

To: Russ Ritenour
AAPM President

Sept. 10, 2006

Fm: Robert L. Dixon
Wake Forest University

Report on meeting concerning ICRP draft 2006 recommendations

Dear Russ,

Thanks for inviting me to represent AAPM at the **NEA North American Regional Conference on the Evolution of the System of Radiological Protection** meeting in DC this week which dealt with the **Draft 2006 ICRP Proposals**. It was organized and funded by the French Nuclear Energy Agency (NEA) - I'm not sure why the French-connection except that they have a big stake in nuclear power in France. The NEA CRPPH committee apparently works closely with ICRP to help shape the ICRP recommendations to make them "more responsive to decision makers, regulators, and the public" (and possibly also to France?).

This "stakeholders" conference follows a similar Asian conference held earlier in Japan, and will be followed by a European Conference in Prague, in late October. **It looks like the real action will be in Prague which meeting will have a greater turnout of the actual ICRP members, but there probably won't be as much dissent.**

Lynne Fairobert was a great help to me and AAPM in this endeavor and also attended.

Lars-Eric Holm, the new ICRP president presented the new ICRP draft recommendations.

The meeting was attended by representatives from this hemisphere but mostly from North America:

Big and powerful govt. agencies: NRC, DOE, EPA, OSHA

A host of Canadians from numerous govt. agencies and various other entities unfamiliar to me.

The HPS (Kelly Classic), The NCRP (Ken Kase), OAS, and the Canadian equivalent of HPS,

A medically oriented panel: AAPM, ACR, FDA, CRCPD, ACMUI, and PAHO

Some "nuclear power industry people" (NEI, NWU,) and "nuclear waste folks" ACNW, NWTRB, NWA, etc

EIEIO: A few "anti-nukes" were there: a lady from the Sierra Club Environmental Coalition on Nuclear Power (or not), and another lady from the Nuclear (mis)Information and Resource Society. The Sierra Club lady carries her own personal (real-time) radiation detector in her purse which she proudly showed to the audience. These ladies were reasonably polite, articulate, and I suspect very effective when addressing a lay audience or their own constituency; however, it would be futile (albeit entertaining) to engage them in serious debate, and I had bigger fish to fry. There were several members of the audience (including the Sierra club lady) who kept expressing the fear that a "released nuclear medicine patient" would sit down beside them in some public place; so when my time to speak came up; I reassured them by noting that they should probably worry a lot more about someone with a potentially-fatal communicable disease sitting down beside them (or someone with a gun).

Source Constraints As you know, AAPM's principle concern is the emphasis on "source constraints" which the ICRP draft now refers to as *"the most fundamental level of protection"* ; which means rather than using the public dose limit of 1 mSv/yr to shield or otherwise limit the

dose to the public from your particular "source" (x-ray room, Linac, entire hospital, etc.), you "constrain it" by dividing by 3 (or more); such that you are shielding to ≤ 0.3 mSv/yr (or 10% of natural background - indeed to a value lower than the natural fluctuation of background from one location to another - exclusive of radon- "down in the noise of natural fluctuation"). This then becomes the de-facto public dose limit. The rationale used is that a member of the public could be exposed to several different sources (≈ 3), so we must limit the dose from each source to 1/3 mSv. This sounds plausible at first, but cannot withstand closer logical scrutiny.

I pointed out during the first panel discussion between the big.gov agencies and the audience, that this whole concept is illogical, based on the simple fact that a given person cannot be in two places at once. If every source in the country were shielded to 1 mSv/yr at its boundary, and a member of the public spent his entire lifetime in the unlikely pursuit of "hopping" directly from one source to another, he would still get only 1 mSv/yr (If you own two automobiles, should you then constrain your speed to 1/2 the speed limit?—same twisted logic).

The entire panel seemed stunned (or stumped) by this simple revelation, and after a period of silence, one panel member came up with a "lame" example of two plants across town? But we've heard it all before - usually wildly improbable scenarios, and/or random events giving (non - regular) and trivial dose increments such as "driving by" a nuclear power plant, but no one can beat us if we're given a chance to properly debate it. Particularly, when I ask them to get out their pencils and estimate the annual dose from their scenarios.

My formal presentation on the medical panel was modeled after the one I initially gave at Marty Weinhaus's "presidents symposium" and one I gave later at the ICRS-RPS international shielding conference in Madeira, Portugal, to which Don Frey had sent me to represent AAPM, and at which meeting they surprisingly offered me an "invited paper" slot in the same plenary session (on the same dais) with the previous ICRP president Roger Clark. The resulting paper by authored by myself with co-authors Ben Archer, Joel Gray, and Doug Simpkin was subsequently published in Radiation Protection Dosimeter and details our rationale for ignoring source constraints.

I had to pare the talk down quite a bit since I had only a few minutes, but the Radiologist representing ACR (Kimberly Applegate) graciously ceded me some of her time, so I think I got the point across. In fact, the Conference Rapporteur, Henri Metvier, borrowed from a couple of my PPT "slides" in presenting the final conference summary, including my quote below:

- **Attempting to increase public protection by forcing the doses allowed from medical X-ray sources to *Heroically* low levels (10% of natural background)**
- **is likely to represent net harm to the patient population (the same public) in terms of both increased healthcare costs as well as increased health risk to individual patients, with no proven benefit whatsoever.**

The fact that NCRP finally "swallowed" the idea of the inapplicability of such constraints for shielding medical x-ray facilities and actually put it into writing, as a result of our NCRP 147 committee's previous battle with certain elements within the NCRP - and greatly facilitated by AAPM, ACR, and RSNA getting behind us resulting in the valuable Consensus Conference sponsored by ACR at Rick Morin's behest; gives AAPM's position a great deal of extra weight. The list of attendees at that conference (who indicated their consensus at the end by vote - with only one negative vote) was also impressive (see my slide). I have attached a copy of my PPT presentation.

Patient Dose in Radiology: This is, of course, also of direct concern to AAPM, and Dr. Applegate gave a well-received presentation of the ACR position; moreover, the ICRP draft proposal does not greatly intrude into medical practice decisions. John McCrohan of FDA also gave an excellent and well-reasoned presentation on medical x-ray issues - basically advising regulators not to be too quick to jump into this arena - especially with trying to impose limiting rules in an arena they

know little or nothing about, (in my words) where their entire “universe”- the radiation- is often an inconsequential and trivial part of the overall risk to the patient in such medical procedures.

Surprisingly, "**source constraints**" received a lot of criticism from a variety of commentators - unfortunately not based on the flawed rationale for their use, but rather on being poorly defined (e.g. what is a “single source”; and how do you use constraints compared to the ALARA principle which implies some optimization process – do you apply the constraint, and then ALARA?).

Also, how can we prevent regulators from interpreting and using constraints as dose limits (Of course, you cannot, as has already been proven following their earlier introduction in ICRP-60. For example, regulations governing shielding design in Britain require use of a limit of 0.3 mSv/yr, as is also the case in many other countries in Europe as well as the world (and used to be in Michigan).

Several commentators said that “constraint” was too strong a word, and they wanted a softer word like “target” or “goal” which would not imply any penalty or censure if it were not met.

People also wanted ICRP to include more specific examples of how to choose the constraint and apply it. *This really scares me*, since it is pretty clear at this point that the ICRP itself doesn't really clearly understand what is meant by the “source” and/or “constraint”, beyond a general and vague description based on who has overall administrative control and authority (the “owner”) to restrict the public access and dose from the group of radiation-emitters he controls. In one example they define an entire hospital as a source which fits that model. This generality and vagueness is actually good since it allows those familiar with their own practice the flexibility to implement a reasonable protection program. If the ICRP attempts to come up with specific examples governing various practices with which they have only a general and vague familiarity, they're going to make a mess. (For example, two “icons of radiation protection” authored an NCRP commentary which suggested “evasive action” by a jet liner in the event of a solar flare; apparently having no appreciation of the havoc which would be caused in the air traffic control system, or of the fact that fuel efficiency for jet aircraft is significantly degraded at lower altitudes –producing risks of collision and fuel starvation which far outweigh any radiation risk). Hopefully the ICRP will refrain from trying to be too specific in this arena.

This constraint concept in fact led to the 1/4 mSv/yr in NCRP 116 (authored by the same two icons who recommended “evasive action” for airliners in the event of a solar flare); and which limit caused us so much grief and extra effort as authors of the NCRP diagnostic shielding report NCRP 147. My (short) formal presentation emphasized the wide consensus among the many societies and agencies convened by the ACR in Reston in 2003 that constraints were not appropriate; and the clear acceptance by the NCRP of our position with wording that the limit (and the constraint) is 1 mSv/yr, and no constraint below this is required. This wording has also been used by all the subsequent medical shielding reports (therapy, dental, veterinary).

So what are we worried about if we have the backing of NCRP? In fact, the NCRP could turn on us at any time and come up with new recommendations, perhaps under pressure to implement the ICRP model.

It is also clear from history that you can never relax your vigilance with so many groups trying to meddle and regulate in this arena. For example, if the NRC were to accept and include these proposed ICRP source constraints in their regulations governing use of medical isotopes, then they would necessarily eventually appear in state regulations as limits covering not only nuclear sources, but x-ray sources as well since US States would rarely, if ever, have two separate public dose limits. This isn't just conjecture but is based on history: this is precisely what happened some years ago when the NRC lowered its public dose limit (governing only their regulated isotopes) from 5 mSv/yr to 1 mSv/yr.

Fortunately, the NRC commentary was very critical of the ICRP draft.

On the other hand, the Canadians- with a couple of exceptions- seemed happy with most of the new ICRP draft proposal.

Most of the Canadians expressed support for the new ICRP plan for protecting “the biota” (“flora and fauna” for you older folks).

The Biota: The proposed ICRP system for non-human radiation protection (which you may recall includes the duck as an animal model) received much skepticism and criticism from the US representatives, and I’m not sure where it is going. I had anticipated that the duck might come up and so was prepared. When a conference representative criticized the choice of animals as “Eurocentric”, ICRP President Lars-Erik Holm “lost his cool” for the first and only time and exclaimed: “a duck is a duck is a duck!”

It was at that point, I sensed that the tense situation needed defusing, so I pulled out my duck call; blew a loud “triple-quack with repeat”; and “broke up” the entire audience (including Lars-Erik).

Afterwards one of the conference organizers from the French Nuclear Energy Agency (NEA) expressed such a deep appreciation for my skill with the duck call, which I gave it to him to take back to Paris.

The New Effective Dose paradigm – whither the gonads? The new tissue-weighting factors proposed by the ICRP to be used for computation of effective dose, results in a precipitous descent of the gonads in the hierarchy of sensitive organs (0.2 → 0.08), and uplifts the breasts (0.05 → 0.12). Those once-proud doppelgangers, icons of radiation protection for decades (and ritually protected at all costs using all manner of lead accessories), have now been relegated to the “backwater” of organs.

This change received much criticism (not just from the gonadal supporters), but from those objecting to the “averaging” of age and gender-specific risk factors used to produce these new (still androgynous) weighting factors for effective dose. Surprisingly, some commentators wanted to include age and gender differences in the system of radiation protection, dividing us into groups (e.g. – “let the old guy take the dose”). ICRP strongly argued against doing that, and I agree.

Lars-Erik also “threw us a bone”, stating that the ICRP still believed in protecting the gonads (but it somehow rang hollow).

I asked the question “what are the error bars on these risk factors”? Again, a long silence. No cogent answer was forthcoming, and finally Lars-Erik made a general remark which shed no light on the question.

Misuse of Effective Dose in Medicine: There is widespread use of effective dose delivered in diagnostic patient exams in radiology as an indicator of risk to the patient from the exam, both for prospective justification of the exam, and as a retrospective indicator of the purported risk to an individual patient after having received the exam and its radiation. (As an example, the provider might say : “Mrs. Smith, the effective (“whole body”) dose which your teenage daughter received from her chest CT exam is 2 mSv, which has an associated risk of “blah, blah, blah”).

There is even a movement afoot via the IEC to add the effective dose resulting from every radiological exam to the DICOM report for individual patients. Since ICRP is the inventor and curator of effective dose, I set out to seek some definitive clarification of this issue for those of us trying to rationalize its application to radiation received from medical exams; making the propositional query that effective dose has long been misused in radiology by such application. Lars-Erik agreed, and I have subsequently found the following statements regarding such use in the ICRP clarification:

“Effective dose should **not** be used for more detailed retrospective dose and risk assessments on exposure of individuals”

“Effective dose should **not** be used for epidemiological studies.

Collective Dose and LNT: “Death by Coefficient”

There was general agreement that the risk coefficient derived using LNT should no longer be utilized to (hypothetically) kill large numbers of people exposed to small doses. (However, the two “anti-nuke” ladies were strongly in favor of allowing the slaughter to continue unabated.)

Although several comments protested the use of LNT, the ICRP and some others said we have to use it (although the DOE representative held out some hope that their research effort in low level radiation effects, might lead to a more rational approach).

Respectfully,

Bob Dixon