilities*: The presence of chemical facilities or fields where pesticides are sprayed, especially by air, should be noted in the study. Petroleum refineries, for instance, may emit carcinogens. This may be a confounding factor in some situations.

4. *Exposure geography*: Defining the exposed populations will be complex. We have already pointed out the issue of tritiated rainfall, which will depend on rainfall patterns as well as air dispersion. The location of public drinking water systems downstream of the water discharge points is also important. For instance, there is a public drinking water system downstream of the Braidwood and Dresden plants in Illinois. The water quality data for such public drinking water systems should be examined to determine whether the women who were pregnant in these areas should be included in the studies. It is unclear whether babies born to mothers who lived within a 50-kilometer radius, which is proposed in the report (p. S.5), is the most appropriate geographic definition for these studies. One early step might be to examine weather data and water consumption patterns and choose the area for study that way.

C. Recommendations

Given the vast differences in risk of various types of adverse outcomes between those exposed in utero and in early infancy, the feasibility study should focus on the case control study for children. We recommend that the six proposed ecologic studies for entire populations living near nuclear facilities be dropped for the next phase. It will be difficult enough to do case control study for children and come up with statistically reliable results. To complicate that with an ecologic study would be to try to go in two rather different directions at once, scattering resources at a time when it is important to focus them. Further, the analysis and results of the case control study will also make much clearer whether it is worth doing the ecologic study.

As a result, we recommend that the next step should consist only of the proposed case control studies for children whose mothers lived near the six facilities proposed to be studied.

In the case of Dresden, the combined exposures from Dresden and Braidwood should be evaluated and the exposed populations should be selected with both these facilities in mind. In this regard, I strongly recommend that the data and analysis of childhood cancer prepared by and presented to the committee by Dr. Joseph Sauer be explicitly taken into account and included in the case control study for these facilities.

The following adverse health outcomes should be evaluated if possible. If one or more of these outcomes cannot be evaluated, a research program making such a study feasible should be done.

1. Cancer incidence for various cancers, including leukemias of various types, and brain and nervous system cancers
2. Cancer deaths
3. Early failed pregnancies
4. Malformations as affected by early embryo/fetus exposure (first 14 weeks).
5. Immune system function as affected by fetal exposure at the time of bone and bone marrow formation. The reliable determination of strontium-90 exposure is important in this context.

D. Bibliographic note

Analysis of tritium, strontium-90, and other matters with specific reference to women and children can be found in the IEER report *Science for the Vulnerable*. [3]

Notes:

1. National Research Council, Committee on the Analysis of Cancer Risks in Populations near Nuclear Facilities – Phase I, *Analysis of Cancer Risks in Populations near Nuclear Facilities: Phase I*, Prepublication copy, National Academy Press, Washington, D.C., 2012, at http://www.nap.edu/catalog.php?record_id=13388 (http://www.nap.edu/catalog.php?record_id=13388). ↩ Return
2. International Commission on Radiological Protection, *Doses to the Embryo and Fetus from Intakes of Radionuclides by the Mother* (ICRP publication 88, Annals of the ICRP, 31(1/3) 2001), Corrected version, Pergamon, Oxford, May 2002, page 24. ↩ Return
3. Arjun Makhijani, Brice Smith and Mike Thorne, *Science for the Vulnerable: Setting Radiation and Multiple Exposure Environmental Health Standards to Protect Those Most at Risk*, Institute for Energy and Environmental Research, Takoma Park, MD, October 19, 2006, at http://ieer.org/wp/wp-content/uploads/downloads/reports/Science-for-the-Vulnerable.pdf (http://ieer.org/wp/wp-content/uploads/downloads/reports/Science-for-the-Vulnerable.pdf), from link at http://ieer.org/resource/reports/science-vulnerable-setting-radiation (http://ieer.org/resource/reports/science-vulnerable-setting-radiation). ↩ Return

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