



# NUCLEAR INFORMATION AND RESOURCE SERVICE

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## NIRS FACT SHEET—Disproportionate Impacts of Ionizing Radiation

### Women & Children Require More Protection from Ionizing Radiation than Men

#### NAS Findings: Adult Males are Group Most Resistant to getting Cancer from Radiation

There is no safe dose of ionizing radiation: any exposure of living cells to sub-atomic particles (alpha, beta, neutron) or waves of energy (gamma, X-ray) ejected from unstable radioactive atoms has the potential to trigger cancer in people.<sup>i</sup>

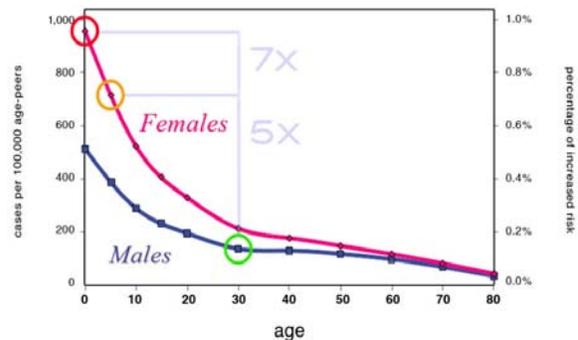
Men get cancer from exposure to radiation, and men die from that cancer, however, *for reasons not yet fully understood*, fewer males get cancer and fewer of them die from it compared to females of the same age at the same level of radiation exposure. The difference is not small: for every two men who get cancer, three women suffer this disease. These findings of physical difference (not based on behavior) of 40% -- 60% more cancer in women compared to men come from the (US) National Academy of Sciences (NAS), Biological Effects of Ionizing Radiation (BEIR) Report number VII, published in 2006<sup>ii</sup>.

It has been common knowledge that children's bodies are the most vulnerable to radiation impacts, but from BEIR VII we also learn that little girls (age 0 -- 5 years) are twice as likely to suffer harm from radiation (defined in BEIR VII as cancer) as little boys in the same age group.<sup>iii</sup>

In October 2011, NIRS published a briefing paper *Atomic Radiation is More Harmful to Women*<sup>iv</sup> containing more details about these findings. The numbers in the BEIR VII tables are the source of

this new information. Gender difference is not discussed in the report text.

Increased Cancer Risk by Age at Exposure to 20mSv Radiation

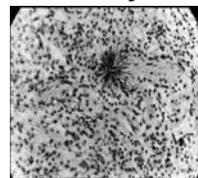


U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model

Graphic by Ian Goddard

Not every dose of radiation results in detectable harm--cells have repair mechanisms. However, every exposure carries the potential for harm; and that potential is tied to age of exposure and gender.

#### Radiation Exposure Standards Based on Adult Male Body



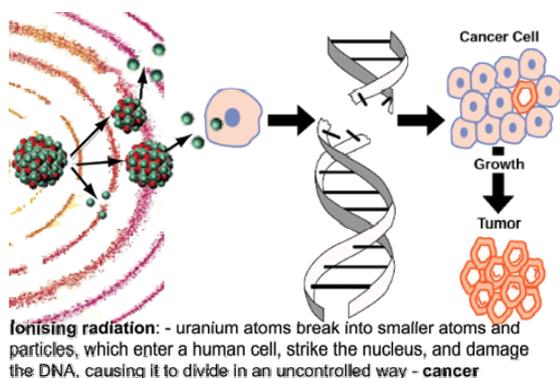
While we cannot see or otherwise detect radiation with our senses, we can see its damage: this photograph by Robert del Tredici shows black dead cells in the lung of an ape around a particle of plutonium.

The use of radioactivity in medicine and industry began little more than 100 years ago. When the

first regulations were made, it was because soldiers and scientists in the U.S. (virtually all male to begin with) were working on building nuclear weapons. The first standards were "allowable" limits for exposing these men to a known hazard.

### Radiation Levels v Dose

Geiger counters and other devices can detect levels of radiation and concentrations of radioactivity. It is much more difficult to say how much of that energy has impacted a living body (dose). Dose is calculated based on body size, weight, distance from the source and assumptions about biological impact. Gender is not factored in a typical determination of a dose. Historically the "dose receptors" were male, and were of a small age range. It is somewhat understandable that the "Reference Man"<sup>v</sup> was based on a "Standard Man"--a guy of a certain height, weight and age. Clearly such assumptions are no longer valid when there is such a striking gender difference--40% to 100% greater likelihood of cancer or cancer death (depending on the age) for females, compared to males.<sup>vi</sup>

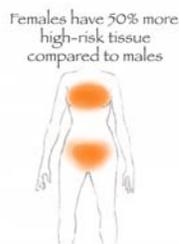


### Not Only Cancer

Radiation harm includes not only cancer and leukemia, but reduced immunity, reduced fertility, increases in other diseases including heart disease, birth defects including heart defects, other mutations (both heritable and not). When damage is catastrophic to a developing embryo, spontaneous abortion or miscarriage of a pregnancy may result.<sup>vii</sup>

### Gender Mechanism Not Yet Described

Perhaps the reason that the National Academy of Sciences does not discuss the fact that gender has such a large impact on outcome of exposure to radiation is that the causal mechanism is not yet



described. Dr. Rosalie Bertell, one of the icons of research and education on radiation health effects, suggests that one basis may be that the female body has a higher percentage of reproductive tissue than the male body. Dr. Bertell points to studies showing reproductive organs and tissues are more sensitive to radiation. Nonetheless, Dr. Bertell is clear: "While research is clearly needed, we should PROTECT FIRST."

### Ignoring Gender Results in More Harm

The NAS BEIR VII findings show that males of all ages are more resistant to radiation exposure than females, and also that all children are more vulnerable than adults. The only radiation standard certain to protect everyone is zero. Given the fact that there is no safe dose of radiation, it is an appropriate goal. Any additional exposure above unavoidable naturally occurring radiation should include full disclosure and concurrence of the individual. It is time to adopt non-radioactive practices for making energy, peace, security and healing.

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<sup>i</sup> See [www.nirs.org/radiation/](http://www.nirs.org/radiation/)

<sup>ii</sup> BEIR VII, Table 12D-3 page 312, National Academy Press (Washington, DC) 2006.

<sup>iii</sup> BEIR VII page 311, Table 12-D 1.

<sup>iv</sup> NIRS: *Atomic Radiation is More Harmful to Women*

<http://www.nirs.org/radiation/radhealth/radiationwomen.pdf>

<sup>v</sup>ICRP Publication 23: Reference Man: Anatomical, Physiological and Metabolic Characteristics, 1st Edition

<sup>vi</sup> IEER: The use of Reference Man in Radiation Protection Standards and Guidance with Recommendations for Change <http://www.ieer.org/reports/referenceman.pdf>

<sup>vii</sup> Non-cancer health effects are documented in classic works of John Gofman, for instance *Radiation and Human Health* (Random House 1982) and digital documents available: <http://www.ratical.org/radiation/overviews.html#CNR> and Dr. Rosalie Bertell's classic work *No Immediate Danger*, Summer Town Books, 1986.