Comments
by
Committee to Bridge the Gap
Nuclear Information and Resource Service
Physicians for Social Responsibility-Los Angeles
Southern California Federation of Scientists
on
NCRP SC 5-1 Draft Report

"Decision Making for Late-Phase Recovery from Nuclear or Radiological Incidents"

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Abstract

The National Council on Radiation Protection and Measurements (NCRP), an organization with close ties to the nuclear industry and agencies, has issued a draft report, "Decision Making for Late-Phase Recovery from Nuclear or Radiological Incidents." The document is controversial and deeply troubling. At its core, it recommends jettisoning longstanding cleanup standards that are based on protecting public health and replacing them with a vague "optimization" process that would allow the economic interests of the nuclear industry and agencies to override health considerations.

In the place of longstanding health-based cleanup standards, NCRP now proposes setting cleanup levels for many radiological releases in the 1 to 20 milliSievert/year (mSv/y) range, with such doses to be permitted to extend for one's entire life. These are extraordinary doses. 20 mSv/y is the equivalent of approximately one thousand chest X-rays annually, or three chest X-rays every day of your life, from the moment of birth to the moment of death. Of course, there would be no informed consent or medical benefit from such exposure, only medical detriment.

20 mSv/y over one's lifetime would produce an excess cancer in **one in every six people exposed**, based on the most current radiation risk estimates from the National Academy of Sciences and EPA. This risk is above and beyond the cancer risk existing without that radiation exposure. This is a breathtaking recommendation. We have historically required cleanup at a cancer risk range of one in a million (10^{-6}) with the ability to fall back to no more than a one in ten thousand (10^{-4}). **The 20 mSv/y recommendation thus would allow cancer risks a thousand to a hundred thousand times what is normally permitted**.

Even the lower end of the NCRP proposed range, 1 mSv/y, would produce a cancer in every 123 people exposed. That too is way outside the EPA acceptable risk range—one hundred to ten thousand times higher.

The problems associated with the dose recommendations in this NCRP draft report are exacerbated by its specific recommended allowable concentrations in soil for individual radionuclides. The report recommends allowing responsible parties to avoid having to clean up contamination they have created, and instead requiring people to be exposed to astronomically high radionuclide concentrations. **The radionuclide concentrations that NCRP proposes be allowed to be left in place, i.e., not cleaned up, are in some cases tens of millions of times higher than EPA's remediation goals for the same radionuclide for the same exposure scenario.**

In short, NCRP is recommending forcing people to be exposed to levels of radioactivity orders of magnitude higher than generally considered acceptable, rather than requiring those responsible to clean up the contamination. It wishes to save money by taking lives. We strongly believe the draft report is scientifically and ethically problematic, and should be withdraw rather than finalized.

Background

The nuclear industry and agencies responsible for large amounts of radioactive contamination, e.g. the Department of Energy (DOE), have long wished to avoid the cost of cleaning up contamination that may be released from their facilities. It is far less expensive to push for weakening radiation standards than it is to comply with protective ones.

During the George W. Bush administration, these forces, and their allies within the Nuclear Regulatory Commission (NRC) and certain EPA divisions (Office of Radiation and Indoor Air, or ORIA, and the Office of Emergency Management, or OEM), commenced a concerted effort to weaken radiation protections. Given the special status provided to terrorism concerns, the initial step was to attempt to relax radiation standards for responding to an Improvised Nuclear Device (IND) or a Radiological Dispersal Device (RDD, or "dirty bomb").

In 2008, the Department of Homeland Security (DHS) issued new Protective Actions Guides (PAGs) for dealing with a terrorist detonation of a nuclear bomb or a dirty bomb. Mixing of the two was obviously inappropriate. No one can deny that a nuclear weapon explosion could cause massive and widespread destruction. However, a dirty bomb is orders of magnitude smaller in effect. Indeed, the draft NCRP report asserts that even a large dirty bomb might affect tens of city blocks; the great majority of prospective RDDs being very much smaller. Setting proposed responses for two such different events permitted proposing relaxing radiation protection standards for small events based on the claim that a massive event such as a nuclear bomb would be so extraordinary as to potentially require exceptions to normal cleanup requirements.

The DHS PAGs jettisoned normal cleanup requirement for the long-term phase and replaced it with a process called "optimization," where no health-based standard would apply and officials could pick any level they wished after the fact. The DHS PAGs further recommended using "benchmarks" for choosing cleanup standards; among the ones contemplated were levels of 10 – 100 mSv/yr. These are extraordinarily high doses. The latter

would cause an excess cancer in every other person exposed, if exposed for thirty years, according to EPA's current radiation risk figures.

The DHS PAGs produced a flurry of concern from the public and from health and environmental organizations. The Bush Administration nonetheless adopted them. Public comments expressed concern that the weakened standards for terrorist events would soon be expanded to encompass all radiological releases. That was strenuously denied, but precisely that happened.

On his last full day in office in 2009, outgoing EPA Administrator Marcus Peacock signed off on new PAGs that extended the controversial "optimization" process to encompass not just nuclear weapons explosions but any radiological release of any sort – nuclear power plant and DOE facility accidents, transportation incidents, releases from radiopharmaceutical factories, etc. Here, EPA's own CERCLA standards for cleaning up the nation's most contaminated sites were proposed to be jettisoned and replaced with a vague optimization process relying on benchmarks from a range of groups extending into the tens of mSv/year, with associated cancer risks of several cancers per ten people exposed.

Unfortunately for the advocates of relaxing standards, the Bush action was late, since it takes some days before such a notice can be officially published in the Federal Register. That meant it would be published not under the Bush administration but under the incoming Obama administration. Recognizing the deeply controversial aspects of the Bush PAGs, the Obama administration withdrew it from the Federal Register before it was published, and promised a thorough review.

The proponents of gutting the nation's radiation protections did not give up, however, and a campaign began to have the Obama administration issue the PAGs, with the optimization provisions intact. As we shall see, that effort failed, and EPA has issued new PAGs which do not include "optimization" nor did it reference "benchmarks." So the advocates of dramatically weakening long-term cleanup requirements have turned to NCRP to issue recommendations they could not get into the EPA PAGs, with the hope that somehow EPA will eventually reference the NCRP recommendations or otherwise the NCRP proposals can pre-empt the EPA PAGs.

The anti-scientific aspects of this lobbying campaign should be noted: the scientific evidence, as demonstrated in the conclusions of the established scientific bodies such as the National Academy of Sciences, has continuously demonstrated ever higher risks of cancer per unit dose, yet the lobbying campaign has been always in the direction of weakening radiation standards.

The NCRP Draft Report

1. Questionable Alteration of Purpose for Which DHS Provided Funds

DHS requested, and provided funding for, NCRP to provide guidance as to how to carry out optimization for the long-term response to an IND or RDD, i.e., fleshing out the DHS nuclear terrorism response PAG. The title of the NCRP project and report, thus, was "SC 5-1: Approach to Optimizing Decision Making for Late-Phase Recovery from Nuclear or Radiological *Terrorism* Incidents."[1] (emphasis added) The report's purpose was, as NCRP itself described it:

> In an effort to more fully define the process and procedures to be used in optimizing the late-phase recovery and site restoration *following an RDD or IND incident,* DHS has requested that NCRP prepare a comprehensive report addressing all aspects of an effective optimization process.
>
> (emphasis added)

Somehow, inexplicably, shortly before issuance, the report's purpose – and even its title—was changed. "Terrorism" was removed from the title, so that it now encompassed *any* nuclear or radiological incident. And the text now urges that health-based cleanup standards be abandoned not just for responding to nuclear terrorism events but for a whole range of non-terrorist radiological releases. It further recommends an optimization process for the EPA PAGs—which do not have optimization in them. NCRP should explain why this change—which creates the perception of being based in a kind of political lobbying for weaker standards for non-terrorist radiation releases outside what DHS requested—does not violate the purposes for which DHS provided taxpayer funds.

2. Failure to Disclose Report Authors and Conflicts of Interest

It is surprising that the NCRP draft report does not disclose who authored it nor present any discussion of potential conflicts of interest, standard practice if this were indeed a scientific report. This is further of note given the report's recommendation of transparency and stakeholder involvement in optimization, a recommendation which NCRP does not seem to have followed in its own activity in this regard.

We have been able to find a list of the panel's members, and a perusal of it perhaps helps explain why NCRP has avoided identifying them in the report or discussing potential conflicts of interest.

[1] See http://www.ncrponline.org/Current_Prog/SC_5-1.html, last accessed 4/15/13

As indicated earlier, a campaign has long been underway by staff at DOE, which has a very large economic interest in reducing radiation standards and thereby cleanup obligations for contamination for which it is responsible, allied with forces within two divisions of EPA—ORIA and OEM-- that have long pushed for similar weakening of standards. To date they have in part failed with regards the EPA PAGs. The release today by EPA of its new PAGs does not include optimization for late phase response to non-terrorist radiological events, nor any reference to any specific benchmarks that could be used instead of longstanding health-based standards.

The NCRP draft report, however, does both. So it should perhaps come as no surprise that three of the key participants in the NCRP panel are from those DOE and EPA divisions. The NCRP webpage that identifies them as part of the panel (see fn 1 above) provides no information about their affiliation. It is unusual for current DOE and EPA personnel to serve on an outside panel that is in essence lobbying their own organizations to overturn policy decisions which they lost internally.

When a reporter submitted a Freedom of Information Act (FOIA) request for presentations by one or more of the above-named individuals, EPA refused to provide, claiming the individuals were not acting as agency personnel but as individuals. When EPA was asked for proof that they had in fact asked for and received permission to take time off from work for this purpose, the requests were also denied. This fails to meet standard tests of transparency.

DOE, ORIA and OEM have long lobbied for relaxed radiation standards. They hoped to get optimization into the EPA PAGs. It is a conflict of interest, and inappropriate, for their staff to now serve on a private panel lobbying to obtain the same result from the government agencies.

Much of the technical issue at the heart of the NCRP draft report is a dispute between EPA's CERCLA cleanup division, which insists on upholding EPA's long-held acceptable risk range, and ORIA and OEM, which would like to see far less protective standards.[2] And part of the technical question centered in the NCRP report is whether to rely, in calculating soil concentrations that lead to certain doses or risks, on DOE's code RESRAD or on EPA's Preliminary Remediation Goal (PRG) calculator which is under the jurisdiction of the CERCLA division. EPA has long criticized RESRAD as insufficiently accurate and protective.

The NCRP report employs primarily the RESRAD code and proposed "acceptable" soil concentrations prepared in controversial DOE "preliminary operational guidance" prepared under the DOE staffer who served on the NCRP panel. It is not surprising then that, in weighing in on the dispute between this individual and the EPA Superfund division responsible for the PRG calculator and their consultants, the NCRP report dismisses (in a single sentence) the EPA calculational method and pastes directly into the NCRP report the controversial DOE tables of extremely relaxed "permissible" concentrations of radioactivity.

[2] This conflict was revealed in an extensive set of internal EPA emails and other documents obtained by Public Employees for Environmental Responsibility (PEER) pursuant to a Freedom of Information Act lawsuit.

If one is to weigh in on a technical dispute involving two agencies and methodologies, people paid to put forward one of those approaches should not be on the panel at all. If one is to have people from that team, then there need to be equal numbers from the EPA CERCLA division responsible for the PRG calculator; and yet there was none. Instead, there were two individuals from adversary divisions of EPA that had lost the fight to have optimization included in the EPA PAGs but appear to be using NCRP as a way of continuing that battle against their agency's position.

Bias, conflict of interest, lack of independence—all seem to cripple this report, and it is evident, as we will discuss later, in the work product. One small example: The draft report pastes in a table, presumably from the DOE preliminary operational guidance document, that purports to compare their proposed cleanup levels with EPA's. Yet it uses not the EPA PRGs, which are the agency's operable standards, but decades-old soil screening guidance that has long been supplanted by the PRGs. There is not even a comparison to the PRGs provided at all. We have had to perform those calculations and will provide the results below.

In summary, it was inappropriate for NCRP to, at the last minute, change the purpose of its study from the one for which DHS funds were provided—looking at optimization for terrorist event response—to expand it to provide recommendations for optimization for all radiological releases, particularly since EPA has declined to include optimization in its PAGs just released. It is a transparent effort to try to bypass that EPA decision. The inclusion on the NCRP panel of DOE and EPA personnel from divisions that lost that fight, under the difficult-to-credit claim they are serving as individuals and got leave of absences from their agencies to do so, casts a pall over the credibility of the NCRP panel. The inclusion of people associated with the DOE proposed extraordinarily relaxed cleanup standards and methodology and the exclusion of their EPA counterparts who are responsible for the more protective standards and methodology similar is a cloud over this process.

3. <u>The Deeply Flawed Substantive Proposed Guidance</u>

At its core, the NCRP draft report is proposing that cleanup standards for radioactive contamination be dramatically weakened compared to longstanding EPA cleanup standards used for the nation's most contaminated sites. Under the NCRP recommendation, people would be sent back to their homes, farms, and offices to live and work in contaminated settings with radioactive concentrations that <u>could be as high as tens of millions of times higher than EPA's PRGs, without cleanup undertaken.</u>

Current health-based cleanup standards are generally based on EPA's CERCLA requirements for cleaning up the nation's most contaminated sites ("Superfund" sites). EPA has historically required protection of the public from contamination aimed at leaving no more than a one in a million risk (10^{-6}) of cancer from the exposure, with the ability to fall back to no more than a one in ten thousand risk (10^{-4}).

NCRP by contrast is recommending an "acceptable" range of 1 mSv/year of radiation to 20 mSv/yr. To put that in perspective, 20 mSv/year is the equivalent of approximately one thousand chest X-rays a year, every year of your life, or three X-rays a

day from birth to death. According to the National Academy of Sciences and EPA, 2 mSv/year over a lifetime would result in a cancer in every sixth person exposed. That is thus a thousand to a hundred thousand times higher risk than EPA's longstanding acceptable risk range.

Even the lower end of the NCRP "acceptable" radiation range, 1 mSv/y over a lifetime, would result in a cancer in every 123rd person exposed. This is one hundred to ten thousand times higher than EPA's historically acceptable risk range.

If one assumes only thirty years of exposure, with the standard assumption that those be one's first years, the risk at 20 mSv/y is one in eight; and at 1 mSv/y, one in about 167, still orders of magnitude beyond anything that could be considered acceptable.[3] What NCRP is proposing – choosing to not clean up radioactive contamination but instead allow people to be exposed to radiation at levels officially estimated to produce a cancer in up to every sixth person exposed -- is clearly ethically unacceptable, and if explained in plain language to the public, would produce an uproar.[4]

The risk figures are explained below:

EPA Radiogenic Cancer Risk Models and Projections for the U.S. Population[5] (the so-called Blue Book) is EPA's most up-to-date official estimate of cancer risk per unit dose, based largely on the National Academy of Sciences' *Report on the Biological Effects of Ionizing Radiation* (BEIR VII). The radiation-induced cancer risk, which incorporates a Dose and Dose Rate Effectiveness Factor (DDREF) to deal with low doses over long times, is 1.16×10^{-3} cancers per person-rem. This is age-averaged. BEIR VII's comparable figure was almost identical--1.14×10^{-3} cancers per person-rem.

Risk per unit dose of exposure for the first thirty years derived from the EPA report is about 2×10^{-3} per rem because of the increased sensitivity at earlier ages.

THEREFORE, 2 rem (20 mSv) per year over 70 year lifetime = $2 \times 70 \times 1.16 \times 10^{-3} = 1$ cancer per every 6th person exposed.

2 rem year over 30 years (1st 30 years) = $2 \times 30 \times 2 \times 10^{-3} = 1$ cancer per every 8th person exposed.

0.1 rem (1 mSv) per year over 70 year lifetime = 0.1 rem/yr x 70 years x $1.16 \times 10^{-3} = 1$

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[3] For most radionuclides of cancer, radioactive decay makes little if any difference in these estimates. The half-life of many of the key radionuclides is too long to have an effect. And even with cesium-137 and strontium-90, for example, with half-lives in the 30 year range, these order of magnitude risks at 30 years of exposure would be unaffected, particularly because the risk is front-loaded at the earlier ages.

[4] To be clear, these are excess cancer risks, risks above and beyond what cancers occur in the absence of this exposure.

[5] Available at http://epa.gov/radiation/docs/bluebook/bbfinalversion.pdf

cancer in every 123rd person.

0.1 rem per year over 1st 30 years = 0.1 x 30 x 2 x 10^{-3} = 1 cancer in every 167 persons exposed.

The normal acceptable EPA risk range has always been one cancer per one million people exposed, to 1 in 10,000, with the goal being the lower number. Thus the optimization range in the NCRP report would be orders of magnitude outside that acceptable range.

The NCRP report is completely misleading in this regard. It claims, in Table 6.5, that the lifetime cancer risk from 30 years of exposure at 1 mSv/y is in the range of 10^{-4}. This is clearly incorrect, and it is hard to understand how NCRP could make such a mistake or misrepresentation. As indicated above, the risk, using the established age-adjusted risk coefficients from EPA and NAS, is in the range of 10^{-2}—one hundred times higher. This table also appears to have come from the DOE Preliminary Operational Guidance document (which is also supposed to be limited to addressing terrorist events); but it is even more worrisome if the document contains such errors and the NCRP panel did not catch them. Perhaps to make the risk seem smaller the risk figure is for annual risk, rather than the lifetime risk, but that is not what the table says and is not how risks from contamination are generally presented. One presents the cumulative lifetime risk from all the assumed years of exposure.

Table 6.4 in the draft report, also apparently merely a table inserted from the DOE preliminary operational guidance, identifies proposed cleanup levels to be for various radionuclides in three different exposure scenarios. The table is keyed to 1 mSv/y with the proviso that one would just scale it up to higher (weaker) cleanup levels, up to 20 mSv/y. The Table 6.4 figures would result in allowing contamination levels orders of magnitude over the longstanding PRGs; for some radionuclides, tens of millions of times higher.

We have here compared the upper and lower ends of NCRP recommended cleanup range, 1 and 20 mSv/year, against EPA's PRGs for the same exposure scenarios—farmers and urban residents. Table 6.4 gives two cleanup levels for each scenario, apparently based on 95% and 50% confidence levels. We have compared them all in the tables below, which we created.

The results are extraordinary. For the residential scenario at 20 mSv/y for strontium-90, for example, the Table 6.4 values are hundreds of thousands of times higher than the goals of cleanup at the nation's most contaminated sites, and thousands of times higher than the maximum allowable in the risk range. For plutonium in the farmer scenario, Table 6.4 would allow leaving tens of millions of times more contamination than is the current cleanup goal.

Comparison of NCRP Proposed Cleanup Values and EPA's Longstanding Preliminary Remediation Goals (PRGs)
Farmer Scenario

Radionuclide	NCRP Farmer @ 95% in Bq/g at 1 mSv/y	NCRP Farmer 50% in Bq/g at 1 mSv/y	EPA Farmer PRG in pCi/g	EPA Farmer PRG in Bq/g	Ratio NCRP Farmer @ 95% at 1 mSv / EPA PRG	Ratio NCRP Farmer @ 50% at 1 mSv / EPA PRG	Ratio NCRP Farmer at 95% @20mSv / EPA PRG	Ratio NCRP Farmer at 50% @20mSv / EPA PRG
Am-241	36	92	0.0137	0.0005069	71,020	181,495	1,420,400	3,629,900
Cf-252	1.9	3.2	0.101	0.003737	508	856	10,160	17,120
Cm-244	90	300	0.316	0.011692	7,698	25,659	153,960	513,180
Co-60	0.34	57	0.000918	0.000033966	10,010	1,678,149	200,200	33,562,980
Cs-137	1.4	2.3	0.00119	0.00004403	31,797	52,237	635,940	1,044,740
Ir-192	3.7	6.3	1.62	0.05994	62	105	1,240	2,100
Po-210	6.9	20	19.9	0.7363	9	27	180	540
Pu-238	41	160	0.00762	0.00028194	145,421	567,497	2,908,420	11,349,940
Pu-239	37	140	0.00635	0.00023495	157,480	595,871	31,496,000	11,917,420
Ra-226	0.06	0.099	0.000611	0.000022607	2,654	4,379	53,080	87,580
Sr-90	1.1	9.3	0.00136	0.00005032	21,860	184,817	437,200	3,696,340

Comparison of NCRP Proposed Cleanup Values and EPA's Longstanding Preliminary Remediation Goals (PRGs)
Residential Scenario

Radionuclide	NCRP Resident 95% in Bq/g at 1 mSv/y	NCRP Resident 50% in Bq/g at 1 mSv/y	EPA Resident PRG pCi/g	EPA Resident PRG Bq/g	Ratio NCRP @ 95% /EPA PRG	Ratio NCRP @ 50% /EPA PRG	Ratio NCRP @ 95% @20mSv / EPA PRG	Ratio NCRP @ 50% @20mSv /EPA PRG
Am-241	73	120	1.8	0.0666	1,096	1,802	21,920	36,040
Cf-252	1.9	3.2	0.197	0.007289	261	439	5,220	8,780
Cm-244	250	570	6.65	0.24605	1,016	2,317	20,320	46,340
Co-60	0.34	0.58	0.0389	0.0014393	236	403	4,720	8,060
Cs-137	1.5	2.5	0.0615	0.0022755	659	1,099	13,180	21,980
Ir-192	3.7	6.3	3.15	0.11655	32	54	640	1,080
Po-210	70	170	38.2	1.4134	50	120	1,000	2,400
Pu-238	130	290	2.95	0.10915	1,191	2,657	23,820	53,140
Pu-239	120	270	2.58	0.09546	1,257	2,828	25,140	56,560
Ra-226	0.061	0.1	0.0121	0.000447	136	223	2,720	4,460
Sr-90	100	170	0.24	0.00888	11,261	19,144	225,220	382,880

The ratio of NCRP cleanup value to EPA's tells one how many times more contamination NCRP would allow to remain in place to expose people compared to EPA's goals for the nation's most contaminated sites.

Because EPA's PRGs are based on one in a million risk, one can readily estimate how much cancer risk EPA says each of those NCRP recommended contamination levels would produce. *For example, strontium-90 at NCRP's 20 mSv/yr level and 95% confidence level for residential exposure would be 225,220 times as high as EPA's Preliminary Remediation Goal, and thus carry with it a cancer risk of 2 cancers per 10 people exposed—orders of magnitude higher risk than anything EPA has ever tolerated before and something that would be very hard to get the public to accept—if NCRP were honest with them about what is being proposed.* (The plutonium values proposed by NCRP for the farmer scenario at 20 mSv/y are so astronomically high that they would produce in theory a risk ten times higher than 100% chance of getting cancer from it—a new form of nuclear overkill.) [6]

But there is no need to focus on the most extreme of the disparities. Even at 1 mSv/yr for the farmer scenario, NCRP is proposing making the farmers live and work in soil contaminated at levels thousands and tens of thousands of times higher than EPA's cleanup goals for many of the radionuclides which aren't even the most extreme in difference with EPA.[7]

EPA has an acceptable risk range of 10^{-4} to 10^{-6}. NCRP is proposing instead 1 to 20 mSv/year over decades or a lifetime, with an associated risk range of 10^{-1} to $10^{-2.}$ *In plain*

[6] Note that there may be in an error in the draft report's Table 6.4 for cobalt-60 in the farmer scenario. The table gives the 95% value as 3.4×10^{-1} and at 50% as 5.7×10^{1}. This is over a hundred times higher whereas for all other isotopes the differences are a factor of three or so. Perhaps a minus sign is missing from the concentration at 50%. This could allow a hundred-fold higher concentration than even the astronomical concentrations proposed generally throughout the table.

[7] The NCRP draft report has essentially a single sentence to distance itself from EPA's PRGs, a claim not detailed, that the PRGs don't include a consideration of mass balance, presumably meaning that the DOE group is presuming some immense "weathering" effect to magically make the contamination go away on its own without cleanup. The PRGs do include radioactive decay. But they rightly don't include weathering, because migration of radioactivity can just as easily increase concentrations in one area as reduce it in another. In the situations NCRP is suggesting—widespread contamination over huge areas—contamination leaving one location can end up simply going to another contaminated area. And reductions in concentration in one area by runoff and wind can simply result in increased contamination levels where the materials deposits and collects.

language, NCRP is proposing to force the public to be exposed to radiation levels with a cancer risk range a thousand to tens of thousands of times higher than the longstanding EPA acceptable risk range, so that the cost of cleanup can be avoided. The cost, however, would be transferred to the public in terms of large numbers of excess cancers and other health effects.[8]

This is simply not ethically acceptable. The draft report should be withdrawn.

[8] It is now well established that ionizing radiation also produces genetic effects, birth defects, cardiac problems, among other health impacts.

Attachment I

Line-by-Line Comments on Executive Summary[9]

line 264: It is not true that TMI resulted in no radiological injury or offsite contamination. See, e.g., the epidemiological study by Professor Steve Wing, University of North Carolina at Chapel Hill.

269: It is misleading to refer only to acute radiation impacts from Chernobyl; by far the largest effects have been latent cancers.

277: It is inappropriate to cite the claim that Fukushima resulted in only 10% of the release from Chernobyl. That largely rests on a self-serving estimate by TEPCO, whose credibility has been severely tarnished by its conduct before and after the accident. There are other estimates far higher; e.g., *Xenon-133 and caesium-137 releases into the atmosphere from the Fukushima Dai-ichi nuclear power plant: determination of the source term, atmospheric dispersion, and deposition* by Stohl *et al.*, Atmos. Chem. Phys. Discuss., 11, 28319–28394, 2011. Their detailed study, confirmed by others, found that cesium-137 releases were substantially "underestimated by the Japanese authorities." The Stohl *et al*. results "indicate a total emission of 35.8 (23.3–50.1) PBq, or about 42% of the estimated Chernobyl emission." As to xenon-133, "The study indicates a total release of 16.7 (uncertainty range 13.4–20.0) EBq, which is the largest radioactive noble gas release in history not related to nuclear bomb testing. The release is a factor of 2.5 higher than the Chernobyl 133Xe source term."

The NCRP draft report further tries to minimize the scale of the Fukushima tragedy by implying that virtually all of the radioactivity that was released at Fukushima went out to sea. Stohl *et al.* however estimate that "19% of the total 137Cs deposition until 20 April 15 occurred over Japanese land." These are very significant quantities.

Thus, there is an appearance of bias of the authors of the NCRP draft report which evidences itself by beginning the report extolling nuclear power and then systematically understating the impacts of each of the three major nuclear accidents they cite.

321: The report asserts that "one purpose" of this document is to elaborate on the optimization process set forth in the Department of Homeland Security (DHS) PAGs for dealing with dirty bombs (Radiological Dispersal Devices or RDDs) and nuclear bomb explosions (Improvised Nuclear Devices). Indeed, that was supposed to be the sole purpose of the document. However, NCRP took it upon itself to ignore the assignment from DHS and in the middle of the project expand it to deal with using optimization to deal with any radiological release – even though

[9] Given the problems identified, it did not seem likely to be fruitful to produce line-by-line comments for the full 500+ page document, so we here identify relevant sample concerns with the Executive Summary that represent problems throughout the draft report text.

EPA in its new PAGs has declined to use optimization in the long-term cleanup. NCRP should be candid and declare that it has decided to ignore the task assigned it and instead try to use that assignment to expand optimization from terrorist events to all radiological releases, even though EPA has declined to include optimization in its PAG for other releases. NCRP appears to be trying to do an end-run around EPA's decision-making in this regard.

330: The draft report asserts that the White House has purportedly made a decision to apply the optimization approach to nuclear power plant accidents. It is inappropriate for NCRP to attempt to declare a purported White House decision that the White House itself has not released. Furthermore, EPA has declined to include optimization in the PAG which is public. Again, NCRP appears to be trying to do an end-run around the EPA PAGs, and put something into them that is not there.

336: This proposed end-state of, not cleanup but a "new normal" of extraordinarily elevated radiation and cancer risks, is the core of the draft report's controversial recommendations, which raises serious ethical concerns. Rather than proposing approaches to clean up the contamination, protect public health, and return the affected communities and land to a clean state, NCRP is proposing NOT CLEANING UP THE GREAT MAJORITY OF THE CONTAMINATION and instead making people return to contaminated areas and experience radiation exposures far in excess of what has historically ever been considered an acceptable excess risk of cancer from the exposure. NCRP proposes government and industry wash their hands of the obligations of thorough cleanup and assuring effective public protection and insisting instead that the public, by increased cancers, pay for the mistakes of those who caused the release. This is transferring the cost of the nuclear establishment's disastrous errors onto the innocent public in terms of increased suffering and deaths. Calling it "the new normal" obscures what NCRP is proposing—which is to never return the impacted areas to normal, and try to get people to accept vastly elevated radiation levels, cancer risks and other health effects from contamination that you propose not be cleaned up. A letter to NCRP sent by scores of groups and individuals has called this proposal "immoral," and it is hard to argue with that characterization.

339 and following: NCRP is not candid here about what optimization entails. It means not setting health-based standards in advance of a release, but allowing decision-makers to pick any standard they wish after the fact, even if those cleanup levels are far more dangerous to the public than any cleanup levels historically employed. Furthermore, optimization means that public health is not the driving factor, but is to be "balanced" by economic interests. In other words, if DOE were to be responsible for a major release of radioactivity from one of its facilities, the decision as to how much to protect the public from the DOE-caused contamination would not be health-based but would be largely overridden by DOE's desire to keep its costs down. This, of course, is not a hypothetical matter, but has happened for decades at DOE's heavily contaminated nuclear facilities nationwide.

384: Here at least NCRP mentions the central underlying revelation in the report: *despite decades of assuring the public that a nuclear power plant accident would cause minimal safety risks, it is now made clear that huge areas could be contaminated at very high radiation levels.* But then the report goes on to say that cleanup should not be based on public health protection as the driver, but instead on factors such as "cost" and "financing availability." That is the core of

the NCRP recommendations: don't burden the nuclear industry and nuclear agencies with the cost of cleaning up to a health-protective standard, instead let them leave the great majority of the contamination in place and make the public pay via markedly elevated cancer risks: the "new normal."

396: Here NCRP admits that very large amounts of radioactive waste would be generated, but then goes on elsewhere in the report to recommend that it not be disposed of in facilities licensed or designed for such wastes, but allowed to be dumped, for example, in local municipal landfills not capable of handling radioactive materials. NCRP is thus proposing exacerbating the contamination problem by placing wastes in places where it cannot be safely handled or isolated from the environment.

421: Again, a core recommendation, hidden in unclear terms. The draft report is recommending the abandonment of long-held radiation protection requirements that are health-based and replaced instead with a fuzzy approach that would allow vastly higher radiation exposures to the public based on cost to industry and government of cleanup. The report suggests the standard not be cleanup to a level that provides acceptable health protection but instead only cleaning up that which is "reasonably achievable" by industry and government given their desire to keep their costs down. The report thus proposes sacrificing public health to save money for the economic interests. If one is going to do that, at least be honest about it. Tell the public: there are longstanding radiation protection standards based on health; we are proposing to ignore those, expose you to much higher levels of radiation than has ever been allowed in the past, in order to save money for interests with which we are allied. As one is well aware, the "as low as reasonably achievable" (ALARA) is virtually always ignored or interpreted to mean it isn't reasonable for DOE or industry to push doses down below the bare minimum required by the regulations. But the report is proposing jettisoning the regulatory health-based requirements, leaving us with an approach that is driven by saving money for the interests with which you are allied.

444: Here is a key disclosure: a "dirty bomb" or a nuclear power plant accident could result in a "potentially vast geographic expanse of contamination." For years the public has been told by government that a "dirty bomb" would result in virtually no radiation hazard, would affect only a small area, and would be primarily an instrument of inducing psychological stress. Now NCRP is declaring the opposite to be true. Additionally, for decades, the public was told a nuclear power plant accident would produce minor consequences; indeed, NRC rules require only evacuation out 10 miles, and that only for the immediate phase of the event. *Now NCRP is admitting that the opposite is true: a nuclear power plant accident could cause very high contamination over the area of a state. But NCRP now argues it would be too much trouble to clean it up to health-protective levels. So, the only scientifically logical recommendation from that conclusion would be to phase out nuclear power and vastly tighten protections over radioactive materials that could be used in a dirty bomb. Instead, NCRP pushes the opposite: loosen radiation protection standards orders of magnitude beyond what is normally and historically allowed so these poorly regulated activities can continue. The public would pay; the responsible parties for the contamination, already largely immunized by Price Anderson, would be further protected from paying for the consequences of their mistakes.*

452: But here the report's authors say a big RDD might affects tens of city blocks. Surely one can handle cleanup of such an area with current health-based cleanup levels—CERCLA. CERCLA applies to Superfund sites such as Hanford that are half as large as Rhode Island. There is no technical basis thus for any cleanup approach other than CERCLA for RDDs. But the report's authors tip their hand, saying "costs and time" should trump public health.

473: The report talks about stakeholder involvement, but then indicates the stakeholders might be resistant to being exposed to the high levels of radiation NCRP proposes they be forced to experience because of the NCRP recommendation to not clean up to health-protective levels but to a more "expedient remediation strategy." It appears that the discussion of the importance of stakeholder involvement in the report is window dressing; what is actually suggested is insisting on exposing the public to unacceptable levels of radiation and if they resist, having a PR strategy to convince them to "suck it up" and accept the "new normal." One of the clearest examples of this contradiction is that the NCRP panel itself was filled with stakeholders associated with the nuclear enterprise with a vested interest in not cleaning up contamination for which it is responsible but no stakeholders representing the public that has an interest in not being irradiated.

566, 577, 580: In vague language NCRP here signals what it is proposing: jettisoning historically required health-based standards and allow other factors important to its institutional allies (mainly cost) to override health considerations for the affected public.