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Statement of Arjun Makhijani on the Report *Science for the Vulnerable* and the *Campaign to Include Women, Children, and Future Generations in Environmental Health Standards*
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In 2005, the Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation (National Research Council of the National Academies) issued a report that concluded that women have a 52 percent greater chance than men of getting cancer from radiation exposure. Seven years ago, the Environmental Protection Agency had reached similar conclusions. Yet, much radiation protection regulation is still stuck in the past – its "reference" person is a man.

Consider RESRAD, the government's software for calculating radiation doses from residual radioactivity in the soil. It is used for setting maximum limits for residual radioactivity as part of the decommissioning of radioactively contaminated sites, including the sites in the Department of Energy's nuclear weapons complex. Hundreds of billions will have been spent before the remediation is complete. RESRAD is very useful, but it has one major problem: its computations of radiation dose are based on "Reference Man," defined as a young adult, "Caucasian" male, who is "Western European or North American in habitat and custom." That is the definition generally used for "Reference Man."

It is clear that a central principle of environmental health protection – *protecting those most at risk* – is missing from much of the U.S. regulatory framework for radiation. For instance, women's higher cancer risk per unit of radiation exposure is not properly reflected in current regulations. Neither is the possibility of early miscarriages or fetal malformations potentially caused by radiation exposure.

Radiation standards generally specify a maximum allowable dose or a maximum contaminant limit, but these are derived numbers based on an underlying notion of maximum fatal cancer risk that any individual in the exposed population would suffer. The use of Reference Man to derive the dose limit means that the cancer risk for women would be considerably higher than that claimed as the maximum target value in the regulation. It also means that the diet of many Native Americans, such as the Yakima in Washington state, or of African Americans along the Savannah River in Georgia and South Carolina, that relies much more on fishing than considered normal for a White "Reference Man." would not be taken into account in radiation protection.

Contrary to Executive Order 13045, *Protection of Children From Environmental Health Risks and Safety Risks*, signed by President Clinton in 1997 and endorsed with amendments in 2003 by President Bush, agencies of the government allow corporations to ignore children. Consider, for instance, a remarkable official opinion from the Nuclear Regulatory Commission to Connecticut Yankee Atomic Power Company [CY], written in 2001, that allowed the company to argue that a "white male, age 20-30" should be the basis for its calculations. And it explicitly allowed the company to argue that "our regulations *prohibit*

considering doses to children" despite the fact "the plain language of the regulation itself does not restrict the terms 'critical group,' 'individual,' or 'human being' to mean any specific age, race, or gender."[1]

The NRC permitted Connecticut Yankee to argue along these lines because the basic underlying document governing the regulations is the EPA's Federal Regulatory Guidance report number 11 (FRG 11), which is based on Reference Man, the young White male. We believe that the inclusion of children in radiation protection should not be optional.

Finally, the embryo/fetus, which is, in many ways, the most sensitive to radiation in terms of *non*-cancer health risks, is excluded from the regulatory scheme, except for protection of pregnant women in radiation-controlled work places after a voluntary declaration of pregnancy. Even there, the maximum allowable dose to the embryo/fetus, 500 millirem, is five times greater than best practices in Europe, for instance, in Germany. Also unlike Germany, there is no U.S. requirement to protect breastfeeding women from contact with significant radioactive contamination in the workplace after she declares that she is breastfeeding.

There is a need to consider the specific non-cancer health risks posed by certain radionuclides, both because of their nature and their widespread prevalence in the nuclear industry. Tritium, which is discharged into waterways in the form of radioactive water, including sources drinking water, from nuclear power plants and some nuclear weapons plants, crosses the placenta. It may increase the risk of early failed pregnancies or malformations. Similarly, strontium-90, concentrates in the red bone marrow, which is the source of stem cells for the immune system. Therefore, harm at the stage of rapid development of fetal and children's bones may create the potential for a wide variety of health problems. Such non-cancer effects are not well-understood, especially at low radiation doses; much less are they the concern of radiation protection regulations. Laboratory experiments, many done at the Armed Forces Radiobiology Research Institute, indicate that uranium, including depleted uranium, may be neurotoxic and may cross the placenta. It may act in the body like lead, but with the harm compounded by radioactivity. While these effects have not been confirmed at low levels of exposure, there is significant cause for concern and reason for the exercise of precaution in regulation. It would be tragic, if, having the knowledge that we do, radiation protection regulations allowed the potential problem to grow, as society did with lead in gasoline for decades.

In sum, while much progress has been made in radiation protection since the late 1950s, there are still vast gaps, many of which go back to the use of Reference Man. It is time to retire him. Others are related to the lack of consideration to non-cancer health effects.

Finally, estimation of health risk, as expressed in regulations, is generally confined to assessment of one chemical at a time or to radiation. Combined radiation and chemical exposures are rarely considered in research and are absent from regulatory framework. This is partly because research into combined effects if difficult, but it is also because the regulatory concepts used in the two fields are somewhat different.

The report we are making public today, *Science for the Vulnerable*, is designed to provide the scientific foundation for a broader and deeper consideration of how environmental health standards should be set. The coalition we are forming today will educate the public at large regarding the variety of environmental health risks we face and how they may be reduced. Among other things, we are asking President Bush to issue an Executive Order for executive branch agencies to review their definitions of reference persons and change them as needed to protect those most at risk.

Our initial list of signatories includes people from many backgrounds and a large variety of organizations, from public health to religious to Native American, to environmental to academic to elected officials to mothers concerned about the safety of breast milk. I sent the letter to President Bush yesterday, on behalf of the signatories. We are hopeful that President Bush will give the matter of strengthening the framework of environmental health protection his attention with the speed it deserves.

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[1] NRC 2001 p. 372 and p. 374, emphasis added. See *Science for the Vulnerable*, at www.ieer.org , p. 98 for the full citation.