



# All Levels of Radiation Confirmed to Cause Cancer

*For more information, please contact: Nuclear  
Information and Resource Service 1424 16th Street NW,  
#404, Washington, DC 20036, USA tel.:  
+202.328.0002; fax: +202.462.2183  
<http://www.nirs.org>*

*Rosalie Bertell, PhD, GNSH, special advisor to the  
Nuclear-Free Future Award, is President of the  
International Institute of Concern for Public Health  
(IICPH), and Editor in Chief of International  
Perspectives in Public Health.*

*6 July--The National Academies of Science released an  
over 700-page report last week on the risks from  
ionizing radiation. The BEIR VII or seventh Biological  
Effects of Ionizing Radiation report on "Health Risks  
from Exposure to Low Levels of Ionizing Radiation"  
reconfirmed the previous knowledge that there is no  
safe level of exposure to radiation Ð that even very low  
doses can cause cancer. Risks from low dose radiation  
are equal or greater than previously thought. The  
committee reviewed some additional ways that  
radiation causes damage to cells. (Dr. Rosalie Bertell:  
This is a huge admission that low dose estimates, far  
from being "conservative," are actually the same*

(linear extrapolation) or higher (supralinear, which we claim). Among the reports conclusions are:

1. There is no safe level or threshold of ionizing radiation exposure. Even exposure to background radiation causes some cancers. Additional exposures cause additional risks. (Dr. Rosalie Bertell: *The magnitude of background radiation risks has never been agreed on. This is vague, but may be helpful. The nuclear industry uses background as "safe" and a little extra as trivial.*)

2. Radiation causes other health effects such as heart disease and stroke, and further study is needed to predict the doses that result in these non-cancer health effects. (Dr. Rosalie Bertell: *"This has never been admitted. I think we have enough information to document this, but they are calling for more study. Other sicknesses caused by radiation are the autoimmune diseases. Focus on cancer was, I think, an administrative decision on the part of the A-bomb researchers, for the sake of research simplicity."*)

3. Children born to parents that have been exposed to radiation could be affected by those exposures. (Dr. Rosalie Bertell: *"Gentic effects, now called genomic instability. These concepts are not new, but indicate that the radiation establishment has finally decided to look at low dose radiation, found the effects we have been noting, and has given them a new name so that they will seem new."*)

The "bystander effect" is an additional, newly recognized method by which radiation injures cells that were not directly hit but are in the vicinity of those that were. "Genomic instability" can be caused by exposure to low doses of radiation and according to the report "might contribute significantly to radiation cancer risk." These new mechanisms for radiation damage were not included in the risk estimates reported by the BEIR VII report, but were recommended for further study. (Dr. Rosalie Bertell: *"The bystander effect fits under the same category of nuclear industry research discoveries (old concepts renamed). We used to call this cellular communication, which was well known in micro-biology. Again it is not new and doesn't really need more research."*)

The Linear-No-Threshold model (LNT) for predicting health effects from radiation (dose-response) is retained, meaning that every exposure causes some risk and that risks are generally proportional to dose. The Dose and Dose-Rate Effectiveness Factor or DDREF which had been suggested in the 1990 BEIR V report to

be applied at low doses, has been reduced from 2 to 1.5. That means the projected number of health effects at low doses are greater than previously thought. (Dr. Rosalie Bertell: *"The linear dose-response has been claimed to be correct for some fifty years. However, although they claim they believe it, nuclear scientists modify it for low dose and low dose rate (making it not really linear). For example, the Atomic bomb data would predict, by linear dose response, about 17 - 20 cancer deaths per 100 Person Sievert exposure to radiation. BEIR and UNSCEAR reduced this estimate by about 2 because of low dose effect, to about 10 cancer deaths per 100 Person Sievert. Then ICRP took the BEIR and UNSCEAR estimates and reduced them by 2 because of the slow dose rate, to 5 cancer deaths per 100 Person Sieverts, which is now used by the nuclear industry. This latter reduction is now 1.5 instead of 2, allowing for more deaths. In my opinion there is no scientific data on humans to support these two reductions from linear. There is some obscure lab data. Our studies showed the true curve to be supra(above) the linear."*)

## **RADIATION RISKIER THAN THOUGHT**

### **RISKS TO PUBLIC and NUCLEAR WORKERS**

The BEIR VII risk numbers indicate that about 1 in 100 members of the public would get cancer if exposed to 100 millirads (1milliGray) per year for a 70-year lifetime.<sup>[1]</sup> This is essentially the US Nuclear Regulatory Commission's allowable radiation dose for members of the public. (Dr. Rosalie Bertell: *"The ICRP recommends no more than (on average) 1 mSv (100 mrad) per year from nuclear industries. In the US, 5 mSv per year is allowed. However, for one's local nuclear facility, no more than 0.25 mSv per year is allowed. The difference is permitted so that long distance transport of radionuclides is able to be included."*) In addition, 1 in about 5 workers <sup>[2]</sup> would get cancer if exposed to the legally allowable occupational doses<sup>[3]</sup> over their 50 years in the workforce. These risks are much higher than permitted for other carcinogens. (Dr. Rosalie Bertell: *"This will likely result in union demands for hazard pay, and may cripple the nuclear industry."*) Specifically, the US Nuclear Regulatory Commission allows members of the public to get 100 millirems or mr (1 milliSievert or mSv) per year of radiation in addition to background. The BEIR VII report (page 500, Table 12-9) estimates that this level will result in approximately 1 (1.142) cancer in every 100 people exposed at 100 mr/yr which includes 1 fatal cancer in every 175 people so exposed (5.7 in 1000)<sup>[4]</sup>. (Dr. Rosalie Bertell: *"I have no idea*

*what Cindy is trying to say on this one!*") The risk of getting cancer from radiation (in BEIR VII) is increased by about a third from current government risk figures (FGR13): BEIR VII estimates that 11.42 people will get cancer if 10,000 are each exposed to a rem (1,000 millirems or 10 mSv). The US Environmental Protection Agency Federal Guidance Report 13 estimates that 8.46 people will get cancer if 10,000 are each exposed to a rem. (*Dr. Rosalie Bertell: "This is about back to the BEIR and UNSCEAR level before ICP lowered it in 1990."*)The Nuclear Information and Resource Service interprets this as further evidence that unnecessary radiation exposures should be avoided. "This means that the government is not justified in deregulating nuclear power and weapons waste-releasing it to regular trash or "recycling" it into everyday household items as proposed by 5 US federal agencies at the behest of nuclear waste generators hoping to save money," stated Diane D'Arrigo, Radioactive Waste Project Director at Nuclear Information and Resource Service Radioactive (NIRS). "This also means that remediation of radioactive sites should be done to cleaner levels and that nuclear transport standards should be strengthened." Cindy Folkers, NIRS Energy and Health Project Director stated "These findings confirm that all levels of radiation are harmful. Since nuclear power routinely releases long-lasting radiation into the air, water and soil, we must avoid a new generation of nuclear power to prevent unnecessary exposures."

Endnotes:[1] NAS Report in Brief June 2005 BEIR VII: Health Effects from Exposure to Low Levels of Ionizing Radiation pp 2-3 (for 1 cancer in 100 people exposed to 100mSv or 10 r ). More detailed calculation: National Academies of Science, Prepublication Copy, Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII Phase 2, June 29, 2005 page 500 Table 12-9. Table 12-9 indicates that average risk (cancer incidence for males and females) of getting leukemia or solid cancers is 1142 out of 100,000 exposed to 10 r. Thus a member of the public who lives for 70 years and receives the permitted 100 mr (or 0.1 r)/year could receive 7 r or 7000 mr in his/her lifetime. [US Nuclear Regulatory Commission permits 0.1 r or 100 mr per year above background to members of the public.] Comparing to BEIR VII's risk estimate of 1142 in 100,000 at 10 r, to the 7 r lifetime dose permitted by NRC:(7r/10r= 0.7) we get 0.7 x 1142 = 799 cancers in 100,000 population at 7 r or 799cancers/100,000 exposed = 1 cancer in 125 exposed (to 7 r over lifetime). [2] At 0.1 Sv (100 mSv or 10 r) the risk is 1 in 100 getting cancer (NAS Report in Brief Jun 2005 pp2-3. At 2.5 Sv (worker legal dose) the dose and risk are 25x

higher or 25 in 100 (or 1 in 4) exposed getting cancer...but since workers are exposed later in life than the general public, adjusting for age would correct the risk to about 1 in 5 exposed to the full legal amount for their working lives getting cancer from those exposures. [3] 10 CFR 20 subpart C, Occupational Dose Limits limit workers to total effective dose equivalent of 5000 millirems or 50 milliSieverts (5 rems or 0.05 Sv) per year. If it is low LET radiation, this is comparable to 5000 millirads or 50 milliGray. [4] National Academies of Science, Prepublication Copy, Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII Phase 2, June 29, 2005 page 500 Table 12-9. There will be 570 fatal cancers in 100,000 exposed at 0.1Gy or 10 r. ( $100,000/570=175$ ) Approx 1 in 175 so exposed will get fatal cancer.

*Copies of Health Risks from Exposure to Low Levels of Ionizing Radiation (BEIR VII - Phase 2) are available from the National Academies Press at [www.nap.edu](http://www.nap.edu)*