"Maximus De Minimus"

or

How the Nuclear Regulatory Commission Proposes to Zap You with High Doses of Radiation And Not Tell You About It

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The NRC claims a de minimus standard is needed "to avoid extending regulatory actions beyond what is needed to adequately protect public health" (FR 51, p. 1113). "It would constitute a level of risk so low that no resources could be justified to control it [the level of risk, or dose rate as a surrogate] or to be further concerned with it" (Ibid.). The NRC proceeds through a derivation which purports to support a dose of one mrem per year to indviduals as an appropriate de minimus level (FR 51, pp. 1113-1114, 1133). We will demonstrate that this level results from a flawed derivation, is subject to widespread abuse, is inconsistent with accepted risk-benefit analytic procedures, and is an unjust standard.

NRC's Flawed Derivation. Let us accept for a moment the NRC's premise that an incrementally added lifetime risk of dying of one chance in a million is insignificant. The NRC assumes a cancer fatality risk coefficient of 1.6×10^{-4} cancer deaths/rem and derives a de minimus level of 0.1 mrem/yr (FR 51, p. 1113). But when you turn the page the NRC proposes 1 mrem/yr as the de minimus level (FR 51, p. 1115). With absolutely no justification, the Commission simply raised the level by a factor of 10.

There are three other flaws in the NRC's derivation. First, the risks of genetic damage from radiation have been ignored. [Explain] Second, many would argue that cancer incidence rather

than cancer death should be the basis for the cancer risk coefficient. This would increase the de minimus level by an additional factor of 2. Third, many experts would argue that the Commission's cancer risk coefficient is no longer valid in light of recent revisions in the estimates of cancer risk to the Japanese exposed at Hiroshima and Nagasaki. Correcting the errors in previous dose calculations and increases in the solid tumor incidence among the survivors forces the cancer incidence risk coefficient up above 10^{-3} cancers per rem, roughly a factor of 10 higher than that assumed by the NRC.

Taking all of these factors into account would lead to a de minimus level of 0.01 mrem/year, a factor 100 times smaller than that proposed by the NRC.

Potential for Widespread Abuse. We don't have to speculate whether the de minimus concept will be abused by the nuclear industry. Abuse is already occurring. The General Electric Company and the NUS Corporation have prepared a report for the Department of Energy a "Final Safety Analysis Report for the Galileo Mission and the Ulysses Mission" (GESP 7201 and NUS 4784, 17 December 1985) which analyzes the risks associated with a spacecraft accident during the launch of Pu-238 thermoelectric generators. The NRC's proposed de minimus rule is applied in the analysis.

Recognizing that the NRC has already jacked the de minimus level up by a factor of 100 before the standards were proposed (see discussion above), it is useful to analyze how they are further manipulated by the user. First, since Pu-238 has a long half-life, GE/NUS claims that a de minimus rate of 1 mrem/yr translates into a 50 year lifetime dose commitment of 50 mrem. Bingo - the de minimus level is now a factor of 50 higher.[1]

The GE/NUS analyzes radiation risks from a spacecraft accident in terms of "effective whole body committed dose equivalent" as defined in IRCP-30. Since plutonium is a bone seeker (when soluble), or is deposited largely in the lung (when insoluble), a 50 mrem effective whole body committed dose equivalent de minimus level translates into 1700 mrem to the bone surface or 400 rmem to the lung![2] If a 70 year dose commitment is assumed, the de minimus level for bone surface exposure by plutonium becomes a whopping 2.3 rems -- maximus de minimus!

NRC's Improper Use of Benefit-Cost Methodology

What is the flaw in NRC's approach? First, in applying benefit-cost methodology one compares marginal costs with the

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1/ In passing, it is perhaps worth noting that GE/NUS use a 50 year dose commitment rather than 70 years (the average lifetime assumed in the de miniumus derivation at FR 51, p. 1113). The dose commitment at 50 years is only one-half that at 70 years.

2/ The weighting factors recommended by ICRP are 0.03 for bone surface and 0.12 for the lung (see ICRP 30, p. 6). These same weighting factors have been adopted by the NRC (FR51, p. 1096).

marginal benefits of the same action. You do not, as NRC would have us do, weigh the cost against some extraneous cost, e.g., natural background radiation. The NRC has been the leader among Federal agencies in the abuse of benefit-cost methodology -- applying it to low probability high consequence reactor accidents well beyond the bounds of credible data. It is interesting how quickly the NRC abandons the methodology when its application to low-dose high consequence scenarios demonstrates unacceptable risks.

Suppose the United States and the Soviet Union had been somewhat more prudent in their efforts to test nuclear weapons in the atmosphere so that the dose to individuals in the Northern and Southern hemisphere did not exceed 1 mrem/year. Under NRC's proposed rule this ends the discussion. But some 4 billion people would be exposed at this level year after year. The effect is:[3]

$$(0.001 \frac{\text{rem}}{\text{person}})\ (4 \times 10^{9}\ \text{persons})\ (2 \times 10^{-3} \frac{\text{cancers induced}}{\text{rem}})$$

$$= 8000 \frac{\text{deaths}}{\text{year}}$$

Most would argue that these lives are worth saving. The benefit of saving thousands of lives a year outweighs the marginal cost of shifting to underground testing.

As a second example, suppose you are a terrorist. Can you kill innocent civilians in a way that is acceptable to the NRC? The answer is yes. All you have to do is choose a method for randomly killing not more than one individual for each one

million potential victims. A single gun shot on a crowded Manhattan street with your eyes closed should do it. Not only are the risks to the New Yorkers acceptable by NRC standards, the justification, or lack thereof, for the murder is not worthy of analysis.

NRC's Unjust Standard

What is wrong with NRC's theory of justice? It totally ignores inequities in the distribution of benefits and costs of a proposed action. Even benefit-cost methodology is inappropriate where the benefits and the costs are not shared by the same individuals. Random violence by the nuclear industry cannot be made acceptable by spreading the risks among a larger population by, for example, diluting radioactivity in the global commons or permitting it to ooze into the environment over several generations. If the NRC chooses to permit this it is certainly worthy of analysis, perhaps even removal from office.

Finally, the GE/NUS report calculates only the dose which would result from continuing exposure to materials in the environment over a period of one year even though dose commitments would continue to be accumulated due to exposure in subsequent years. Under some accident scenarios, for example, where the activity is released at high altitudes, the effective period of exposure could be a decade or more. Thus, applying the

de minimus level to only the dose commitment from the first year exposure has the effect of increasing the de minimus level, in some cases by as much as a factor of 10 or more.

The inquisitive reader will want to multiply all of these factors together, inlucing the factor of 100 introduced by the NRC prior to proposing the de minimus level. I hesitate to do so recognizing that Justice Department attorneys and Kansas judges are incapable of believing anyone as honorable as the NRC, GE and NUS could foster a series of manipulations to produce such divergent consequences.

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4 See Johnson v. United States, 597 F. Supp. 374 (D. Kan. 1984).