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Definitely Not
Below Regulatory Concern:

What is Wrong with the New NRC Policy

by

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I. The NRC's BRC Policy

Based on an estimated cancer risk coefficient of 5×10^{-4} fatal cancers per person-rem, the Nuclear Regulatory Commission (NRC) proposes to exempt from regulatory control "practices"[1] that result in:

(a) an individual dose rate of 10 millirem/year (mrem/y), or 1 mrem/y, depending on the practice; and

(b) a collective dose rate less than 1000 person-rem/y, where individual doses rates below 0.1 mrem/y are not counted in the summation of the collective dose.[2]

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[1] "Practice" is defined by the NRC as "a defined activity or a set or combination of a number of similar coordinated and continuing activities aimed at a given purpose that involves the potential for radiation exposure." Examples include: "disposal of specific types of very low-level radioactive waste; the release for unrestricted public use of lands and structures with residual levels of radioactivity; the distribution, use, and disposal of specific consumer products containing small amounts of radioactive material; and the recycle and reuse of specific types of residually contaminated materials and equipment. Nuclear Regulatory Commission, "Below Regulatory Concern Policy Statement," June 27, 1990, p. 5.

[2] NRC, BRC Policy Statement, pp. 7-9.

II. Problems with NRC's Cancer Risk Coefficient

The NRC has incorporated two factors into its cancer risk coefficient[3] that make radiation exposure appear three to four times smaller than it would otherwise. First, the NRC does not count the cancers caused by radiation exposure which do not result in death; and second, the NRC reduces its risk estimate if the radiation exposure rate is low. With regard to the first, cancer morbidity (incidence) is 1.5 to 2 times higher than cancer mortality (death). By counting only cancer fatalities, rather than all cancers, the NRC's cancer risk coefficient is reduced by 1.5 to 2 times. Women who survive radiation-induced breast cancer are surely pleased to have survived, but undoubtedly they would have preferred not to have developed cancer in the first place. All cancers should be counted.

We turn now to the second non-conservative factor incorporated into the NRC's cancer risk coefficient. To obtain its cancer risk coefficient (5×10^{-4} cancer fatalities/person-rem) the NRC has applied a dose reduction factor of 2 to the estimate of the cancer risk coefficient found in the 1988 UNSCEAR

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[3] A cancer risk coefficient is a parameter that expresses the number of cancers that will occur per unit of radiation exposure, expressed, for example, as the number of cancer fatalities per person-rem. A rem is a unit of radiation absorbed dose equivalent, often referred to as simply "dose." The international unit is the seviert (Sv), where one Sv = 100 rem. A person-rem (or person-Sv) is the collective dose to a group of individuals.

Report, and rounded the result[4]. NRC and others have contended that a dose reduction factor of 2 to 10 is appropriate because the risks estimated at high doses and dose rates may overestimate the effects at lower doses and dose rates. The most recent estimate of the cancer risk coefficient by the National Academy of Sciences' BEIR Committee (BEIR V) is 8×10^{-4} cancer fatalities/person-rem, for continuous lifetime exposure at 100 mrem/y.[5] Despite references to a dose reduction factor, the BEIR V Committee, unlike the NRC, chose not to apply one in its quantitative estimates for continuous lifetime exposure at 100 mrem/y. The NRC's BRC limit applies to doses delivered at a rate of 10 mrem/y, a rate 10 times smaller. Since no hard evidence exists that a dose reduction factor is appropriate for human exposure at either 100/mrem/y or 10 mrem/y, the NRC's application of a dose reduction factor of 2 is not conservative and should not be applied. If the BEIR V estimate of the cancer risk

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[4] The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in its 1988 Report to the General Assembly gives as its estimate of the cancer risk coefficient: 7.1×10^{-4} cancer fatalities/person-rem. Reducing this by a factor of 2 gives 3.6×10^{-4}. The NRC value of 5×10^{-4} is said to be consistent with this value; NRC, BRC Policy Statement, p. 13.

[5] National Research Council, "Health Effects of Low Levels of Ionizing Radiation (BEIR V)," (Washington, D.C.: National Academy Press, 1990), p. 172; we have taken the average lifetime mortality estimates for males and females [(520+600)/2)/100,000 = 5.6×10^{-3}] and divided by the average lifetime of 70 years to obtain the cancer fatality risk coefficient, i.e., 5.6×10^{-3} / 70 = 8×10^{-4}.

coefficient were applied without a dose reduction factor of 2, the cancer risk coefficient would be 8/5 = 1.6 times higher.

Combining the above two factors results in a cancer risk coefficient that is 2 to 3 times higher than assumed by the NRC, i.e., $1.2\text{-}1.6 \times 10^{-3}$ cancers/person-rem. In discussion below we will examine the implications of the NRC's BRC dose limits using both the NRC's risk coefficient 5×10^{-4} cancer fatalities/person-rem, and the risk coefficient derived here and rounded to 1×10^{-3} cancers/person-rem.

III. The Individual Dose Limit Is Too High

To determine pesticide limits for foods, the EPA and FDA both use a risk-based guideline of 10^{-6} lifetime risk of cancer incidence.[6] Assuming the NRC's cancer risk coefficient, 5×10^{-4} cancer fatalities/person-rem, a 70 year lifetime, and a ratio of cancer incidence to death of 1.5, the EPA/FDA guidance translates into an average annual individual dose rate limit of 0.02 mrem/y. This a factor of 50 lower than the 1 mrem/y limits adopted by NRC under the BRC policy, and 500 times lower than the 10 mrem/y

6 See, for example, Environmental Protection Agency, "Captan: Intent to Cancel Registrations; Conclusion of Special Review, Notice of Final Determination" Federal Register, February 24, 1989, pp. 8121-8122.

limit! Risks that are apparently of no concern to the NRC are of considerable concern to other federal agencies.

IV. The Collective Dose Limit Is Too High

The NRC has decided not to regulate radiation exposures if the collective dose rate less than 1000 person-rem/y. At this limit, practices that kill up to one person every two years (applying the NRC risk coefficient), or that result in more than one cancer per year (assuming 10^{-3} cancers/person-rem), would not be regulated. This is tantamount to a license to kill -- as long as the violence remains random. Using a handgun to shoot and kill one person in New York city is murder -- even if the selection of the individual to be shot is completely random and his/her individual risk is less than one in a million. Yet, if such random death is the result of radiation poisoning there is no problem -- at least under the new NRC policy.

The situation is actually far worse. In calculating the collective dose rate, NRC does not count exposures where the individual dose rate is below 0.1 mrem/y.[7] This means if the individual risk of death is less than 5 in 10 million per year (applying the NRC cancer fatality risk coefficient), or less than

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[7] NRC, BRC Policy Statement, June 27, 1990, p. 9.

one cancer in a million per year (assuming a cancer <u>incidence</u> risk coefficient or 10^{-3} cancers/y), the risk to these individuals will not be counted in weighing the costs and benefits of the proposed practice.

The failure to count potential health effects caused by radiation exposures at low dose rates has the effect of adopting a dose threshold below which the effects are zero. But NRC purport to use the linear no-threshold hypothesis,[8] and even states,

> It is important to emphasize that, in this policy, the Commission does not assert an absence or threshold of risk at low radiation dose levels but rather establishes a baseline level of risk beyond which further government regulation to reduce risks is unwarranted.[9]

Then, in an abrupt about-face, the NRC provides two arguments for adopting a dose rate threshold. First, it says this "may unduly complicate the dose calculations that will be used to support demonstrations that proposed exemptions comport with the criteria in this policy," and it "introduce[s] unnecessary complexity into the collective dose assessments."[10] This is a specious argument. Calculations like these are done routinely in the health physics

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[8] Ibid., pp. 7 and 14.

[9] Ibid., p. 7.

[10] Ibid., p. 9.

profession, as for example, as part of EPA's 40 CFR 190 rulemaking.

The Commission's second argument is that "the calculations could impute an unrealistic sense of the significance and certainty of such dose levels."[11] But are we to assume that setting the risk at low dose equal to zero provides a more "realistic sense of significance and certainty"? Nonsense.

The Commission's understanding of current knowledge of the cancer risk at low doses is reflected in the following statement by the Commission,

> "More recently, the BEIR V Committee of the National Academy of Sciences/National Research Council states that it 'recognizes that its risk estimates become more uncertain when applied to low doses. Departures from a linear model at low doses, however, could either increase or decrease the [estimation of] risk per unit dose.' The Commission understands that the Committees's statements reflect the uncertainty involved in estimating the risks of radiation exposure and do not imply either the absence or presence of detrimental effects at such low dose levels."[12]

Without knowing whether the effects at low doses and low dose rates are higher or lower than predicted by the linear model, it is unconscionable to err, as does the NRC, on the side of not protecting public health.

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[11] Ibid.

[12] Ibid., p. 13.

To better appreciate the implications of the NRC's threshold dose rate assumption, we examine the following cases:

Case 1.-- Disposal of transuranic waste in a solid waste landfill. Suppose it were shown that the long-lived transuranic radionuclides could contaminate an aquifer that serves as the water supply for one million people. Under the NRC's BRC limits it would be perfectly alright to kill five people over each 100 year period (a small fraction of the lifetime of some transuranic radionuclides), or to cause ten cancers every 100 years (assuming 10^{-3} cancers/person-rem) for hundreds or even thousands of years.

Case 2.-- Routine release of radioactive tritium, carbon, noble gases, and/or halogens into the atmosphere. Each of these elements will spread over the global commons. If one assumes a linear non-threshold relationship between dose and effects, the greatest potential impact would be the cumulative effect of exposing a very large number of people (e.g., 4 billion people in the northern hemisphere) to very small individual doses over long periods of time -- for tens of years in the case of tritium ($T_{1/2}$ = 12.3 y) and krypton-85 ($T_{1/2}$ = 10.7 y), for thousands of years in the case of carbon-14 ($T_{1/2}$ = 5730 y), and for millions of years in the case of iodine-129 ($T_{1/2}$ = 16 million y). It is this concern that led to the banning of atmospheric nuclear weapons tests and the EPA's implementation of emission limits on commercial nuclear fuel reprocessing plants to control the release of the above isotopes (40 CFR 190). Under the NRC's BRC limits it would be perfectly alright to err on the side of killing 200 people per year in the northern hemisphere, or to cause 400 cancers per year (assuming 10^{-3} cancers/person-rem) for hundreds, or even thousands of years.

There are many variations of the above two cases. For example, the 0.1 mrem/y threshold will likely be used in assessing the potential effects of an accident during the space launch of nuclear reactors, including the thermoelectric generators (e.g., SNAP reactors) that utilize plutonium-238 ($T_{1/2}$ = 87.7 y) as a heat source. The potential exposures could be to as many as one million people (similar to case 1) if the reactor was destroyed early in the launch trajectory, or to the entire population in the northern hemisphere (similar to case 2) if it burned up upon reentry.

V. NRC's Theory of Justice

Judging the merits of a proposed action commonly involves weighing the benefits against the costs of the activity. The NRC's BRC Policy does not require this. Instead, its policy relies on an assumption that if radiation doses to individuals from a proposed activity are small compared to their exposure from natural background and medical radiation, that is, 1-10 mrem/y compared to 300 mrem/y, then it is probably not worth regulating the practice. Under the BRC approach the NRC is not weighing benefits against costs, but instead weighing the costs of the proposed activity against an extraneous cost (natural background radiation). By analogy, under the NRC philosophy it would be acceptable to shoot someone in Washington, D.C., since the inhabitants have shown a willingness to live with a murder rate that is already high.

Even if the NRC corrected this deficiency one must bear in mind that decisions based on cost-benefit methodology are only appropriate where the benefits and costs are shared by the same individuals. Under the BRC Policy, most of the benefits will accrue to the nuclear industry, while most of the cost will be passed along to future generations. There is no justice in such a policy.

In its infancy, the Atomic Energy Commission's prevailing philosophy was to control risks associated with radioactivity emissions and waste disposal through dilution. Subsequently a consensus emerged that this approach was wrong, and increasingly the philosophy shifted to containment. The NRC with its BRC policy is turning the clock back -- advocating a policy of diluting radioactivity in the global commons and permitting it to ooze into the environment over several generations. This is a policy that condones and legitimizes random violence by the nuclear industry, so long as the risks are spread over larger populations.

VI. Conclusion

The individual dose rate limits of 1 mrem/y and 10 mrem/y are 50 to 500 times too high, respectively, when compared to agency guidance with respect to food contamination. Truncating the calculation of the collective dose -- by ignoring exposures below 0.1 mrem/y -- should not be permitted. Even without truncating the collective dose calculation, a collective dose limit of 1000 person-rem is too high. Finally, limits on the individual dose rate and collective dose are not the only factors which should be considered in determining whether to exempt a practice from regulatory control. One must also weigh the costs of controls against the potential for a commensurate reduction in risk. Finally, injustices to the exposed population must be considered. Even if the benefits of deregulation are percieved to outweigh the risks, it is inappropriate if my advantages derive from your cancer.