The Committee Manager
Ian Thackeray
Joint Select Committee on the Transportation and Storage of Nuclear Waste
Parliament House
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Sydney NSW 2000

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31st July 2003

Dear Sir

Please accept the following submission by the **Medical Association for Prevention of War** to the **Parliamentary Inquiry into the Transport and Storage of Nuclear Wastes in NSW.**

The submission was prepared by MAPW Vice-President, Dr. Bill Williams MBBS, in consultation with the MAPW National Council (shown at right).

Yours sincerely,

Dr. Bill Williams MBBS
Vice-President

Ms Giji Gya
Executive Officer
National Office

MEDICAL ASSOCIATION FOR PREVENTION OF WAR (AUSTRALIA)

Submission to the Parliamentary Inquiry into the Transport and Storage of Nuclear Wastes in NSW – July 2003

Mission Statement

MAPW, the Australian affiliate of the global federation, International Physicians for the Prevention of Nuclear War, affirms the mission statement of IPPNW as its own:

"IPPNW is a non-partisan international federation of physicians' organisations dedicated to research, education and advocacy relevant to the prevention of nuclear war. To this end, IPPNW seeks to prevent all wars, to promote non-violent conflict resolution and to minimise the effects of war on health, development and the environment."

MEDICAL ASSOCIATION FOR PREVENTION OF WAR (AUSTRALIA)

Submission to the Parliamentary Inquiry into the Transport and Storage of Nuclear Wastes in NSW – July 2003

Author: Dr Bill Williams, M.B.,B.S. Vice-President MAPW.

Terms of Reference

From the Votes and Proceedings of the Legislative Assembly, Thursday 8 May 2003 entry 17 (12)

A Joint Select Committee has been appointed to consider and report upon proposals by the Commonwealth Government to transport nuclear waste through and potentially store nuclear waste within New South Wales, with specific reference to the following matters:

(a) logistical arrangements associated with the proposals, including sourcing, transport and storage of waste;

(b) health and safety risks associated with the transportation and storage of nuclear waste in New South Wales;

(c) extent of possible resource implications associated with the transportation and storage of nuclear waste within New South Wales; and

(d) any other relevant matter.

Introduction

The Medical Association for Prevention of War (MAPW) is an organization of Australian medical and other health practitioners, formed in 1981, which addresses the health consequences of warfare and associated social and industrial aspects of modern warfare. Whilst our main aim is the elimination of nuclear weapons, other issues involving the nuclear industry are of significant concern: in particular, the management of nuclear and other radioactive waste products. Although the majority of Australia's radioactive waste had its origin in research, medical and civil industrial processes, its potential for diversion into terrorist activities makes its future management highly relevant to our cause. Furthermore, the recent diversion of thousands of tonnes of uranium into munitions and their extensive use on the battlefields of Iraq, Afghanistan and Kosovo by purchasers of Australian uranium, gives this issue sharpened focus.

Background

Low level and short-lived intermediate level radioactive waste
Australia has an existing inventory of approximately 3,700 cubic metres of low level and short-lived intermediate level radioactive waste, and produces approximately 50 cubic metres of the material per year - from research, medical and industrial use of radioactive materials. This waste is currently in temporary storage at multiple locations.

In addition about 500 cubic metres of low level and short-lived radioactive waste will arise from the decommissioning of the ANSTO-HIFAR reactor (the current reactor at Lucas Heights) by 2035. Further decommissioning wastes of a similar volume will arise from the proposed replacement research reactor.

Over the projected life of the proposed National Repository, it is expected that Australia will have up to 10,000 cubic metres of waste to dispose of.

Long-lived intermediate level radioactive waste (LLILW)

Australia also currently possesses approximately 500 cubic metres of long-lived intermediate level radioactive waste. It includes wastes from the production of radiopharmaceuticals and used sources from medical, research and industrial equipment, and wastes from mineral sands processing. A further 10 cubic metres of LLILW will generated per annum at the Lucas Heights site, with an expected 100 cubic metres arising from the decommissioning of the research reactors.

This waste remains dangerous for many thousands of years and its long-term management remains highly controversial. Although proponents of the nuclear industry frequently cite deep geological disposal as a viable option, after over fifty years of nuclear waste production there are still no such facilities operating on earth, due to a combination of safety, economic and logistical concerns.

Health consequences

The human health consequences of exposure to ionizing radiation can be categorised according to received dose, with associated specific medical phenomena.

(a) Deterministic Effects
Deterministic effects are caused by exposure to high levels of radiation that cause large numbers of cells to die or lose their ability to replicate. Extreme doses of radiation to the whole body (around 10 sievert and above), received in a short period, cause so much damage to internal organs and tissues of the body that vital systems cease to function and death may result within days or weeks. Very high doses (between about 1 sievert and 10 sievert), received in a short period, kill large numbers of cells, which can impair the function of vital organs and systems. Acute health effects, such as nausea, vomiting, skin and deep tissue burns, and impairment of the body's ability to fight infection may result within hours, days or weeks. The extent of the damage increases with dose.

(b) Stochastic Effects
Doses below the threshold for deterministic effects may cause cellular damage, but this does not always lead to harm to the individual: the effects are probabilistic or 'stochastic' in nature. Stochastic effects result from damaged cells not dying but surviving in a modified form. These modified cells may, after a prolonged process, develop into a cancer. These stochastic effects usually appear many years after the exposure and, although they do not occur in every exposed individual, there is no threshold below which they will not occur.
If the modified cell is a germ (reproductive) cell, then the damage may be passed on to that person's future descendants. Then, hereditary effects may be observed in these descendants.
It is known that doses above about 100 millisievert, received in a short period, lead to an increased risk of developing cancer later in life. There is solid epidemiological evidence – especially from studies of the survivors of the atomic bombings - that, for several types of cancer, the risk increases roughly linearly with dose, and that the risk factor averaged over all ages and cancer types is about 1 in 100 for every 100 millisievert of dose (i.e. 1 in 10,000 per millisievert).

Low Level Ionising Radiation (LLIR)
There is persisting controversy about the potential for human health detriment at doses below 100 millisievert, but an accumulating body of scientific evidence attests to serious risks at low levels, even at doses below a few tens of millisieverts.
Cell biology and the study of the immune system have made tremendous progress since the inception of the nuclear era. Biologists have identified specific LLIR-induced damage at the *molecular* level to nucleotide sequences on chromosomal DNA, including double-strand breaks, large deletions and sister chromatid exchange. Mutational events at key points such as the proto-oncogene or suppressor gene loci provide a credible mechanism for radiation-induced malignant transformation.
Sub-micron diameter alpha-particle emitters (such as uranium-235, americium-241 and plutonium-241) may be inhaled and scavenged from the lung to the lymphatic system and thence in principle to any part of the body. Alpha-emitters cause very high doses to local cells in the 40-micron range of their disintegration tracks. Cells will be hit again and again since the particle will continue to emit radiation: a lifetime of alpha-particle bombardment of surrounding cellular microenvironments ensues. The recent report of the European

Committee on Radiation Risk (ECRR) examines the risk modeling of the International Commission on Radiological Protection (ICRP) on which official radiation exposure limits are based and concludes that *the current limits are too high by at least a factor of ten*.
The data from research involving populations exposed to the radioactive fallout from the Chernobyl catastrophe - including studies of paediatric thyroid cancer, infant leukemia and the observation of increased minisatellite DNA mutations - has driven the further downward course of official recommended exposure limits worldwide. Regulatory authorities like the Australian Radiological Protection and Nuclear Safety Agency (ARPANSA) have reluctantly acknowledged that their current guidelines are inadequate. A recent report from the World Health Organisation recommends dropping the exposure limit for emergency administration of stable iodine to children to 10mGy, which is *one tenth* of the current Australian intervention dose, and *one hundredth* of the old NH&MRC standard from 1976.

It is disturbing that the risk model within which the nuclear programme currently operates – including the framework for Australian radioactive waste management - was drawn up before the discovery of DNA. This fact needs to be borne in mind by legislators charged with the responsibility of protecting the public from the harmful effects of ionising radiation.

Current Management Issues

Minimisation

The best strategy regarding radioactive waste is to produce as little as possible.
Australia's current radioactive waste management plan fails to address the clear need for waste minimisation. Most of Australia's nuclear waste will come from the controversial existing and planned nuclear reactors in Sydney.
Without a new reactor there would be little if any pressure for a nuclear waste repository.

MAPW has called for the cancellation of the Replacement Research Reactor project.
The argument that Australia needs a new nuclear research reactor to maintain a viable nuclear medicine capability is deceitful. (**see Appendices A and B for detailed MAPW critique**).
The best form of waste management is for the Federal Government to turn off the tap and support reduction at source.

Transport

Transporting of nuclear waste increases the risk of radioactive contamination. The Federal Government has no legal obligation or intention to inform local governments, residents or emergency services of the plan to transport nuclear waste through their area. This raises serious concerns about the preparedness of local emergency service to respond in the event of an accident.
Transportation of radioactive waste through key agricultural regions and across major river system could tarnish New South Wales clean, green image and have negative impacts on the key agriculture, food, wine and tourism industries.
Current plans for intervention in radiation emergencies do not constitute international best practice and there is considerable confusion between the relevant jurisdictions and combat agencies with regard to appropriate responses and respective areas of responsibility. (see **Appendix C for MAPW re ARPANSA's 'Interventions in Radiation Emergencies'**)

Storage/Disposal
The geological disposal of nuclear waste has long been the favoured option of the nuclear industry and vast resources have been channeled into making this process a reality: as yet, however, there are no such facilities operating anywhere. It is the ‘natural’ preference of the nuclear industry partly because if we bury it ‘out of sight out of mind’ - rather than securing it where we will remain conscious of it - then the industry will have little to deter it from producing more and more and more …
What seems at first a means of reducing the burden on future generations would almost inevitably foist upon them an even greater nightmare than we have created for ourselves. Furthermore, the argument that it is safer to permanently bury radioactive waste in a remote centralised location ignores the fact that producers of waste will inevitably continue to have a need for on-site storage irrespective of whether a repository is built or not. Such institutions generally have (or ought to have!) the expertise to manage their waste safely. Where storage facilities are inadequate they need to be remedied, pending longer-term management processes. Radioactive waste has been kept in dry, above ground storage in Australia long-term, enabling efficient monitoring and surveillance.
There is an increasing international trend towards Hardened Onsite Storage (HOSS) of radioactive - especially long-lived intermediate and high level - wastes.
Multiple regional secure sites are a viable alternative.

Recommendations

1. terminate the Replacement Research Reactor project

2. prioritise waste minimisation

3. secure above-ground storage of current radioactive waste burden

Conclusion

The NSW Parliament has the opportunity to intervene in the ongoing project to manage Australia's radioactive waste burden, with an eye to the needs of future generations.
The fundamental principle should be waste reduction at source.
Australia does not need a new nuclear reactor. The first step in solving the problem of transport and storage of nuclear wastes in NSW must be to undertake all possible steps to terminate the Replacement Research Reactor project and pursue safer options for Australia's isotope requirements.

APPENDIX A

MAPW POSITION PAPER - 2002
A NEW NUCLEAR REACTOR FOR SYDNEY?

The Medical Association for Prevention of War (MAPW) opposes the construction of a replacement nuclear research reactor at Lucas Heights in Sydney. MAPW supports the Recommendations of the Senate Inquiry (Chapter 11 - May 2001) for an independent public inquiry into the risks, benefits and desirability of a new reactor, and into alternative scientific projects that represent better value for money (over $300 million) and are less hazardous.

MAPW acknowledges the importance of satisfactory isotope supply for medical and industrial purposes, and recommends that if an independent public assessment *were* to favour a replacement reactor, the proponents be directed to site it well away from substantial populations centres, to obviate the need for large-scale emergency evacuation and potassium iodide distribution contingencies in the event of significant radionuclide dispersal.

MAPW calls for an urgent independent analysis of the radiological consequences of a loss of coolant and explosive nuclide dispersal from the existing HIFAR reactor (and any proposed replacement) whether by accident or sabotage. This must include an assessment of the current emergency procedures in the event of radiological hazard and the desirability of pre-emptive potassium iodide distribution – particularly to children living and studying in the reactor vicinity.

Even a relatively small nuclear reactor represents a major long-term health hazard. In addition to the inherent risk associated with the reactor itself is the continuing absence of a finalised process for the management of spent fuel and radioactive waste. Because of the essential prerequisite for secure and proven isolation of such toxins for millennia, any existing technology is by definition experimental. The first principle of best management practice is the absolute minimisation of waste generation.

Australia's requirements for isotopes for medical and industrial purposes can and should be met by

(a) local production in cyclotrons and spalliation sources, and
(b) importation of some isotopes such as technetium/molybdenum which currently require reactor production.

This approach is contemporary practice in many industrial nations including the USA, Japan and the UK – only a tiny fraction of radioisotopes used are produced in their own domestic reactors. A single reactor in Canada produces about sixty percent of the world's medical isotopes. Importation of isotopes via the well-established international isotope market served Australia satisfactorily during the three month "down-time" at the existing HIFAR reactor in Sydney during February -May 2000, and it is a viable option for the future. The world already contains sufficient reactors to meet global medical, scientific and industrial needs many times over. Expansion of the range of isotopes generated in local *non-reactor* facilities could be promoted through a dedicated R & D program.

MAPW calls on the Minister for Health to direct that

- the current RRR construction licencing process be curtailed whilst the recommended analyses are undertaken, and
- the Australian Radiological Protection and Nuclear Safety Agency (ARPANSA) revisit the Siting Licence application process

APPENDIX B

REPORT ON ARPANSA PUBLIC FORUM (14th & 17th December 2001) TO ASSESS ANSTO'S APPLICATION TO CONSTRUCT A REPLACEMENT RESEARCH REACTOR AT LUCAS HEIGHTS.

INTRODUCTION

Preparation for the public forum included a general review of the recent epidemiological and radiation-biology data on the health hazards of ionising radiation, and analysis of the following documents in particular:

- Preliminary Safety analysis Report (PSAR), Probabilistic Safety Assessment (PSA), and Q's and A's to the PSAR and PSA
- Safety Evaluation Report (SER) for Siting Licence
- International Peer Review of PSAR and Q's and A's
- Senate Inquiry Report into Need for RRR (May 2001)
- First Round submissions re Construction Licence application
- ARPANSA website documentation
- ANSTO website documentation

The panel heard detailed presentations from opponents and proponents of the replacement research reactor (RRR) and questioned presenters accordingly.

In determining the advisability of granting a Construction Licence, the following principles are paramount:

- "… the CEO of ARPANSA… must take into account **international best practice** in relation to radiation protection and nuclear safety" *(Section 32(3) 0f ARPANS Act 1998)*
- "Whether the information establishes that the proposed conduct can be carried out **without undue risk to the health and safety of people, and to the environment."** *(ARPANS Regulation 41(3))*
- "Whether the applicant has shown that the magnitude of the individual doses, the number of people exposed, and ***the likelihood that exposure will happen, are as low as reasonably achievable, having regard to economic and social factors***."
- "… detailed review and acceptance of the **finalised plan (for Radioactive Waste Management** for the RRR), including contingency arrangements, would be required for any construction or operating licences for the reactor to be issued." *(3.4.3 Conclusion – ARPANSA Safety Evaluation Report on RRR siting application)*
- "Reactor construction should not be authorised until **arrangements for the management of spent fuel rods** from the replacement reactor have been **demonstrated to the satisfaction** of ARPANSA…" (Recommendation 26 - Minister for Environment and Heritage, March 1999)
- "The Minister for Industry, Science and Resources and the Minister for Health should give **timely consideration** to strategies for the **long-term management** and **eventual permanent disposal** of Australia's long-term intermediate level nuclear wastes…" (Recommendation 27 - Minister for Environment and Heritage, March 1999)
- "Whether the applicant has shown that there is a ***net benefit*** from carrying out the conduct relating to the controlled facility." *(Regulation 41(3))*

For the following reasons, I advise that the applicant has ***NOT*** met these and other criteria in the context of the proposed reactor construction.

RECOMMENDATIONS.

RECOMMENDATION 1

> **Further consideration of the application requires full documentation, including radiological consequence analysis for major explosive impact on a suburban 20-megawatt pool-type reactor and spent fuel storage facility. This documentation should be made available to the public and subjected to**

detailed *independent* expert analysis as part of the construction licence application assessment. This assessment should include re-visiting the issues of design and defence-in-depth and must readdress 'siting assessment'.

RECOMMENDATION 2.

In the light of the independent public review recommended in *(1)* above, the details of planning for an emergency response to a serious radiological emergency must be re-assessed - independently. This would include consideration of extensive distribution of potassium iodide, advice re preparation for and potential duration of sheltering, upgrading of medical (radiological) response capabilities and detailed evacuation instructions. The issues of grazing animals and property contamination must also be considered.

RECOMMENDATION 3.

ANSTO must document finalised authorisations for spent fuel rod processing in specified facilities that are currently engaged in an equivalent process. In line with the recommendation of the Senate Committee (May 2001), ANSTO should prepare and fully cost a contingency management plan for spent fuel conditioning and disposal within Australia.

RECOMMENDATION 4

ARPANSA should stipulate that DITR demonstrate public acceptance, local authority acceptance and State Government acceptance of the proposed National Store and consequent issues. Site finalisation and public environment assessment should be mandatory before granting a construction licence and thus legitimising the production of further long-lived radiological toxins.

RECOMMENDATION 5

ARPANSA should call for a re-assessment of the costs and benefits of a RRR, taking heed of the findings of the Senate Inquiry, which recommended an independent public inquiry. Experts from senior scientific bodies such as CSIRO and ASTEC, as well as senior representatives from medical science would be able to provide an updated analysis, and thus advise ARPANSA (and the Commonwealth Government) re this issue of "net benefit".

1. LOSS OF COOLANT / TERRORISM SCENARIOS

ANSTO has failed to provide adequate documentation illustrating the evidence-base for its categorical assertion that a loss of coolant and explosive damage to the spent fuel storage facility – including events of catastrophic sabotage – would have insignificant health consequences.

The PSAR asserts the following:

- "No **credible external event** has the potential to affect the safety of the Reactor Facility" (16.18)
- "… the estimated low probability of an aircraft crashing onto the Reactor facility **would not require the design of the reactor to withstand aircraft crashes**. Nevertheless, the impact of a lightweight aircraft has been placed within the design basis for the reactor core … The design **worst case** external missile considered was a **light aircraft** …" (16.14.1)
- "Sabotage is not amenable to probabilistic treatment but is countered by information from the intelligence agencies on its likelihood and by **adequate provisions in the design** … The result of this (threat) assessment was that none of these attacks would threaten the **integrity of the reactor core** or create radioactive releases greater than those analysed from other beyond design basis accidents … design of the facility is such that the response systems are **scalable** to meet **foreseeable changes** in the threat level." (16.14.10)
- "Whilst the crash of a light aircraft is a design basis event, **crash of other aircraft** are not and **could be expected to result in core damage**." (p.16.58)
- "No emergency counter-measures outside the facility, such as sheltering or evacuation, would be required in the event of nuclear accidents." (p. 1.3)

In other words, the reactor is not designed to withstand a large aircraft crash, which could be expected to result in core damage. A deliberate multi-suicide/murder hijacking assault of this nature was NOT "foreseen" by the intelligence agencies and "consultants in terrorist activity" at the time of the PSAR (i.e., pre-September11) and hence neither the "response systems" nor the design have been "scaled" to the changed threat level.

A deliberate large aircraft crash *is* a foreseeable risk now and the siting and the design of the reactor must incorporate this. The Experts Mission to Review the PSAR (10.7.01 – 13/79) criticised the failure of the applicant to include "a variety of **potential human-induced events** in the design basis…" and that "… any possible adverse change in the present situation has not been considered … The grillage provides partial protection from only one type of aircraft crash but **fails to serve as a protective envelope** for blast or impact loads in general. It is recommended to **review this decision** on the basis of updated data and calculations as well as projections for the **potential development** in the area that may change the present situation **unfavourably**."

The situation has clearly changed "unfavourably".

Mr Leask from ASNO drew attention to Information Circular 225, an IAEA guidance document, which details specific standards and measures that should be considered for physical protection of nuclear materials. He stated that this document "is likely to be further revised in 2002-2003" and that ASNO will then require ANSTO to "review and update its security plan as necessary to ensure it complies with best international practice regarding **physical protection**."

Given the recent unforeseen developments in international terrorism and the likely major impact on international best practice response, any licence to construct a reactor should only be considered in the context of the *revised* version of INFCIRC 225. i.e., licencing should not pre-empt the international review of standards and safety measures.

ANSTO asserts that even a catastrophic explosion that ruptures the core, causing rapid loss of coolant, meltdown, vapourisation and explosive dispersal of the core contents would not result in **undue risk to the health and safety of people, and to the environment.** ANSTO is similarly dismissive of the hazard potential of explosive damage to storage facilities for radioactive waste, including spent fuel rods.

> PROF. GARNETT: "… *doses to the public are less than, considerably less than, any dose that anybody normally operating facilities gets and they are way below what is required for any countermeasures off-site". (p.160, Forum transcript)*

This assertion is staggeringly at odds with the assessment made by nuclear engineer and former ANSTO staff-member Mr Tony Wood in his submission:

> MR. WOOD: "*With respect to the PSAR the bottom line is that we have an open pool reactor which, at any given time, will contain 500,000 Curies of Iodine131. We only have to let one quarter of 1% of this iodine escape to the atmosphere before the exposure dose at the exclusion boundary exceeds the recommended IAEA Generic Intervention Level for Iodine prophylaxis adopted by ARPANSA."*

I found this discrepancy disturbing and so challenged Mr Wood re his figures and their bases, which he later provided – see **Appendix 1**. Without detailed data it is impossible to judge the soundness of Professor Garnett's assurances, but examination of the **available** information casts considerable doubt on their plausibility.

These assertions must be subjected to rigorous independent analysis prior to further consideration of the licence application.

There will inevitably be debate over quantitative analysis of the radiological consequences, but the *facts* (e.g., the inventory of stored wastes, including nature and amounts of nuclides such as plutonium, strontium, caesium, cobalt and iodine) and the *assumptions* employed in the modelling must be open to scrutiny.

Sydney-siders must be fully informed of the potential for explosive dispersal of significant quantities of long-lived carcinogens and mutagens into their suburbs and their food chain.

RECOMMENDATION 1

> **Further consideration of the application requires full documentation, including radiological consequence analysis for major explosive impact on a suburban 20-megawatt pool-type reactor and spent fuel storage facility. This documentation should be made available to the public and subjected to**

detailed *independent* expert analysis as part of the construction licence application assessment. This assessment should include re-visiting the issues of design and defence-in-depth and must readdress 'siting assessment'.

2. EMERGENCY RESPONSE

"Condition 23 of the Minister for the Environment, flowing from the EIS process … requires ANSTO to develop **a specific plan to facilitate public understanding** of the hazards and risks of the reactor, the **emergency arrangements** and their implications for the community" *(ARPANSA Safety Evaluation report)*

As detailed in **(1)** above, ANSTO has not facilitated public understanding of the hazards and risks of the reactor.

Furthermore, ANSTO has not provided adequate documentation in the public arena to conclude that the **emergency planning process** is appropriate or adequate. Representatives of the Sutherland Shire Council (Ms Genevieve Rankin and Dr Gary Smith) described unsatisfactory procedures to date in regard to public consultation and planning. Mr Tony Wood gave credible evidence, with detailed reference to international experience and best practice re emergency planning that seriously questions ANSTO's performance. On several occasions Mr Wood echoed the critique of obfuscation and secrecy levelled at ANSTO by more habitual opponents at the Forum on the Friday. These comments reflect the finding of the Senate committee of inquiry (May 2001) that ANSTO's "attitude seems to stem from a culture of secrecy so embedded that it has lost sight of its responsibility to be accountable to parliament." This attitude was evident in ANSTO's disinclination to be forthcoming on the matters of loss of coolant, sabotage consequences, or the legitimate concerns of the public re potential radionuclide dispersal and emergency response.

The repeated invocation by ANSTO to consult their website re emergency plans, which they describe as "appropriate and adequate", are misleading and trivialising.

For example,

- if, as the ANSTO website declares, potassium iodide will be available to emergency workers in the event of a serious incident, **on what grounds** has the assumption been made that emergency workers might require medication, but not the general public?
- if – as this suggests – there IS potential radiological risk to offsite personnel, what is the estimated risk and the potential dose to the public?
- if an event requiring distribution of KI to SES workers occurs - how long should public sheltering persist, who would require evacuation, to where and when?

Mr Wood opined that the effects of a significant incident at the reactor – including nuclide dispersal – could be ameliorated by adequate preparation and planning. He indicated that "international best practice" entails distribution of potassium iodide to target persons within one hour of exposure.

His challenge to ANSTO to "tell the truth, even if it is unpalatable" is timely and appropriate.

RECOMMENDATION 2.

In the light of the independent public review recommended in *(1)* above, the details of planning for an emergency response to a serious radiological emergency must be re-assessed - independently. This would include consideration of extensive distribution of potassium iodide, advice re preparation for and potential duration of sheltering, upgrading of medical (radiological) response capabilities and detailed evacuation instructions. The issues of grazing animals and property contamination must also be considered.

3. SPENT FUEL PROCESSING

ARPANSA cannot grant a construction licence for the proposed RRR until a ***"finalised plan for radioactive waste management"*** exists, and the "arrangements" for spent fuel rod management have been demonstrated to be ***"satisfactory".***

ANSTO has failed to articulate a "finalised plan" for the processing of spent fuel. The COGEMA / INVAP /?third country / (home-conditioning) flow-chart in their application constitutes an algorithm for contingencies – none of the options are "final" (i.e. definite, conclusive, absolute) … all depend on numerous anticipated developments (and are thus *contingency*, not finalised plans).

The proponents have failed to demonstrate a secure contract with COGEMA to reprocess silicide fuel – partly as a result of uncertainty over the exact type of fuel to be used, as the preferred fuel type (uranium-molybdenum) is as yet unqualified:

PROF. GARNETT:

"Uranium molybdenum fuel *development* ***is well under way…"(transcript, p.147)***
and

"…the ***development*** *process is going extremely well"(transcript, p.147)*

Furthermore, the evolving international reprocessing situation urges caution rather than optimism about this preferred fifty-year route.

Similarly, the Argentine option - described as a "fallback" position - is far from "finalised". In an area of potential major hazard to human health such as radioactive waste management, the fallback position should be *at least* as secure as the preferred option. This one is even less secure: the process INVAP has proposed is not currently operational, the process is unauthorised and the facility itself is not currently engaged in equivalent, let alone identical operations … INVAP is simply *proposing* to condition spent fuel from Australia. This process is described by INVAP employee Mr Gerbino as a "***novel method*** to eventually process (Argentine) research reactor fuel elements … the site for an ***eventual*** full scale plant is under study…"

This lack of finality was underscored by the INVAP representative at the forum:

> DR JOHN LOY:
> *"Okay, so there has been no conditioning process for long-term storage?"*
>
> MR PABLO ABBATE
> *"No."*
>
> *(transcript, p.149)*

Furthermore, the Argentine constitution (Statute #41) clearly prohibits the importation of foreign radioactive waste. What the courts will make of the disagreement about definitions (and surely Australian spent fuel is to be processed for storage and disposal, not for further use…) remains to be seen, but protracted litigation should be anticipated.

This is not a 'fallback position'; it is a 'stopgap' measure.

Various presenters referred to the parlous state of the Argentine political and economic situation: assurances were given by the INVAP representative and by ANSTO – with much force being attributed to *"presidential assurances" (transcript, p.150-1)*.

Furthermore, according to

PROF. GARNETT:

"The whole contract has commercial guarantees backed up by commercial banks. The letter from the President to the Prime Minister and the Government guarantee is an extra icing on the cake…" (p. 168)

Since December 17th, the situation has deteriorated from instability and bankruptcy, through crisis, to state of emergency, presidential resignation and helicopter evacuation. At the time of writing, the presidential palace and the parliament are being sacked and burned by disgruntled Argentines, while the third president in one week has resigned.

The suitability of Argentina as the provider of a nuclear reactor needs to be fully reviewed in light of these developments. Simple assurances are no longer acceptable.

Prof.Garnett dismissed other management options as being barely worthy of discussion, asserting that there would be no problem processing Australian spent fuel in any of a number of countries. This is a trivialisation of the issue – most **unsatisfactory** - especially given ANSTO's inability to demonstrate a secure contract for processing the spent fuel in the first instance.

Her absolute denial of intention or capacity to 'home-condition' merely reduces the number of contingencies.

Plans which "are dependent on a range of probabilities" – e.g. which fuel will be used? will the French reprocess it?, when will Argentina have available resources? - are no more than "contingency" plans. (def. Shorter Oxford)

If there is no definite, secure mechanism for managing spent fuel waste, then that waste should not be created in the first place.

RECOMMENDATION 3.

ANSTO must document finalised authorisations for spent fuel rod processing in specified facilities that are currently engaged in an equivalent process.

In line with the recommendation of the Senate Committee (May 2001), ANSTO should prepare and fully cost a contingency management plan for spent fuel conditioning and disposal within Australia.

4. WASTE STORAGE AND DISPOSAL

The Department of Industry, Tourism and Resources presented detailed options for the management of Low-Level (LL) and Long-Lived Intermediate-Level Waste (LLILW). However, none of these potential management routes are 'long-term', 'finalised' or 'eventual permanent'.

The LL-repository is not built, its siting is still open to conjecture (despite preferences being allocated) and there is substantial public opposition.

The LLIL waste–repository is even less secure: opposed by state and local legislature, the public at large and the representative body of senior traditional law-women.

It is unconscionable that the regulator could permit construction of a nuclear reactor, which will produce toxic long-lived waste for 50 years, without a definite storage/disposal facility sited or constructed, let alone operational.

The DITR presentation accurately reflected its submission to ARPANSA: a detailed description of a range of possibilities and a proposed course of action. The current status of this "plan" could be summed-up as:

> *" Herewith a prospective date for an announcement of a proposed site for the temporary management of long-lived waste".*

Not even the date for the announcement is finalised… The national LLIL waste store project is in the preliminary planning phase: pre-siting, pre-EIS, pre-authorisation. The scheme is calculated to generate a semblance of finality and thus to allay grave and legitimate concerns about the unsolved dilemma of managing highly toxic long-lived waste. But these concerns will persist and grow as long as a satisfactory solution is unavailable.

The Minister's recommendation re **"timely consideration"** of "**long-term"** management and **"eventual permanent" disposal** strategies for Australia's long-term intermediate level nuclear wastes acknowledges the enormous burden of responsibility this waste constitutes, and the fact that long-term is just that: millenia, not decades.

There *is* no satisfactory ***eventual permanent disposal*** solution to the hazards posed by long-lived alpha-emitters. There is considerable *optimism* in the rhetoric of DITR and of ANSTO on this matter, but optimism is no substitute for scientific rigour.

Vast resources have been devoted to the dilemma of 'eventual permanent disposal' over the past half century, without satisfactory conclusion. To suggest that 'it's just a matter of time' is simply wishful thinking.

ARPANSA's brief is to ensure that there is no "undue risk to the health and safety of people". This includes the stipulation that "… ***acceptance*** of the **finalised plan (for Radioactive Waste Management** for the RRR) … would be required for any construction or operating licences for the reactor to be issued.

> **RECOMMENDATION 4**
>
> **ARPANSA should stipulate that DITR demonstrate public acceptance, local authority acceptance and State Government acceptance of the proposed National Store and consequent issues. Site finalisation and public environment assessment should be mandatory before granting a construction licence and thus legitimising the production of further long-lived radiological toxins.**

5. NET BENEFIT

At the time of granting the "siting licence', ARPANSA stated that it was satisfied that there was a net benefit in the RRR project:

"… the benefits of the project… exceed the detriment that may arise from the exposures of people to radiation …"

'Net benefit' implies an equation that weighs the risks and their costs against the potential benefits:

"… practices that lead to an increased exposure to radiation must be **justified** to ensure their **overall benefits outweigh the additional risk** due to the increased exposure …' *(ARPANSA Safety Evaluation Report – 3.3.2)*

This is a dynamic equation: when the values attributed to either side of the equation alter, the analysis must be re-quantified.

No evidence was presented to the forum that would substantially re-value the factors on the benefit side – national interest, neutron-beam research, isotope production. On the risk-costs side however, there has certainly been a re-valuation, weighting the equation heavily in that direction, since the catastrophic events of September 11. Several presenters to the forum indicated that Australia faces a greater threat of terrorist activity than previously estimated and that nuclear reactors are a clear target (confirmed by the CEO of the IAEA).

Despite suggestions by ANSTO (and ANA) that the prospect of a commercial airliner crashing into the reactor had been factored into the PSAR, no evidence was presented to that effect. Vague references to large aircraft crashes in the EIS for the Holsworthy runway project have been cited elsewhere, but no documentation has been forthcoming.

And so more queries arise:

i/. Nobody – not even ANSTO – could honestly claim that deliberate, multi-suicide / murder utilising a commercial airliner as a weapon of mass destruction was factored into the PSAR or into the broader cost/benefit analysis.

The risk has *changed*. And so the net benefit calculation must have changed as well.

This must be re-calculated.

ii/. The PSAR describes the "grillage" structure over the reactor building that is designed to impede / withstand the impact of a Cessna. If there are design features to accommodate light-plane crashes, then why is there no requirement for design features to accommodate large plane crashes?

If, as ANSTO has dubiously asserted, there would be no undue health risk to the public in the event of a large plane crash, why was it considered necessary to include design features that are aimed at reducing the impact of a small plane?

RECOMMENDATION 5

ARPANSA should call for a re-assessment of the costs and benefits of a RRR, taking heed of the findings of the Senate Inquiry, which recommended an independent public inquiry. Experts from senior scientific bodies such as CSIRO and ASTEC, as well as senior representatives from medical science would be able to provide an updated analysis, and thus advise ARPANSA (and the Commonwealth Government) re this issue of "net benefit".

Is the recent augmentation in risk still outweighed by the projected benefits?

ARPANSA FORUM APPENDIX 1.

MR.WOOD *(personal communication – emphasis added):*
1) "*... the EIS has given a number for the Iodine 131 inventory for this reactor. See EIS Vol 2 Appendix G Page 25*
Figure for Iodine 131 is 1.82×10^{16} *Bq (Bequerels) 1Curie (Ci) =* 3.7×10^{10} *Bq*
That is ***491,892 Curies***
2). Over the years many safety studies have been done for HIFAR and I refer to one of the more recent ones which was presented as report DR 22. HIFAR Safety Analysis: Frequency and Off Site Consequences of Fault Sequences Initiated by within-plant Failures.
In this one it was assumed in a worst case scenario 4.6 % of the iodine 131 escapes to the atmosphere. Once the iodine release number is known is a fairly standard calculation to determine the doses down wind. Normally stable meteorological conditions are assumed at least for part of the time with temperature inversion and wind-speed of 1 m per second. This is very common in Sydney at night.
This calculation for HIFAR showed that the dose to the child thyroid at the 1.6 km boundary would be 1900mSv.
To determine the percentage release to give a dose at the boundary of 100mSv [ARPANSA has adopted the IAEA Generic Intervention level for Iodine prophylaxis which is 100 mSV]:
If 4.6% of the inventory delivers 1900mSv at the boundary
To determine what fraction release gives 100mSv at the boundary
100/1900 of 4.6% = .24%

That is if ¼ of 1% of iodine escapes and no countermeasures are taken one intervention level, (100mSv) will be received at the boundary. There was not sufficient information in the PSAR for me to convert magnitude of release to dose but this information was available from DR22. It was valid to use this because the fissions products would behave the same for the two reactors except the new one had double the inventory.

To be conservative I ignored this factor of 2 so *the real number would be one eighth of 1% instead of the one quarter of 1% I claimed for the Generic Intervention limit to be reached.*

APPENDIX C

Response by MAPW (Feb. 2003) to the ARPANSA Radiation Health Committee's *Recommendations for Intervention in Emergency Situations Involving Radiation Exposure – Consultation Draft, October 2002*

"Let us not ask ourselves 'if' – let us prepare for 'when'."

NSW Premier, Mr Bob Carr (1)

INTRODUCTION

The *Consultation Draft* is a comprehensive approach to the complex issues entailed in responding to radiation emergencies and MAPW congratulates the Working Group of the Radiation Health Committee on the document (2).
The response to a radiation release will always be a dynamic process – "a work in progress" – and the on-the-ground response will evolve as information and analysis of the extent of the emergency accumulates. There is likely to be significant doubt in the initial response phase about the *extent* of the release and its potential consequences (3), so emergency response authorities should adopt the most conservative approach at the outset.
MAPW notes with some concern that "pre-September 11" attitudes to radiation emergencies continue to adversely influence planning. MAPW advises that "generic" radiation emergencies should be referred to as 'incidents' or 'events' or 'emergencies', not as 'accidents'(4).

SUMMARY OF RECOMMENDATIONS AND COMMENTS

- *MAPW recommends that in the event of a radiation release where estimated exposure levels will exceed 1 mSv, the public be advised to take shelter until further information about the release is available.*
- *MAPW recommends that the current Generic Intervention Level of 5 mGy for urgent sheltering be retained.*
- *MAPW recommends that the Generic Intervention Level for stable iodine prophylaxis for children and pregnant women be lowered to 10 mGy, as advised by the World Health Organisation.*
- *MAPW recommends that limited household, school, and reception centre pre-distribution of stable iodine be recommended as an integral part of emergency response planning*
- *MAPW recommends that the Generic Intervention Level for stable iodine prophylaxis for children and pregnant women be the same as the Generic Intervention Level for evacuation*

1. SHELTERING

1.1. MAPW recommends that in the event of a radiation release where estimated exposure levels exceed 1 mSv, the public be advised to take shelter until further information about the release is available.

The draft document recommends sheltering at an intervention level of 10mGy avertable dose *(5)*.

The ARPANSA recommended annual limit for public exposure to ionising radiation to the public is 1 mSv. However, the recently released report of the European Committee on Radiation Risk recommends "the total maximum permissible dose to members of the public arising from all human practices should not be more than 0.1mSv" (6, 7).
Exposure to levels between 1 and 10 mSv are assumed to increase stochastic effects (i.e. carcinogenicity and genetic disruption)(8).
Sheltering is simple, safe and effective (9), and unlikely to have adverse consequences.
The public must be informed of the release promptly – it would be better to advise sheltering immediately and await further advice, rather than expose people to up to 10 mSv (or considerably more if initial data prove to be under-estimates).

1.2. MAPW recommends that the current Generic Intervention Level of 5 mGy for urgent sheltering be retained.

In addition to recommending *immediate sheltering* as a precautionary measure (1.1 above), MAPW advises that there is no scientific basis for the draft document recommendation to raise the (urgent) 'sheltering' intervention level to 10 mGy.
The linear-no-threshold hypothesis states that even at very low doses, radiation can still harm DNA (8). The trend in setting radiation dose limits has been downwards for several decades, as scientific understanding of radio-pathogenesis has grown. Epidemiological data, in particular examining the health impacts of the Chernobyl accident in 1986, have driven recommended exposure rates lower still (10, 12) . At the molecular level, researchers have identified specific radiation-induced disturbances in DNA strands, and linked them causally with human carcinogenesis (11).

2. STABLE IODINE PROPHYLAXIS

I. GENERIC AND OPERATIONAL INTERVENTION LEVELS FOR CHILDREN AND PREGNANT WOMEN

2.1. MAPW recommends that the Generic Intervention Level for administering stable iodine to children and pregnant women be reduced to 10 mGy, as advised by the World Health Organisation (12).

The draft document recommends that the Generic Intervention Level for administering stable iodine to children be reduced from the current level of 100mGy to 30 mGy. (*p.38)

On the basis that the risk per unit is of the order of a factor of three between children aged under ten years at exposure and older children (Heidenrich et al., 1999*), a reduction of the intervention level for thyroid administration, from 100 mGy to 30 mGy, would seem appropriate (Consultation Draft – RIESIRE* 2002 Annex A, *p.54).*
This reasoning fails to take account of the fact that the thyroid vulnerability to I-131 escalates dramatically in inverse proportion to age, such that ***the rate of incidence of thyroid cancer in children aged 0–1 year at exposure is approximately twice that of those aged 2–3 years at exposure, and <u>approximately 16 times</u> that of those aged 8–9 years*** *(10).*

The draft document cautions against reducing to the World Health Organisation's (WHO) recommended 10mGy IL on the grounds that this may impair the emergency response capability and divert resources away from higher risk categories (13). Using response capacity as a category to decide safety levels is perverse; conclusions and recommendations should not be based on generalities, but specific data and calculations.
There is evidence of child thyroid carcinogenesis at exposure levels below 10 mSv from the post-Chernobyl cohort (14), although at the less than 10 mSv/mGy dose range, controversy is likely to continue long-term (11, 15). The primary source data is conflicting and risk estimates vary (by orders of magnitude).
The Working Group advising the National Radiological Protection Board (U.K.) expressed ambivalence about which level to adopt and recommended that consideration be given to adopting the lower (10mSv) level in the context of overall emergency response planning (16).
In view of the inaccuracies inherent in the epidemiological data and radiation consequence analyses, a more community-oriented paradigm (informed by molecular biology) should be incorporated into the emergency-planning model. In the event of a radiation release involving radioactive iodine, citizens exposed to the plume will inhale radioactive iodine, absorb it through their lungs and into their bloodstream. Their thyroid glands will rapidly concentrate the radioactive iodine, which will begin to irradiate their thyroid cells. Beta and gamma radiation will damage DNA strands in thyroid cell nuclei. DNA defects may be passed on to succeeding generations of thyroid cells if normal repair processes are inadequate. Mutant cell colonies may become cancers. Even miniscule amounts of radiation have been show to damage DNA. The risk of carcinogenesis at low exposure levels is small - but real.
The most conservative intervention level (10 mGy avertable dose) should therefore be adopted

II. PRE-DISTRIBUTION

2.2. MAPW recommends that limited household, school, and reception centre pre-distribution of stable iodine be recommended as an integral part of emergency response planning

The draft document advises against the "widespread" household pre-distribution of stable iodine. (p.51)

The prompt (preferably *pre-exposure*) administration of potassium iodide (KI) is extremely safe and extremely efficacious in averting I-131 uptake by the paediatric thyroid to prevent carcinogenesis (17).
Household pre-distribution is standard practice now overseas, including in Ireland, France, Switzerland, Holland, Germany and various states of the U.S.A. (18).
Household pre-distribution into predesignated zones calculated from adequate radiation consequence analyses is the surest way of enabling timely administration (i.e. within one hour of exposure) of stable iodine to a substantial proportion of the vulnerable population.
Door-to-door distribution at the time of the event is unrealistic, logistically difficult and dangerous, and would be an onerous burden on combat agencies (who may decline the job on OHSS grounds anyway). Evacuation to assembly points for administration of KI will be necessary for people without a domestic supply, but only as *part* of the emergency response. Limited household KI pre-distribution will ensure many citizens can deliver the iodine to thyroid tissue in the required window-period. Citizens self-administering their KI dosage will substantially reduce queues and congestion at KI distribution points.

3. EVACUATION

3.1 MAPW recommends that the Generic Intervention Level for evacuation be the same as the Generic Intervention Level for stable iodine prophylaxis for children and pregnant women.

The draft document currently recommends 30 mGy as the Generic Intervention Level for stable iodine prophylaxis for children and pregnant women and 50 mSv as the Generic Intervention Level for evacuation (Table 5, p.38).

The primary aim of the emergency countermeasures is to reduce health risk to potentially exposed citizens. As door-to-door distribution of KI is impractical, and household pre-distribution will only achieve partial population cover, the public will logically need to begin evacuating at the same GIL adopted for KI prophylaxis, as the only source of KI for those without a domestic supply will be at the predetermined assembly points.

4. REALITY CHECK

- People will begin <u>*self*</u>-evacuating as soon as the release is notified.
- I t would be best if they had already taken their KI.
- The KI is extremely safe and an unnecessary dose is not a problem (babies will need to be monitored for weeks/months after).
- Most parents are accomplished at dosing their small children, e.g. 'Combantrin' for worms!
- KI is safer to have in the home medicine cabinet than mum's iron supplements
- Emergency response will need to focus on traffic control.
- Assembly areas should be designated well away from the release, i.e., a zone where exposures are below the *current* lower level for sheltering (5 mSv)
- Pre-planning must include mock-emergency exercises on-the-ground, including premature self-evacuees, and concentrating on immediate shelter, self-administration of KI where available, then orderly evacuation to assembly points < 5 mSv.
- Pre-planning must include *education*. People need to understand that KI is only a partial intervention, that shelter and evacuation are essential components of the emergency response. Information must explain to the public that fission products include isotopes other than I-131, such as cesium, strontium, americium and plutonium, which are not blocked by KI, and if absorbed will be retained long-term and continue to irradiate tissue (like bone-marrow and lung). *All* are potentially carcinogenic and mutagenic, so avoiding exposure to the plume is critical, especially for children and pregnant women.

5. PRESCRIPTION FOR RADIATION EMERGENCIES:

1. Notification
2. Go inside
3. Take your medicine
4. Listen to media
5. Organize evacuation – assisted/unassisted – to (?)15 km (contingent on Radiological Consequence Analyses)

<u>*NOTES*</u>

1. Sydney Morning Herald, 24/10/02.
2. *Recommendations for "intervention in emergency situations involving radiation exposure"* (RIESIRE) Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 2002
3. *"*Emergency response decisions would be highly dependent upon the specific conditions at the site and often on meteorological conditions at the time. There will be limited environmental monitoring information available during the initial part of this phase to aid decisions on the introduction of protective measures*"*. *(*ARPANSA, *Consultation Draft – RIESIRE,* 2002, p.7, section 2.3*)*
4. See: ***4.3 RESPONSE TO REACTOR-BASED ACCIDENTS*** *(*ARPANSA*, Consultation Draft – RIESIRE*, 2002, p.24, section 4.3*)*
5. ARPANSA, *Consultation Draft – RIESIRE,* 2002, p. 20, section 3.4
6. *Recommendations for limiting exposure to ionising radiation (*ARPANSA, 2002*),* and see ***ECRR Executive Summary*** *at* www.euradcom.org/2003/execsumm.htm.
   see *Recommendations for limiting exposure to ionizing radiation* (ARPANSA, 2002).
7. ARPANSA, *Consultation Draft – RIESIRE,* 2002
8. ARPANSA, *Consultation Draft – RIESIRE*, 2002*, p.9,* section 2.4
9. Following the accident at the Chernobyl nuclear power plant in 1986 a significant rise in thyroid cancer cases in the exposed children was observed in Belarus, a small part of the Russian Federation and the northern part of the Ukraine. Childhood thyroid cancer is normally rare, and there is little doubt that the increase, which is most marked in the youngest exposed children, was due to exposure to the radioisotopes of iodine present in the fallout (Williams et al., *One Decade After Chernobyl: Summing up the consequences of the Accident*, IAEA, Vienna, 1996). About 1800 thyroid cancer cases had occurred up to 1998 in those who were children or adolescents at the time of the accident (UNSCEAR, 2000).
   Studies in Belarus indicate that **the rate of incidence of thyroid cancer in children aged 0–1 year at exposure is approximately twice that of those aged 2–3 years at exposure, and <u>approximately 16 times</u> that of those aged 8–9 years.** (Cardis et al., *Radiation and Thyroid Cancer*, 1999).
   On the basis of these studies it is clear that the risk per unit dose for children aged under ten years is higher than that for adults, with a factor of three between children aged under ten years at exposure and older children (Heidenrich et al*., Radiation Research, vol. 151, no. 5, p.617-25,* 1999). (*Consultation Draft – RIESIRE* 2002, Annex A, *p.52*)
10. "We have concluded from reviews of published data and the outcome of our own studies that the data relating to the role of gene mutations in tumorigenesis, the monoclonal origin of many tumours and the relationship

between DNA damage repair, gene/chromosomal mutation and neoplasia are well established. The data available are broadly consistent with the thesis that, at low doses and low dose rates, the risk of induced neoplasia increases as a simple function of dose and there is no threshold-like component related to DNA damage or DNA repair. These mechanistic studies, in addition to the epidemiological information available, indicate that, for the purposes of radiation protection, there is little basis for arguing that low radiation doses (< mSV) would have no associated cancer risk, and that in the present state of knowledge it is appropriate to assume an increasing risk with increasing dose". (John W. Stather, Deputy Director, National Radiological Protection Board (U.K.). Letter, *MJA*, *vol.172*, 3 April 2000, *p.352*)
For more detail, see: Taylor et al, *Lancet* 1994; *343:86-87*, Hei et al, *Carcinogenesis*, *vol. 15, no.3 pp. 431-37, 1994*, Vahakangas et al, *Lancet*, 1992; *339:576-80*, Hussain et al, *Carcinogenesis*, *vol. 18, no.1, pp.121-25*, 1997.

11. *"Guidelines for iodine prophylaxis following nuclear accidents"*, World Health Organisation, Geneva, 1999. (Table 1, p.4)
12. *Consultation Draft – RIESIRE* 2002, Annex A, l.2071*, p.54*
13. In 16 out of 30 cases of thyroid cancers in children exposed to the Chernobyl fallout (in Bryansk district) it was established that the most probable individual doses values were 50mGy or less. Some cases occurred in **children exposed to estimated doses of less than 10mGy**. (Souchkevitch and Tsyb, *Scientific Report: International Programme on the Health Effects of the Chernobyl Accident*, WHO, Geneva, 1996.)
14. "…the short half-life of the dominant radionuclide, I-131, means that it is unlikely that the uncertainties surrounding the dose estimates will be refined in the future." (Recommendations of the 2nd UK Working group on Stable Iodine Prophylaxis, *NRPB*, *vol.12, no.3*, 2001, *p.12*.)
15. "WHO recommends an intervention level of 10 mGy thyroid dose for application to young children; NRPB currently recommends a lower intervention level of 30 mGy thyroid dose. The Working Group offers NRPB reasons both for and against reducing the intervention level in the UK to 10 mGy and asks it to review the possibility of such a change in the context of the full UK emergency planning arrangements." *(NRPB Press Release,* 13/09/01*)*
16. Taking stable iodine immediately before exposure to radioactive iodine reduces the dose to the thyroid by at least 95% (Le Guen et al, *Health Physics, vol.83*, *Issue 2*). Administration within the first hour post-exposure offers about 85% protection. Beyond 4 hours post-exposure the benefits are dramatically reduced. i.e, Stable iodine administration must be prompt. The Polish authorities administered over 10 million doses of stable iodine to children after the Chernobyl accident, most within 4 days. There were no major adverse impacts. Potassium Iodide is very safe and efficacious. (*Consultation Draft – RIESIRE* 2002, Annex A, *p.52-3)*
17. Information from the State of Vermont Health Department*:*

DISTRIBUTION METHOD

Potassium Iodide will be distributed in the following manner:
i). People who live or work within the EPZ will be offered the opportunity to obtain their own personal dosage of KI. This will be accomplished through outreach and education efforts by the Department of Health, in concert with locally stationed public health nurses.

ii). Within, and just outside of, the EPZ, Offsite Response Organizations (ORO's) will be utilized to store sufficient quantities of KI. In the event of a radiation emergency, these ORO's will be utilized for mass distribution of KI. ORO's will be sited in local fire departments, police barracks and other centrally located and easily secured structures.
iii). Special population segments will be provided with their own specific distribution systems located within, or near, their respective setting(s). Such populations as those served in hospitals, nursing homes, schools, child and/or adult care facilities will be provided KI in this manner.