Reviewer's report

Title: Are passive smoking and air pollution a greater health risk than major radiation incidents?

Version: 1 Date: 22 November 2006

Reviewer: Yasuhiko Yoshimoto

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General
This is a review article. Also author's conclusions are misleading. For policy decisions in public health services, QALY has been developed to quantify a health impact that takes into account changes into longevity and quality of life. ICRP also has developed a concept of radiation detriment, including cancer incidence and hereditary effects, with a dosimetric quantity effective dose for radiological protection in low dose and low dose rate range from daily practices. In the case of major radiation incidents it is important whether countermeasures to reduce radiation exposure of the individual were timely and adequate or not. A primary target of radiological protection depends on the type of each radiation incident situation. For example, effective dose is not appropriate in making decisions on the necessary treatment for ARS at extremely high doses. An increase of thyroid cancer incidence has still continued in the former USSR contaminated areas by Chernobyl accident. Continuous efforts are essential to share the past experiences scientifically with the public and build a sound risk communication.

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)
Title: Title is not appropriate. Author could not derive to the question a balanced and impartial comparison of ionizing radiation, air pollution, obesity, and smoking, particular with respect to major radiation incidents on which author focuses.

Background:
It should be pointed out that;
1) It is an international consensus by Chernobyl Forum 20 years after the accident that the interventions implemented by the governments were mainly timely and adequate to reduce radiation exposure from the accident. For example no case of ARS was recognized among the residents in the 30 km zone around the reactor with relatively swift evacuation of the people in the areas.
2) There is no little doubt that an excess of thyroid cancer has occurred due to childhood/adolescence exposure in the Chernobyl highly contaminated areas, far beyond the 30 km zone. But the experiences indicate the excess would be reduced by an appropriate official control of uncontaminated food supplies/restrictions of 131-I contaminated food stuffs (in particular milk) and providing information to personal control over the risk after the accident and pre-information of protection action for radioiodine inhalation such as sheltering/evacuation/iodine prophylaxis and area improvement of iodine deficiency in daily life.
3) The Chernobyl accident reminds us that uncertainties for assessments of radiation doses from internal exposure are larger than those from external exposure. This may raise a concern of an increase for leukemia as well as solid cancers other than thyroid cancer in the contaminated areas. But no persuasive evidence was found to support the concern.
4) A concern of the public differs in degree for women of child-bearing age and for the population at large. Yet no evidence has been found on human for heritable genetic effects of radiation. Radiation is much less likely to have adverse genetic effects than had worried in the past when conducting many tests of nuclear weapons in the atmosphere after military combat uses in Japan in 1945. On the other hand efforts have been undertaken to identify the special population of in utero radiation exposure from Chernobyl accident. This concern may be raised because there is an association between exposures to diagnostic x-rays in utero, only 10 mGy and subsequent childhood cancers. But no convincing evidence was found because of the limited population and crude dose assessment. Among the somatic effects of radiation other than cancer, developmental effects on unborn child due to in utero exposure are of greatest concern. But they depend on the stage of gestation, the dose, and the dose rate. Termination of pregnancy is an individual decision affected by many factors. Doses below 100 mGy low LET of in utero exposure should not be considered a reason for terminating a pregnancy, especially prolonged exposures.
5) Health effects including benign neoplasms other than cancer have been linked to radiation exposure. A special attention has been paid to recent accumulated statistical evidence for the increased frequency of nonneoplastic diseases such as cardiovascular disease. But the role of radiation is uncertain in such nonneoplastic diseases and there is lack of evidence to estimate the risk in doses below 100 mGy,
especially prolonged exposures.

6) After a large scale nuclear facility accident such as the Chernobyl accident its operating organization or its national regulator may sometimes faces the allegations of acute symptoms which could be caused by radiation although the possible maximum dose is said to be less than the necessary dose to produce; they are considered to be a product of psychological stress (radiophobia used in the past as a dismissive term) or efforts to gain compensation from the organizations associated with the accident.

The psychological impact of Chernobyl accident on the local residents of the former USSR, especially women of child-bearing age, is understandable due to evacuation and relocation with the worry of possible health effects from the radiation exposures. Also intervention practices caused high radiation exposure to emergency workers including facility personnel during the accident and lesser exposure to more large recovery workers after the release of radionuclides had ceased. Over 20 emergency workers died of ARS. Psychological stress may differ for voluntary and involuntary risks. Increase in non-specific health effects other than cancer has been reported among the residents and recovery workers. It is difficult to interpret these findings in terms of radiation dose. Unfortunately the consequences of the USSR break-up also have had a profound effect on the health of the population.

The radiation risk which most of the public can encounter is small even at a major radiation incidence and its uncertainty becomes greater as the risk becomes smaller. To allay concern over this uncertainty could be reached through the timely and adequate implementation of remedial measures to reduce radiation exposure at a radiation accident and trust and public confidence at provided information of radiation risks without misleading so that the public can become more aware of and comfortable with the responsible radiation use in our daily life.

7) It is a controversy to evaluate cancer burden including the risk of leukemia and solid cancers other than thyroid cancers with a lack of clear evidence to demonstrate an excess, in Europe as a whole from radioactive fallout from the Chernobyl accident. The publication (Cardis et al, IARC, 2006), not based on the past twenty-years experiences after the accident, is particularly troublesome, perhaps even irresponsible, because the implied health consequences were based on hypothetical calculations of very large number of the population and the small cumulative dose based on average country- and region-specific doses.

8) It is obvious that health problems are different among selected issues. Radiation exposures in daily life are controllable except natural radiations. Major radiation incidents such the Chernobyl accident rarely occur. Health problems of smoking habits and obesity have a strategy as a primary prevention to attempt the entire population to move the population distribution in the direction of lower risk. The decisions to not-smoke or diet are based on the individual risk management. Health problems of air pollution are similar with respect to the responsibility of government and industry risk managements. However, more clear mechanisms of health effects from air pollution remain to be identified compared with those of radiation. It is suspected that a message by the present manuscript can allow a broader audience to gain a reasonable impression of what should be learned from the Chernobyl accident.

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Method:
1) A brief description should be needed for risk measurements such as absolute risk, relative risk (RR), excess RR, and Years of life lost (YOLL) as well as confounding factors.
2) Calculating radiations risks: Effective dose is intended for use as a radiation protection quantity. It should be noted that for the risk estimation of a known exposed population, relevant absorbed dose should be used.
3) Calculating radiation risks: It should be stated that the recent BEIR VII has defined low dose as doses in the range of near zero up to about 100 mSv of low-LET radiation.
4) Calculating radiation risks, second paragraph: Delete "At this level, excess cancers may not be observable against a background cancer rate of 20-25% in populations in industrialized countries", In a hypothetical situation this argument is nonsense because power to detect an excess depends on sample size.
5) It should be noted that risk in a population also depends on the distribution of important modifiers of risk such as age and sex.
6) YOLL is not a sensitive risk measurement and not useful for non-fatal cancer. Instead years of life lost per excess death (incidence) for a specific disease is reasonable although this measurement is not sensitive to dose.

Results and Discussion
1) References [40-49] were not clearly cited in the manuscript except Tables.
2) References should be cited in Figures.
3) Exposures and risk scenarios/ radiation risk: It should be stated that the doses relevant to ASR cases and an increase of thyroid cancer in Table 2.
4) Title in Table 2 should be "Radiation risk for cancer mortality".
5) In Table 2 general population and working population should be separated to help readers to understand.
6) Exposure and risk scenarios, third paragraph: It should be noted that each endpoint in Table 3 is the mortality from different cause group; all cause mortality for air pollution, mortality from ischaemic heart disease for passive smoking, and cancer mortality for Chernobyl emergency workers.
7) Shielded whole body kerma should be noted for radiation dose, Gy in Table 4.
8) Column title "Risk estimate" in Table 5 should be "Risk factors".
9) Uncertainty for obesity should be also summarized in Table 5.
10) Unit of exposure and baseline group should be noted in Table 5.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article of limited interest

Quality of written English: Acceptable

Statistical review: No