Australian Regulatory Framework

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Chief Executive Officer, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Physicist turned public servant.

Dr Loy was trained as a physicist at the University of Sydney. Not long after completion of his PhD (high-energy cosmic rays), Dr Loy joined the Australian Public Service and has worked in a variety of positions for the past 25 years.

His career has included working with Government science agencies (Bureau of Meteorology, Antarctic Division); in the Prime Minister's Department, including the Cabinet Office; as a senior adviser to a Cabinet Minister; and in the Commonwealth Health Department, since 1987.

Within the Health Department, he has headed Divisions covering medical research, public health including drugs strategy and HIV/AIDS strategy, and health financing.

Dr Loy was appointed as acting head of ARPANSA in September 1998. His first task was to steer the Agency's establishing legislation through the Parliament. The Act was passed in December 1998 and formally came into effect in February 1999. He was appointed as CEO to APRANSA on 14 April 1999.

The functions of the CEO are to advise the Government and the public and carry out research on radiation protection, nuclear safety and medical exposures to radiation (both ionizing and non-ionizing). ARPANSA also regulates the national Government's use of radiation and nuclear installations, notably the research reactor at Lucas Heights.

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Good morning and thank you for the invitation to address your conference. I am afraid my address will be a lot more boring than David's but I will try and gallop through a fair amount of material to give you the basis for some questions later on and some discussion in the workshops this afternoon.

So, to begin with a very short course in radiation effects and some of this obviously covers what David also covered. People, in talking about the effects of ionizing radiation distinguish between two kinds of effects, deterministic effects, that is when you have sufficiently high doses, the severity of the reaction depends upon the dose and you are talking here about doses of around one cevet, which is a big dose, don't worry about the meaning of the term, and upwards, and by the time you get to six to eight cevets, you are looking at the very high likelihood of death, quite quickly and the two workers who died from the Toko Murai accident were looking at over sixteen or seventeen cevets and nine or ten cevets, so there was very little chance of those poor people surviving. And the second kind of effect, quite different, is stochastic effects, meaning that the probability of you obtaining this outcome, the probability depends upon the dose not the severity. You either get the cancer or you don't, but the probability of you getting the cancer depends upon the dose of the radiation you receive, broadly speaking. So that is the second kind of effect and that is the kind of effect that occurs at lower doses and we will talk more about that in a moment.

What are lower doses? Well people talk about the natural background of radiation that exists all the time around Australia that is about three millicebers and you can't avoid that, that is cosmic rays, that is potassium 40 in your body, it is the rocks - they might have radium or uranium in them. In looking at radiation effects, epidemiology and especially the A bomb survivor data as David said, is the basis for most of our knowledge. It does show a clear increase in the probability of cancer, let's specifically refer to cancer, above around a hundred millicebers - which is quite a substantial lifetime dose, quite substantially above your three millicebers natural background, but still, certainly within the kind of doses that people in an industry might expect to get. So a clear increase above that. The evidence of the effects below around about a hundred millicebers is uncertain and it is fiercely debated. David has presented some evidence to say that the effects are larger than the atomic bomb survivor data. There are certainly many scientist in the United States particularly, who would argue the effects are smaller, may even be zero, and may even do you some good, somewhere below a hundred millicebers. So you can go to conferences particularly in the US and people will hurl epithets at each other about this evidence. But current radiation policy in the world is based upon the hypothesis, the assumption, the guess, that there is no threshold to these effects, there is no point of which they are zero, and roughly speaking they're linear. So, you have the high dose effects and you draw a straight line down to the origin at zero and that is the kind of fundamental faith of radiation protection workers in international standards setting and health physics today. But it is still called a hypothesis because as I said, that evidence is still debated, but that is the basis upon which we in Australia, work in radiation protection standards and we are in line with the rest of the world in doing that.

I will just do a quick commercial about ARPANSA, the Australian Radiation Protection and Nuclear Safety Agency set up by this Act. with a simple objective in the Act to protect

the health and safety of people and the environment from the harmful effects of radiation, so that is a pretty straightforward statement. As Fred mentioned the Act determines a set of functions for the CEO of ARPANSA, one of them is to promote uniformity of policy and practices between the Commonwealth and the states and as I always say, I am glad it is just about promoting uniformity rather than achieving it. But then, advice, research services etcetera about radiation and finally, an important function of course that gets some degree of attention is the licensing of Commonwealth entities including the Australian Nuclear Science and Technology Organisation.

The Act also establishes these bodies; the Radiation Health & Safety Advisory Council, the Radiation Health Committee and the Nuclear Safety Committee. The Council is a kind of peak policy body or intended to be a peak policy body, the Radiation Health Committee is a group largely made up of the state and territory regulators who look after radiation protection standards and the Nuclear Safety Committee is the equivalent technical body for nuclear safety issues.

So, where do Australian standards come from in the first place? They come from a few international organisations and the first of which I will mention is the International Commission on Radiological Protection, and David briefly touched upon their role. They go way back, established in the early days as a spin off from the International Organisation of Radiologists, because clearly radiologists were the people most being exposed to radiation in those days. It is a kind of priesthood. The Commission itself consists of twelve members and a chair and it is selected by itself, so it is a kind of self selecting eminent priesthood, financed, well, we kick in a bit of money and probably most other similar agencies throughout the world would give them a bit of money and they run on the smell of an oily rag with lots of in kind contributions from the employers of the various organisations. So, they issue recommendations on the principles of radiation protection and this kind of stuff works better with a power point presentation. That is the brown book, ICRP60 which is currently the bible of radiation protection, from the International Commission issued in 1990. It was a fundamental review of radiation protection limits and the approach to radiation protection drawing upon experience of the past. It did recommend dose limits based principally upon the A bomb survivor data but not exclusively but principally and talked about differences between what it called practices, things that people do actually using radiation, like creating nuclear power plants or research reactors or whatever or medical uses of radiation and interventions were there was some already existing radiation exposure and the intervention is designed to reduce it. So the Maralinga remediation for example would be an example of an intervention.

Importantly it sets the kind of framework for people thinking about how to do radiation protection. Not just dose limits, it is a framework of saying, if you are looking at a practice, somebody wants to do something with radiation, they should justify it. They should say, well, why should you use radiation to do this rather than something else? And the way they use it should be optimised, and that word is meant to mean that they should use it in such a way as to reduce exposures to workers and the public to as low as reasonably achievable. I will say more about that, but let's move on.

The RCRP dose limits are for practices, people using radiation. These are not limits in the sense that limits are often used in public health issues. They are not points below which something is safe and above which it is unsafe because of the linear no threshold hypothesis, there is no safe level. There is consequence from any exposure, so they are

not setting limits saying, boom, here, you are safe, below this you are safe, above it you are not. The limits are set as what is tolerable, what is acceptable, so they are full of value judgments and nobody is walking away from that. That is part of the radiation protection judgement, radiation protection doctrine that the world has made judgements that on the basis of what we think we know, that this kind of limit divides something between tolerable, acceptable, whatever word you might want to use and intolerable, unacceptable, but not between safe and unsafe.

The other eminent international body or the second international body that I will quickly mention is the UN Scientific Committee on the Effects of Atomic Radiation. Again, it was a creature of the earlier days but flowed from about 1955 and the UN meeting on peaceful uses of the atom, and it is established by the General Assembly and has twenty one states on it now, including Australia and every three to five years it reports on the health effects of radiation and global doses. It does a really very extraordinarily thorough examination of the doses that people are receiving in broad categories of workers and so on, throughout the world and how these doses are derived and it was influential in showing the gradually rising dose that the whole world was receiving from atmospheric nuclear testing during the 50s and 60s and that was an influential piece of argument in ending atmospheric testing. It is just about to issue its year 2000 report which will be a very thorough examination of the epidemiology of the doses as I said and also does a very big assessment of the effects of Chernobyl.

And finally, the International Atomic Energy Agency is an organisation set up in '56 to look at issues about, well its role was expanded by the Non Proliferation Treaty and I guess it is like the Non Proliferation Treaty. It is the deal that says, on the one hand let's not proliferate nuclear weapons, but on the other hand, we want to use the benefits of quote unquote nuclear energy, so it is part of that deal, compromise, whatever you would like to call it, that lies at the heart of the Non Proliferation Treaty, and the current Director General talks about the three pillars of the agency being technology, nuclear technology, being the safety of that technology and the third pillar is safeguards, the technical measure to verify the Non Proliferation treaty. But in terms of the role of the IAEA, what it really does, from a brown book it produced the red book that translates the ICRP60 science and sort of general guidance into regulatory guidance and they are the international basis safety standards that are meant to be the sort of goal standard for radiation protection for countries throughout the world. It is a joint publication actually of all of those various acronyms from the UN agencies, so it is intended to cover workers so the ILO puts its stamp on it as well.

As well as that basis guidance, the IAEA continues to produce a whole range of publications and this distinction between the kinds of publications is interesting. There is a kind of hierarchy of the fundamental documents that talk about objectives, concepts and principles and then there are some requirements for particular practices, it should be, these are the things you have to do if you are going to use radiation for looking at people's teeth, or if you are uranium mining or whatever, so there are requirements and then there is a third hierarchy of guides. These are good ideas that you might pick up in order to meet the requirements. So having been through a brown book and a red book in Australia, we have a green book and this is our version of the basis safety standards based upon ICRP60 and that was produced by the National Health and Medical Research Council and the National Occupational Health and Safety Commission in 1995. The ICRP60 came out in 1990, we produced in Australia our version of it in 1995. That was a pretty good effort given that the EU is really now only just bringing this into force and

the United States hasn't bothered for reasons which only an American can explain. The important thing it does lay down these dose limits, and I have described what a dose is and it is important to emphasise that it isn't a distinction between safe and unsafe, but the dose limit notion of twenty millicebers per annum for occupational exposure and one milliceber for the general public.

Now, that is interesting in itself that there are two dose limits and I guess the ethical basis for that, if there is one, there is obviously a practical basis for it, the ethical basis for it is presumably based upon that workers may accept a higher level of risk in terms of informed consent, they may receive compensation for a higher level of risk, and in a kind of helicopter view of society, there are plenty of other industries were similar risks are accepted quote unquote. But, nonetheless, there is clearly an ethical issue in distinguishing between occupational exposures and general public exposures. Again, as does the brown book and the red book, it goes into this notion of optimisation. Don't just take dose limits as being what you have to achieve, you have to do better than that, you have to optimise your use of radiation in a way to reduce your exposures.

Obviously that is our fundamental document. There are lots of other important radiation protection standards and publications that are around and are being reviewed over time and obviously the transport code is an important one, how you go about transporting radioactive material and that describes the different levels of hazards of different kinds of material and the kinds of packaging that are required to transport that in a reasonable degree of safety. The mining and milling codes for radioactive ores are obviously important, and they are currently being revised to fully reflect ICRP60 and also there were two codes and we are bringing them together into one. And disposal of radioactive waste is obviously you know, an interesting topic that some people find engaging and clearly we have a code, we have an extant code that talks about disposal of radioactive substances by the user, that is, what is legitimate to put up your chimney, to put into your sewerage or to water, and what can you take to the tip, basically, that is the user disposal code. What level of radioactivity is reasonable to be treated that way. There is a code for near surface disposal and that will be very relevant to the national waste repository and the presumably maybe at some point, you might be looking at a code for the intermediate level, but we will worry about that when the time comes. The disposal code by the user is pretty old and that is under revision at present.

The whole series of the up hands assistant I've called it, we've got a radiation protection series which will be overseen by the Radiation Health Committee and reporting to the council that I described. When they come to doing any particular body of work, they will set up a working group to actually draft the requirements. There is a requirement in the Act and one that is taken seriously that when in doing that, it must be a process of public consultation, so at least there is some way in for the public to have a say, a view, put a point about the development of these various codes.

What are some of the other issues that are around in radiation protection standards and standard setting and the like in Australia? There is a debate which is never quite resolved is what is a radioactive substance that ought to be subject to radiation protection regulation and there are naturally occurring radioactive materials and some of those can be defined as radioactive substances or not, depending on the view of the regulator at the end of the day. Some of them are really highly active, like mineral sands processing can lead to exposures, very substantial exposures to workers, others like oil sludges, the gunk that is left over after people process crude oil or natural gas from

deep-sea wells does need management but it is not a significant hazard, but it certainly does need management. So those kinds of issues still need a bit more sorting through.

National uniformity we keep struggling at and we have a kind of national directory which is meant to be a sort of basic guidance, and obviously we need to work on further guidance about waste management and maybe people might want to question me a bit more about that anyway.

I did a last slide saying for the future, and I asked myself the question, will the dose limits be reduced further, and I think David made a presentation that said they should be and will be, I am not so sure. I think clearly there is more evidence coming forward, there are biological studies, the interpretation of which just escapes me completely, but certainly they are very complex and interesting sets of studies. Whether these produce firm evidence in the next decade that lead people to want to revise the limits, I am less believing in them than perhaps David, but I think one of the important things he did say about that is maybe a lot of this evidence will tell us more about individual susceptibilities and that might be a lot more interesting than just the number that is the limit. But, we will have to see what happens.

The IRCP, that eminent priesthood that I referred to is starting to sort of scratch its collective head about were to go from here in terms of the radiation protection system, and there are some problems with it. Conceptual problems mainly and this notion of a difference between a practice intervention and how you deal with it and therefore you end up with different kinds of dose limits and how does anyone make any kind of intellectual consistency out of that is a problem that they are trying to grapple with and they are talking about a controllable dose as the kind of framework for doing that and there is a lot of debate and questioning about the value of something called collective dose, that is, clearly, in a worker environment you are looking at the doses that individuals received, if you are looking at release of radioactive material widely, you are looking at doses that a very large number of people may receive, and then you are looking at very, very tiny doses that a very, very large number of people may receive and is that a kind of meaningful notion or does it all sort of run into the sand at some point and what is that point and I guess valued judgments then suddenly raise their head again.

So, I guess what, in summary, I think Australian radiation protection standards are very consistent with the accepted international practice, and I think we can hold our head reasonably high in that sense. The international practice itself is coming under questioning and will continue to come under questioning and obviously that is something we need very much to follow and be a part of. Thank you.