

Radiation Effects Research Foundation (RERF)  
Senior Review Panel Questionnaire

1. Do you believe that continuing the Life Span Study of 120,000 individuals of all ages (of whom 40% are surviving) is important for the purposes of your Commission?

The Nuclear Regulatory Commission (NRC) considers the Life Span Study (LSS) cohort to be a source of some of the most important radiation-induced health effects information upon which the U.S. system of radiological protection is based. The LSS cohort has several features that make it particularly valuable:

- the number of individuals included in the cohort is large,
- the cohort includes members of both sexes and a variety of ages at the time of radiation exposure,
- the radiation exposures attributable to an atomic bomb range from negligible to several Sieverts, and
- the members of the cohort have been monitored for over 50 years.

The recent inclusion of cancer morbidity information has increased the value of the cohort. Continued monitoring of the survivors in this cohort is especially important because many of these individuals were relatively young at the time of exposure.

The LSS should be continued for the next 15 to 20 years. Much information on cancer incidence and non-cancer disease occurrence, especially health effects information from the youngest members of the LSS cohort, will be obtained during the next two decades. However, there is relatively little epidemiological information for healthy groups of individuals exposed to low doses of ionizing radiation. Additional information on cancer incidence attributable to radiation exposure less than 100 mSv is needed by the nuclear regulatory community in order to continue to support NRC regulations, and assure that there is adequate protection of public health, safety, and the environment. This work is also important to continue efforts to bridge the gap between epidemiology studies of radiation exposure and cellular/molecular radiation biology. More important, additional information on non-cancer disease occurrence and cataracts (e.g., posterior subcapsular cataract) formation is desired. Both categories of late occurring illness/injury are thought to be deterministic in nature. However, recent scientific publications involving atomic bomb survivors and emergency responders to, and cleanup workers at, the Chernobyl nuclear power plant suggest that the threshold for induction health effects may be many times less than previously believed. The International Commission on Radiological Protection (ICRP) recommends an annual equivalent dose to the lens of the eye of 0.15 Sv. For example, the ICRP recognizes that additional information on the sensitivity of the eye is forthcoming and will review their recommendations when it becomes available. The NRC lens dose limit is 0.15 Sv (15 rem) per year. Consequently, additional information from the LSS, and other radiation exposure cohorts, is needed to confirm that the NRC lens dose limit is adequately protective for occupational workers.

2. RERF is considering whether to expand part of the clinical studies cohort (the Adult Health Study) who were under age 10 at the time of the Bomb in order to better understand the sensitivity of the young to radiogenic effects. Is this work relevant to your Commission? In your opinion, should it be done?

Understanding the delayed health effects attributable to radiation exposure, especially exposure to more sensitive members of the general public (i.e., children) is of interest to the NRC. There are relatively few data sources for pediatric radiation exposure and long term non-cancer disease surveillance. The issue to consider is whether there is a sufficient number of members in the LSS cohort that were younger than 10 year old at the time of radiation exposure. The RERF should demonstrate that there are sufficient numbers of children in the LSS for inclusion into the Adult Health Study for there to be sufficient statistical power to conduct meaningful analyses on non-cancer health endpoints. There are a number of sources of bias and confounding variables that will need to be considered. Unless there is a reasonable expectation that additional information will be obtained, the expansion of the clinical studies cohort should not be a high priority.

3. Does your Commission find the study by RERF of non-cancer diseases and their induction by radiation of value?

Since 1990 evidence has accumulated that the frequency of non-cancer diseases is increased in some irradiated populations. The strongest statistical evidence for the induction of these non-cancer effects at effective doses of the order of 1 Sv derives from the most recent mortality analysis of the Japanese atomic bomb survivors followed after 1968 (Preston et al., 2003). That study has strengthened the statistical evidence for an association with dose – particularly for heart disease, stroke, digestive disorders and respiratory disease. However, the Commission notes current uncertainties on the shape of the dose-response curve at low doses and that the LSS data are consistent both with there being no dose threshold for risks of disease mortality and with there being a dose threshold of around 0.5 Sv.

4. The F<sub>1</sub> cohort (children of atomic bomb survivors) has been studied beginning in 1946. The subjects are now about 50 years old on average. Is the continued study of the cohort of value to your Commission?

The U.S. National Academies in the BEIR VII report noted that the principal messages from the Japanese studies is that there is “no significant adverse effects in over 30,000 progeny from parents with estimated conjoint gonadal dose of the order of about 0.4 Sv or less.” In a February 2007 news release, RERF investigators reported that there was “no evidence suggesting increased risk associated with parental radiation exposure” and a “negative association of parental dose and prevalence rate of multi factorial diseases.” RERF studies on birth defects, mortality, chromosome abnormalities, and serum proteins also indicate there is no radiation effect on the F<sub>1</sub> cohort. With these observations in mind, continued study of the F<sub>1</sub> cohort is not a high priority to the NRC and probably should not be a high priority to the RERF.

5. Are there modifications to these primary research activities of the RERF that you believe would be helpful to the mission of your Commission?

Risk communication to members of the public should be a programmatic priority for each RERF research activity. Members of the public do not perceive radiation as a weak carcinogen. Rather, any illness or death often is attributed to possible radiation exposure. Yet, data from the RERF LSS does not support this perception. For example, information obtained from the RERF website indicates that as of the end of 1990, a total of 4,687 nonleukemia cancer deaths had occurred among the 50,113 LSS survivors with significant exposure (5 mSv or more). If this population had not been exposed to radiation, RERF estimates that 4,306 cancer deaths would have occurred during this time. The number of cancer deaths attributable to atomic bomb radiation is 339, or 7 percent. For those LSS survivors receiving between 5 mSv and 200 mSv, 63 of 3,391 cancer deaths, or 2 per cent, may be attributable to radiation exposure. These are very low numbers. It is vital that the RERF staff increase its efforts to educate the public about the relative hazards of exposure to ionizing radiation. This is also especially true with regards to radiation-induction of non-cancer diseases.