(This is the full letter referenced by "*Don't underestimate the death rate from Chernobyl*" published in **NATURE** 437:1089, 2005 – try this link if the first does not work)

Health and Environmental Fallout from UN Chernobyl Report

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Sir:

A recent UN press release, reported by Valeska Stephan (Nature, 437, 181; 2005) and many newspapers, suggested the health and environmental effects of the Chernobyl

accident were not as great as originally suggested. We believe that these suggestions, based on the reports of the UN Chernobyl Forum, are misleading.

First, the estimate of excess cancer mortality in the contaminated areas in Belarus, Russia and Ukraine is reported to be 4,000 deaths. The full estimate is 9335 excess cancer deaths, excluding thyroid cancer, in the next 95 years. 4175 deaths were estimated for liquidators, evacuees, and residents of Strict Control Zones, and another 5160 in other contaminated areas. This estimate is given in Health Effects of the Chernobyl Accident and Special Health Care Programmes., Report of the UN Chernobyl Forum Expert Group "Health" (EGH), Working Draft, July 26, 2005 in Table 16.4 "Predictions of background and excess deaths from solid cancers and leukemia in populations exposed as a result of the Chernobyl accident" (Cardis et al., 1996).

This estimate is not significantly different from an estimate of future cancer mortality prepared by the US government in December 1987 (Report on the Accident at the Chernobyl Nuclear Power Station, US Nuclear Regulatory Commission, NUREG-1250, Rev. 1, US Nuclear Regulatory Commission Washington, DC). In Chapter 8 on Health Effects the authors estimated about 10,000 fatal cancers associated with the accident would occur in the Soviet Union across the next 70 years. This appears comparable to the current UN estimate and not an excessive over estimate.

The NUREG-1250 also estimated 100 thyroid cancers with 10 deaths. This under estimated the 4,000 thyroid cancers with 9 deaths already reported in the contaminated areas. This thyroid cancer excess is continuing to grow, and as mentioned in the UN report may be starting in adults too. It should be noted that, while there are only 9 thyroid cancer deaths in the 4,000 thyroid cancer cases, thyroid cancer therapy is dangerous. Surgical removal of the thyroid may also remove parathyroid glands, cause permanent recurrent laryngeal nerve palsy. If the cancer has metastasized, ablative radiotherapy with iodine-131 is required. There may be recurrences, damage to salivary and lachrymal glands from iodine-131, pulmonary fibrosis may follow therapy for metastases in the lung, etc. Section 6.10 "Clinical aspects of thyroid disease" in the Chernobyl Forum EGH report lists a number of other possible sequellae. In addition, lifetime replacement thyroid hormone therapy will be required, at a minimum.

NUREG1250 also estimated some risks the UN Chernobyl Forum did not address. The excess cancer mortality outside the Soviet Union was estimated as about 4,000 cancer deaths across the next 70 years. Thus a reasonable estimate of cancer risks from the Chernobyl accident, even though dose data was erratic and preliminary, would not lead to an extremely high estimate.

Second, the absence of statistically significant increases in solid cancers in the Chernobyl Forum report is expected. As the Forum pointed out, there is an important caveat relative to the data on solid cancer; a typical minimum latent period for solid cancers is of the order of ten-fifteen years. "...so no increase in risk for solid cancers would be expected to manifest itself until the end-1990s at the earliest. Thus, if solid cancers are to occur from Chernobyl radiation exposure, they would only now begin to

appear." Consider that smoking-related illnesses often only appear after 20-30 years of exposure. So, this new UN Chernobyl report confirms that earlier estimates of risks were not excessive and results are proceeding as would be expected.

Third, there is good evidence of very high levels of non-cancer morbidity, some of which stems from the treatments for cancer patients have received. For example, from clinical studies of 1502 children living near Chernobyl have found that 14.4 % were diagnosed with goiter (Shestopalov, V., M. Naboka, E. Stepanova, E. Skvarska, T. Mousseau, and Y.Serkis. 2004. Risk assessment of morbidity under conditions with different levels of radionuclides and heavy metals. Bulletin of the Chernobyl Zone 24(2): 40-47). There is also evidence of genetic damage in human, animal and plant populations surrounding Chernobyl (e.g. Weinberg HS, Korol AB, Kirzhner VM, et al. 2001. Very high mutation rate in offspring of Chernobyl accident liquidators. PROCEEDINGS OF THE ROYAL OCIETY OF LONDON SERIES B-BIOLOGICAL SCIENCES 268 (1471): 1001-1005; Ellegren H, Lindgren G, Primmer CR, et al. 1997. Fitness loss and germline mutations in barn swallows breeding in Chernobyl NATURE 389 (6651): 593-596; Møller AP, Surai P, Mousseau TA. 2005. Antioxidants, radiation and mutation as revealed by sperm abnormality in barn swallows from Chernobyl PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES 272 (1560): 247-252). Much of the information on this subject appears to have been ignored by western scientists, perhaps due to language barriers. Also, the worst consequences may be yet to come if genetic defects accumulate in the coming generations, as has been suggested for Chernobyl barn swallows (Møller AP, Surai P, Mousseau TA. 2005. Antioxidants, radiation and mutation as revealed by sperm abnormality in barn swallows from Chernobyl PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES 272 (1560): 247-252).

It is perhaps surprising that the Chernobyl Forum and popular media are down-playing the effects of Chernobyl. Compare the impact of 9/11 (about 3,000 deaths of civilians and emergency responders) with Chernobyl (4,000 – 10,000 deaths). The U.S. spent about $38 billion dollars in compensation for losses (deaths and property damage insurance) for 9/11 (Rand Corporation. 2004. Compensation for Losses from the 9/11 Attacks). This does not count the other costs like increased airport security, increased military spending, rebuilding New York, and increased insurance costs. The number of people resettled into less contaminated areas following Chernobyl is comparable to the number displaced by Hurricane Katrina and yet recovery dollars spent on Katrina are likely to exceed Chernobyl by at least an order of magnitude.

We believe it is too early to assess the overall impacts of radionuclide exposure on human health or plant and animal populations. In particular, it is too early to assess possible consequences stemming from multigenerational accumulation of genetic defects. As we approach the 20th anniversary of the Chernobyl disaster we should be more sensitive to the long term implications rather than suggesting that the coast is clear for redevelopment in the contaminated zones. Health impact assessment combines two stages: the exposure assessment (dose-response) and the risk assessment. These two stages are overlapping and interconnected and the prioritizing of the exposure assessment can lead to risk underestimation. Any final judgment must be drawn upon all available

epidemiological evidence. Up to this point, most studies have focused on cancer due to funding constraints with very little investment in studies of non-cancer morbidity or model systems. Perhaps a more cautious and appropriate course of action would involve support for rigorous, long term studies of humans, plants and animals of the contaminated zones. Model organisms with relatively short life-spans may provide a clear picture of the long term (multigenerational) consequences for human health, while humans exposed to Chernobyl are a unique population and must be supported and observed far into the future. Given the long latency period for many diseases and the growing interest in rejuvenating the nuclear power industry, it is imperative that studies of the affected populations continue.