

ARPANSA PUBLIC FORUM

TRANSCRIPT OF PROCEEDINGS

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MEETING COMMENCED

DR JOHN LOY

Welcome to the second day of the public forum on the proposal for a construction licence for a replacement research reactor at Lucas Heights. I will not go through the matters that I mentioned in my opening statement last Friday other than to say and to welcome back our three panellists. They have enjoyed their weekend in Sydney and are fit and relaxed and moving on to the next stage of the forum. So without any further ado, we have a number of presentations to get through today, so can I first ask Tony Wood to come forward and present.

MR TONY WOOD

Good morning. Gentlemen, I will begin by laying my cards on the table. I support the new reactor project. I support ANSTO because I admire the diligence and determination exhibited in bringing the project to its present state but my support is qualified for reasons which will soon become apparent. I class myself as a supporter because all my criticisms of ANSTO have been aimed at improving its public position. Moreover, the criticisms were first made in private. I hope that a construction licence will be issued but only after ANSTO has satisfied ARPANSA in effecting the changes described here. I would like to speak on three subjects, drawing on my paper to ARPANSA in phase 1. They are: (1) My dilemma with the Preliminary Safety Analysis Report, PSAR; number 2, a more realistic PSAR requires an effective emergency plan - how good is ours; and number 3, does ANSTO have a problem with its safety culture.

My dilemma with the PSAR: with respect to the PSAR the bottom line is that we have an open-pool reactor which at any given time will contain half a million curies of iodine 131. We only have to let out one quarter of 1 per cent of this iodine to 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. This is a very safe reactor but it is not harmless, as depicted by ANSTO in its handout publicity material. The PSAR tells us that the most severe of all accidents considered delivers a smaller dose at the exclusion boundary than an individual living

for 1 month in Sydney would receive through a natural background. Moreover, it suggests that even this infinitesimally trivial event would not be expected to occur more than once in 300,000 years. At this point in the preparation of the PSAR an important point has been overlooked, it is called a reality check and this check tells me that this result is unreal. It has been achieved by a series of logical steps but has led to an illogical conclusion which is not apparent to ANSTO.

I think that overall the PSAR is not a bad document. I do not have the time, the inclination or the competence to check it in great detail. It uses the PRA process which is a useful process to identify and evaluate a number of accident sequences apply risk analysis and compare them in order to direct attention to areas of high risk which might require closer attention. The mistake here is in equating the absolute numbers produced to the real world. The real world of actual accidents is characterised by unforeseen sequences of events and sometimes by hidden failures awaiting the final event which triggers the actual accident. All those years ago at the Oak Ridge Reactor School a clever old man called Eppler warned us about believing very low probability numbers assigned to precisely defined accident sequences. He like to quote actual reactor incidents where, during the course of an incident, the plant acted substantially as designed but failed to prevent the accident because it was exposed to a set of conditions that the designer did not foresee. If you do not foresee it how can you estimate its consequences. How could the designer of the twin towers in New York foresee that they would be demolished in less than 1 hour by 12 determined men armed only with Stanley knives.

Take a reactor example: at Windscale it was completely unforeseen that the thermocouples correctly located in the graphite to register the highest temperature for normal operation would mislead the operators by not registering the highest temperature during the abnormal operation of the Wigner energy release. This caused England's worst reactor accident. Let me quote from the text of a reactor safety course given by the technical training division office for analysis and evaluation of operational data US Nuclear Regulatory Commission dated November 1997. I quote, "No PRA" - that is probabilistic risk assessment - "would have considered the possibility that a licensed operator would actually turn the emergency core cooling system off during a loss of coolant accident yet that occurred at Three Mile Island". This was the USA's worst

reactor accident. The text goes on, and I quote again, “Similarly, operators are not expected to disable large numbers of safety-related systems in violation of technical specifications yet this was done at Chernobyl. Thus human errors of commission may be very significant to actual risk yet at present there is no comprehensive method by which such actions can be examined as part of a probabilistic risk assessment”.

If the world's worst terrorist event, the world's worst reactor accident and the worst reactor accidents in the UK and the USA were all unforeseen and could not have been anticipated in a probabilistic risk assessment am I asking too much to expect ANSTO to admit of this possibility in its PRA. The net result of the failure to apply the reality check to the PSAR accident is that the public has been misled. In attempting to be realistic ANSTO has been in fact unrealistic and in the wrong direction. It has presented the reactor as being completely harmless which it is not. I emphasise here that this does not mean that it is particularly harmful or unsafe. That is a different issue altogether and outside this discussion although I would be happy to discuss it in question time if you wish. My point is that the claim made by ANSTO belongs to the world of the theoretician and not the real world.

I think John Loy has gone a long way towards swinging the pendulum back towards the real world in his document called On Assessment Of Physical Protection And Security Arrangements. It has long been recognised that the integrity of the pool is the key to the safety of this reactor. Any event jeopardising its integrity could clearly result in the full core melting and if such an event were to cause simultaneous containment failure then we would have a genuine upper-bound accident. ARPANSA has formally requested ANSTO to, I quote, “Review and provide to it an assessment of the potential sabotage or terrorist targets within the proposed reactor replacement facility and of the consequences of successful attacks on these targets. The assessment is to include consequences of the impact of a large commercial aircraft on the facility”. This is a clever move and I hope ANSTO has noted the use of the key-word “successful” because a successful attack bypasses the debate on the effectiveness of the security measures and the design features intended to frustrate the attacker. They are assumed to have failed. Moreover, for an attack to be successful in the eyes of the attacker the reactor would have to be destroyed.

If I could introduce a speculative note here the members of the panel might care to comment later. This pool reactor might pose a greater threat from terrorist attack either by aircraft crash or direct attack than does a large power reactor. Because of the greater mass and larger footprint of the power reactor it might be much more resistant to attack and much less likely to a sustained fuel melting than a small-pool reactor. Since the risk is defined as the probability times the consequences, the much larger consequences of a successful attack on a power reactor might be offset by the much lower probability of success. I am not suggesting that is so but it might be. For example, in Canada we might be considering a Maple reactor compared with a Candu, which is the easier nut to crack.

I would like to think that the ARPANSA directive would produce public dose calculations for a genuine upper-bound accident involving a full core meltdown and say, 20 per cent leak rate per day for the containment. On the basis of ANSTO's past performance I do not think this will happen because it desperately wants to prove that the reactor is harmless and it continues to see that the only way to do this is to show that the release from the upper-bound accident would be trivial. I do not think ANSTO will set out to deceive. It will just follow its instincts. A fair measure of ANSTO's credibility will be the extent to which it opts to use assumptions which would produce numbers favourable to its bias.

I believe there is another and a better way. Why not leave the existing theoretical evaluations of the beyond-design basis accidents intact but for the purpose of evaluating the public consequences of the ultimate accident consider a conservative hypothetical event of unspecified origin leading to full core meltdown combined with say, 20 per cent leak rate per day for the containment. Then look at the doses downwind and their effect on the public. Provided ANSTO has a good emergency plan they will not be too bad. Moreover, ANSTO would then be bulletproof in this area for the next 40 years and we would have catered for the unforeseen accident, a possibility that ANSTO in its PSAR has yet to acknowledge.

Let us face it, ANSTO is committed to having an emergency plan and ARPANSA is committed to ensuring it is a good one and if one can live with the consequences of a full core meltdown, and I am sure you can, what have you got to lose by including it in

the PSAR. As you well know, doing this in no way implies that you think this will happen. It just says, for example, "If these security people who say confidently that the integrity of the new core could never be threatened by a terrorist attack are ever proven wrong then the dose rates at the boundary will have been predicted and if necessary intervention countermeasures will ensure that consequences will be minimal". This generic accident or an equivalent must be included in the PSAR rather than considered external to it because ARPANSA's regulatory principles require that the emergency plan be based only on accidents considered in the safety analysis report.

If I could sum up my position on this topic in a couple of sentences it would be while probabilistic risk analysis is a very important process for improving the safety of reactor designs it is still theoretical in nature and not part of the real world. The real world belongs to Chernobyl, Three Mile Island, Windscale, Brown's Ferry, SL1 and several near misses I could nominate and the emergency plan bridges the gap. ANSTO does not understand this distinction hence its misleading public statements on the emergency arrangements.

This is number 2 which is a more realistic PSAR requires an effective emergency plan. How good is ours. Since I have been talking about the real world let us start by looking at lessons from Chernobyl. This is a subject which should be required study for anybody working on reactors and I can only briefly touch on it here. Moreover, I am referring only to the health effects on the public from the Chernobyl accident. The health effects on the site workers were much more severe. The main radiological consequences of the Chernobyl accident is thyroid cancer in children, some of whom were in the womb at the time of the accident. Iodine crosses the placenta. The thyroid cancers occurred earlier than expected and there have been about 1800 cases and a few deaths. There will be some more cases, mainly to people who were very young children at the time of the accident.

Apart from this increase there is currently no evidence of a major public impact attributable to radiation exposure from the accident. Leukaemia, which is the next most radiosensitive disease and has a latency period of 3 years, was not even seen after 15 years and no other cancers have been seen beyond those expected from sampling the control population. It is well known that thyroid cancer is normally non-fatal and

treatable. Better still, it can be prevented by taking very simple precautions, provided - and I emphasise this - that these precautions are taken promptly. The first action is to shelter indoors with the windows closed; the second is to take potassium iodide pills to saturate the thyroid gland with non-radioactive iodine so that it will not take up the iodine 131. The US Food, Drug and Administration said this year, and I quote, "For optimal protection against inhaled radio-iodines potassium iodide should be administered before or immediately coincident with the passage of the radioactive cloud though potassium iodide may still have some substantial protective effect even if taken 3 or 4 hours after exposure".

The USNRC reactor safety course that I mentioned earlier provided a curve showing that a delay of 4 hours renders the potassium iodide only 20 per cent effective. 15 years after Chernobyl one message comes through loud and clear, thyroid exposure from radio-iodine is, relatively speaking, much more important than we had previously thought. I believe the test for an emergency plan is whether it can demonstrate that procedures are in place to ensure that (1) within half an hour of the accident occurring the most exposed members of the public would receive notification of the accident and advice to stay indoors and within 1 to 2 hours they would all have potassium iodide pills. Those numbers or something close to them are so important that they should appear in large bold letters on the top of any new reactor emergency plan to signify its goal. The implications of this are significant; time is of the essence and there would be no time for long-winded consultations and belated approvals.

There is a third option of public evacuation, which is important, but given the protection offered by the size of our exclusion boundary it could perhaps be considered after the first phase. It may be found not to be necessary and that itself poses a small risk. How good were the emergency arrangements at Chernobyl. In June this year a conference was held on the health effects, results of 15-year follow-up study by the World Health Organisation United Nations Scientific Committee on the Effects of Atomic Radiation and representatives from the various republics.

The first item under Medical Lessons Learnt from Chernobyl is, I quote, "The radiation protection of the population in the early period after the accident was inadequate notably in relation to the prevention of the intake of radio-iodine". We have had 15

years since Chernobyl to put in place an emergency plan good enough to ensure that we would not repeat the same mistakes here. Have we succeeded. Sadly, I think not, but before discussing the adequacy of the plan I would like to introduce a sobering thought. Of all the airborne contaminants iodine poses the greatest threat to the community and the group within the community at most risk is the children. The risk is inversely proportional to the age. The community is particularly sensitive about the health of its children and would be very unforgiving if an accident were to occur and urgent measures available to protect the children were not employed in time due to administrative bungling. I would hate to be the one who had to stand up in the witness box and explain at the inquiry that by the time we got all the necessary approvals the measures were too late to be effective.

Now let me discuss the emergency plan. By emergency plan I mean a document detailing the arrangements for minimising public radiation exposure in the event of a major reactor accident. The plain fact is there is no such plan. When I sought a copy of the latest emergency plan I was given two documents neither of which is complete and both are intended only to protect ANSTO, not the public. They have a quaint way of expressing it, they call it the vulnerable community but this vulnerable community is not the public but only those people enclosed by the Lucas Heights perimeter fence. These documents are entitled ANSTO Emergency Plan HE 1 and Lucas Heights Science and Technology Emergency Plan HE 2. The first is to cater for emergencies at Lucas Heights for which outside assistance from state agency is needed and the second is to cater for emergencies at Lucas Heights for which outside assistance from state agency is not needed. Both have to be read in conjunction with standard operating procedures which are held at ANSTO and without them it is impossible to judge whether they are adequate even for this limited application.

Another document called The Sutherland Shire Local Disaster Plan is needed to cater for the public. This plan is a most remarkable document. In this case the vulnerable community represents the people in the Sutherland Shire who would be exposed in the event of a reactor accident and it lists a number of hazards to which they might be exposed such as bushfires, earthquakes, oil spills, aircraft crashes but no mention of radioactivity among the hazards. In the whole document there is no mention of the words, "iodine", "nuclear" or "reactor" and only one mention of ANSTO. No one

would guess from reading this plan that there was a nuclear reactor in the area. I was interested to hear Genevieve Rankin last Friday say much the same as I have said here about this plan but she added something I did not know and that is that these words were left out because somebody thought the reactor should not be portrayed as a hazard. If this is true it must constitute a world's first. Here we have a document presented as a reactor emergency plan that does not mention the word "reactor" or "radioactivity" because it does not want to upset people.

All three of these documents have arisen from the State Emergency and Management Act of 1989 which forms a basic planning network for all emergencies state-wide. For most emergencies this seems like a very practical arrangement. It envisages emergencies being controlled at the lowest appropriate level and escalated when required. The problem is it makes no concession to the unique requirements of a major reactor accident leaving one with the unanswered question of "Where is the reactor emergency plan." If it is tucked away among the three plans mentioned above together with their various operating procedures it is very effectively hidden and therefore inappropriate.

Overall responsibility for implementing off-site countermeasures rests with the state authorities and this has devolved at Lucas Heights on a site controller who would be a policeman. There is little doubt that the police and ambulance can and would act promptly if required. The problem is who will be authorised to recommend to the site controller what action is needed and when it should be initiated. This is not an ordinary accident which hazards familiar to the police. A highly prescribed plan is needed in which many important decisions have been taken in advance. For example, how will the potassium iodide tablets be dispensed. Ideally, they should be in the homes or the schools of the potential users prior to the event otherwise there would be a delay in dispensing them and the dispensing officers may receive considerable exposure and may even be reluctant to participate.

However, this option may not be palatable to the officials preparing the plan. If it is intended to distribute the tablets only when required the plan should clearly by his position the official making this decision so there will be no confusion at the inquiry as to who was responsible for the consequences. It is a topic which may be worthy of

public debate. I would be interested to hear the views of some of our friends of Friday on the following question, "Assume there is going to be a reactor anyway. Should potassium iodide tablets be available and if so should they be held in people's homes." It is a serious question.

Another important decision is who is going to recommend the site controller when countermeasures should be implemented in order to avoid the intervention dose levels being exceeded. Will it be a senior official in the Department of Health or would he delegate this to the senior ANSTO officer or to the ANSTO duty officer reactor engineer of the day. The plan should identify that person to avoid any confusion after the event as to who is responsible if there is an unnecessary delay in making that decision.

I am going to quote now an actual incident which illustrates the importance of clearly defining who is in charge. On one occasion at HIFAR with the reactor shut down workmen were trying to stop a small heavy water leak. They were working in a radiation field higher than normal but considered to be acceptable. The duty health physicist came along and monitored the field and ordered everyone out. The reactor manager happened to be there and he said, "We need another 15 minutes". The health physicist said, "Definitely not. I am responsible for their health and I want them out now". The manager said, "I'm responsible for the safety of the reactor and all those people who would be affected if this situation escalated to a major accident and they are going to stay until the job is finished". Both parties were taking their responsibilities seriously but at least one of them did not have a clear idea of who had the final authority. That type of misunderstanding could be tragic during the course of a major accident. End of anecdote.

Is there an ongoing programme to make police officers, ambulance officers and even doctors aware that they may be involved in working in radiation fields or with contaminated patients. If so, we should be able to read about it in the plan. I can recall an incident when after a minor accident at Lucas Heights a worker with a contaminated wound was refused admission to Sutherland Hospital because of his contamination. Is there a computer program in the site operations office which will accept data such as the estimated magnitude of the iodine released from the fuel, the current meteorological

parameters such as wind speed in the Pascal stability category and then predict doses downwind at various distances. If so, reference to it should be in the plan.

I think ANSTO has failed because it has not brought its specialised knowledge to bear in briefing state officials on the peculiarities of reactor accident. It has failed to do this because the ANSTO officers involved in the preparation of the plan did not have a reactor background and were so eager to please the police who wanted a standard format that they did not realise that they were abrogating the special public responsibility that ANSTO has as a nuclear reactor operator. We cannot expect busy police and Health Department officers to maintain awareness of the effects of reactor accidents. This is ANSTO's specialty.

Perhaps the problem has arisen because ANSTO does not believe - and it has stated this publicly often enough - that any countermeasures would ever be needed. Either you need a plan or you do not. If you decide to produce a plan then it must be a plan that you think will work. It also has to be one that ARPANSA thinks will work because one of its functions is to judge the effectiveness of the emergency plan. Without an effective plan how can you issue a licence. I would like to see ANSTO in consultation with state authorities produce a single document which integrates with the DIS plan system of the state government but is specific to a major reactor accident. No ANSTO officers should be allowed to participate in the preparation of this plan unless he has a very clear understanding of the causes and consequences of major reactor accidents.

Now I am on to number 3 which is "Does ANSTO have a problem with its safety culture." I would like to refer back to my earlier statement about ANSTO's achievement in progressing the project so far. It has been a remarkable performance. It has far exceeded the efforts of all those who have gone on before. I know because I was involved in the earlier efforts. It must be uncomfortable for ANSTO now to have a hostile Sutherland Council as a neighbour. The recent federal election campaign must have been unnerving but the project is now safe and the pressure is off. Now it should be possible for ANSTO to relax, be less defensive and more responsive and to concede that nobody including the critics always gets it right first time. However, the critic may see things that your in-house team overlooks since he approaches the problem from a

different angle. Moreover, in-house teams in general have been known to be reticent about offering unpopular opinions.

These problems are about safety culture. I am not suggesting that the safety culture is at a low ebb at ANSTO but I am saying that this obsession with describing the reactor to the public as harmless itself threatens safety culture. It indicates a state of mind where “We don't need to tell them this it will only worry them unnecessarily”. We are about to enter the construction phase. It has not been unknown overseas for results to be falsified in order to avoid the public and the regulator finding out that certain aspects of the construction did not achieve the claimed quality standard. This might be an extreme example and I am not suggesting that ANSTO would stoop so low but the example could represent the end of a line which began with a similar small threat to safety culture. I believe it is important that the public be told the truth even if the truth is unpalatable. I have cringed at some of ANSTO's public statements. Surely there is someone at ANSTO with a practical reactor background and the courage to flag up when ANSTO is yet again about to mislead the public. For example, the claim that ANSTO makes for nuclear indemnity is indefensible.

I am conscious of the fact that I have run out of time for this presentation so I will go straight to my conclusion in three parts. I support ARPANSA approving the issue of a construction licence subject to ANSTO revising the PSAR to include a hypothetical upper-bound accident in which there is a simultaneous full core meltdown combined with major containment failure; that is 1. Number 2: ANSTO in consultation with state authorities producing an emergency plan taking advantage of lessons learned from past accidents and terrorist attacks and offering confidence that thyroid exposure would be minimal following the hypothetical upper-bound accident; and 3: ANSTO demonstrating to ARPANSA that it is conscious of its prime responsibility for public safety and it accepts the need for candour in communications with the public.

Mr Chairman, that is the end of my presentation but I would seek leave to take another minute or two just to explain my position on the sabotage issue.

DR JOHN LOY

All right.

MR TONY WOOD

I would like to make my position clear on the security issue since it was dealt with in my written papers in phase 1. I presented two written papers in phase 1; one for publication, one not for publication and these were fairly specific about the type of terrorist attack on the reactor which might be successful. This argument goes back to the original EIS which shows to my mind a ridiculously trivial accident for the reference one. I wanted to show that there was a scenario that could offer much worse circumstances which could not be dismissed as a candidate for the reference accident. I would like to make it clear just where my difference with the safeguards office lies. It does not lie with the security organisation itself which I think does a pretty good job. I believe all countries need to have an efficient security organisation and recent events have made it clear that this is more important than ever. I believe security organisations have a thankless and almost impossible task when it comes to preventing terrorist attacks. This is because the attacker has the tremendous advantage of choosing the time and place for the attack.

Moreover, we live in an open society and as a community we are reluctant to have our installations fortified and to commit large amounts of funds for this purpose. We would rather spend it on schools and hospitals et cetera. Because a security organisation does not have unlimited funds we must accept the fact that we will continue to be, to some degree, vulnerable. There is no point in trying to hide this but I think the PSAR does this and this is where we part company. This is what the PSAR said about sabotage, I quote, "The result of this assessment was that none of these attacks would have threatened the integrity of the reactor core to create radioactive releases greater than those analysed from other beyond-design basis accidents".

For those people here who are not familiar with the reactor core whose integrity might be threatened, let me explain. It is very small and very fragile. It would fit in the smallest of those wheelie bins we used to cart up our rubbish to the street for collection, the ones with the red lids. Visitors from overseas, that might mean nothing to you but I am sure it would mean something to many people in the audience. It is made up of 16 tubes set out in array of four by four. Because the tubes have to be close together they are square instead of round and each is about 3 feet long and 3-1/2 inches on each side.

Each tube is filled with about 20 flat plates running along its length set out like CDs in a stacker with a small air gap in between. The thickness of each plate is about that of a CD and they are made of aluminium with a small amount of uranium contained in each.

As every schoolboy knows, aluminium melts at 600 degrees Centigrade which is quite a low temperature. The reactor core is very flimsy and has a very low heat capacity. If you were to shut the reactor down and lift the core out into the air it would melt in 1 or 2 minutes from its own internal heat and would flow like mercury releasing a significant part of its inventory of fission products. The new fuel elements themselves have to be handled very carefully to avoid physical damage and even a small explosive charge would threaten the integrity of the core. So it is apparent that what the security people are saying is that their countermeasures would be successful in thwarting an attack. How can they be so confident when their overseas counterparts have had so many failures and they have already had a few of their own.

My position now is by all means accept the assurance of the security people that they will do their best to thwart attacks and hopefully they will succeed but let us evaluate the hypothetical full core meltdown event with consequent containment failure for the purpose of the emergency plan. Should ever a successful attack occur a good emergency plan would then provide adequate protection for the public.

DR JOHN LOY

I think that has given us a pretty rich breakfast for Monday morning. I will continue the tradition we began on Friday and throw the first questioning to Garry Schwarz from Canada.

MR GARRY SCHWARZ

Thank you very much, Mr Wood. You have made some rather very interesting points and I think a lot of good points. I guess the one thing that I would ask is that one of the things you did not actually talk about this morning but you did mention in your paper was that you talked about the transparency of the process and I think in regard to the transparency of the process you are really concerned about transparency with regard to looking at security events and terrorist attacks and that in fact the PSAR might not reflect whatever might be ultimately analysed. You have talked today about another

way of going about this without being specific about how a particular attack could be handled. You would just simply say, "Okay, let's just assume that you've got a core melt and then you release -and your containment has got a 20 per cent leak rate basically and let's see how that goes", and that is certainly one way of going about in handling something like that.

Typically, when you design a facility you always try to have some kind of an appreciation though for where are your sensitive areas that could generate this kind of a situation because clearly there are certain areas where you would have to take and hit the facility in order to generate this kind of an event. You cannot just put the bomb anywhere, it has got to be in some very specific areas and in looking at that there may be some particular preventative measures that you may be able to put into place to help offset the possibility of that occurring together with whatever security provisions you have.

I guess in the end I look at it this way: first, you have got the postulated event and secondly you have got your protective measures which are your security measures, I guess you might say in a sense, and I am wondering when we look at the transparency of this particular situation what would you regard as being the necessary amount of information that should be made available to the public to give them reasonable assurance that this event has been looked at adequately.

MR TONY WOOD

Obviously, when we are dealing with most of the engineering problems associated with the development of the PSAR or the safety of the reactor this is all open to peer review. I mean, I can find out, for example, what assumptions were made in producing the calculation and I can go back to the reference, if necessary, and check to see whether that seems to be valid or not. You cannot do this of course when you are talking about the security side of things. Security people say, "Trust us, it will be all right. We have put measures in place but we cannot tell you about it". So there is really no transparency in that operation so my suggestion then is to say, "Well, not matter what happens it's not going to be much worse. It's going to be of the accident that might arise as a result of some security problem or from any other source is not going to be much worse than - well, it cannot be worse than a full core meltdown.

You are only then interested in how the containment works and the weather conditions on the day. So you cannot control the weather conditions on the day but I think that if you make this assumption that we are going to have a full core meltdown and we are going to have a major containment failure - you might not be able to live with this on a power reactor but I think you can live with it on this reactor and that seems to me to be the bulletproof way to go.

As far as transparency is concerned, there is no transparency when it comes to security matters, and I understand and accept this, but this - I think - that is why I said in the paper John Loy's initiative has, I think, might to a large degree solve this problem.

MR GARRY SCHWARZ

That is certainly one of doing it. You take basically the maximum accident that you can have, that you can postulate, and you say okay can I live with that. Of course, even within the regime of what we call core melt accidents there are different core melt accidents, some more severe than others.

MR TONY WOOD

There will always be something worse of course, but if you have got something that is of the right order, then I think that is - you are saying that is about as much you can do. For example, it could be raining on the day. You would get wash out.

MR GARRY SCHWARZ

Yes. You were talking also about an emergency plan and you said that an adequate plan does not exist right now, that would be something that one would be looking for and I guess that would go hand in hand with postulating this type of an event. You would have to have in effect an emergency plan to go with this. I do not know what you have in mind, but typically you talk about having an effective emergency plan and the kind of things that you would like to see in something like that, and I presume that also you would be talking about taking and exercising that plan periodically.

MR TONY WOOD

Yes, certainly. As I think I might in the paper, I think the basic problem here is that the police came in in this in 1989 with a very strong conviction of what was required because that was what they wanted to implement state wide, and what should have happened, they should have been confronted by some people who knew what was required from the reactor side of things who said, well look okay we understand what you are on about, but this has to be done too, this is a minimum requirement of ours, we know what yours is, this is ours, and I feel - and that might happen yet here, and what could happen is, I would hope, that if they were to produce a new emergency plan that the ANSTO people would go to the police and say, we do not have a single document here which is our emergency plan, it has got to integrate with yours, and if the police say, no we are no we are not going to be in that then that is when it goes up one step higher, that is where it could get to the stage when John Loy says, well I am not issuing a licence, and if that happens I can tell you this, the Prime Minister of this country is going to make sure this reactor happens and there will be some high level negotiations minister to minister or Prime Minister to the Premier, but we would get a plan which is the sort of plan which we should have.

MR GARRY SCHWARZ

What would you like to see take place before a decision is made regarding a construction licence in this respect with regard to emergency planning.

MR TONY WOOD

That is arguable, you might argue that you do not really need this plan until we come to operation, until you are required to operate the reactor, but I say that - to demonstrate the safety of the reactor you should be able to show - the safety document itself should show the safety of the design and that should be accompanied by an emergency plan which shows how you would cope this worst accident, but apart from all that, we have got an operating reactor out there right now.

MR GARRY SCHWARZ

I understand that.

MR TONY WOOD

But that is a different issue, but I mean it cannot be ignored.

MR GARRY SCHWARZ

With regard to the definition of the new reference accident, if I can put it that way, what do you regard with the timing of that relative to - what would you like to see with regard to the analysis for such an event prior to construction licence.

MR TONY WOOD

This suggestion that I am making here bypasses the analysis. It just says, let us make this assumption that we are going to have a full core melt down. In approaching the safety analysis you say, we will do this sum, can we live with the result, yes good, if we cannot, we might have to go back and refine the calculation even because it is possible that very conservative assumptions were made along the way which now you could not afford to have, so you would go back and analyse it further. What I am getting at really is that we have been down the path of trying to second guess what might happen and the whole theme of my paper is that you cannot, in fact if you have got a good probabilistic risk analysis it almost goes by definition if an accident occurs to that plant it is going to be from unforeseen circumstances because by definition the probabilistic risk analysis will find the weak areas in the design and they will be fixed.

MR GARRY SCHWARZ

I guess what I was getting at is I am presuming that you would want to see the results of the core melt situation basically in support of the issuance of a decision on the construction licence, in other words that that information would be available before the issuance of a construction licence.

MR TONY WOOD

It is very easy to obtain. It is already available in the Lucas Heights site - but for the HIFAR reactor.

MR GARRY SCHWARZ

I am just going to close and before I pass onto my colleagues here - I know are anxiously awaiting to ask their questions, but I would just say one - make one observation to you, and that is that it is okay to have a sort of a bounding accident like this, what you can sometimes get into though, you have got to be a little bit careful with

using bounding accidents because what you can into is that the designers then say, well all of our other events are all covered by this bounding accident, so therefore we do not have to take such care in the provision of protection for other events, and that is not what you want to get into because really what you want to do is you want to keep this very, very low in terms of probability of occurrence, so in fact you want to take a number of protective measures to ensure that this event should basically never happen, although you have taken provision for it, so you have to be careful with that because I know some of our designers back home have fallen into that trap sometimes when they have taken - come up with large bounding analysis and then they have not actually demonstrated what the protective systems would really do.

MR TONY WOOD

But the protection you have there is I suppose professional integrity of the design team and the regulator who makes sure that the proper analyses are done and not just of course in the design itself as you well know, the safety of the reactor goes well beyond the design, it goes through the construction phase and the operation phase as well. Any errors, in any one of those areas can result in an accident.

MR GARRY SCHWARZ

I am just saying it is very important that you send the correct signals to people of what all this doing and what the real total philosophy is here, and whether this particular event fits into the envelope of the reactor safety philosophy.

MR TONY WOOD

I understand that and that is part of the safety culture and that is one reason why I raised the question for safety culture, I mean it is very important.

MR GARRY SCHWARZ

Thank you very much.

DR BILL WILLIAMS

Thanks Tony. That was a very interesting presentation. Just a few points for clarification, you have said basically I guess that ANSTO needs to take a reality check and I think you really accused them of misleading the public on their Websites and the

documents that they have provided to the public and you have encouraged them to be much more open and show candour about this. You are encouraging them to say, let us look at full core melt down as a realistic possibility and something that can then be dealt with, and you saying that you do not think it would be too bad and that people could live with the consequences of a full core melt down, you say that with great confidence, I am wondering why and where that confidence comes from.

MR TONY WOOD

Because the sums have already been done for the HIFAR reactor which has a fission product inventory of half this new reactor, so you have only got to multiply by two for the results from that - that tells you what the dose down wind was going to be.

DR BILL WILLIAMS

If there was a full core melt down, there would be dispersal into the surrounding environment of contaminants - you are focused on iodine, but presumably - I mean there are hundreds of different nucleides in that inventory, including strontium and caesium and things like that, you are dismissing the risk to the public.

MR TONY WOOD

I am not dismissing them because by and large precautions that you take for one will - the worst one will give you protection on the others, but the thing about it is that it turns out from the evidence that is coming from Chernobyl is that - the exposures that the people received at Chernobyl have not resulted in detectable levels of these other cancers from caesium and strontium and the other fission products, so my suggestion is that if you do what you need to do about iodine, then -

DR BILL WILLIAMS

I am familiar with the World Health Organisation's position on this and I accept what you are saying about that, but I actually think that it is far more controversial than that. The medicine about it is - is more controversial and even if the World Health Organisation is correct because of the controversy that would be involved in that, I think it would be trivialising to say that the people of Sutherland Shire let alone the people of Sydney could live with the consequences of a full core melt down, and I accept that

what you are saying that we need to talk about it is the first step, but I am not personally convinced that saying that it is okay to release strontium and caesium and -

MR TONY WOOD

The biggest health hazard that has arisen at Chernobyl and Three Mile Island is the psychological hazard - the psychological effect I mean - people who have been exposed have in many cases have taken a sort of psychological position far beyond what their actual exposure would warrant. Now these are genuine health effects and when you read the reports of the conferences that have occurred on Chernobyl and Three Mile Island they say that this is - it is this effect - the psychological effect from the exposure that has been received, so that is very important. I am not doubting that at all, but I am just saying that - at the moment I do not think we have got adequate protection for exposure from any - iodine or strontium or caesium or any of the other fission products because our procedures are so cumbersome that they will take so long to implement that they will be ineffective.

DR BILL WILLIAMS

I can see what you are saying and I want to ask you a bit more about that, but the other thing - when you were mentioning Chernobyl and I think it is really important that we look at what happened there, I think you said that apart from the thyroid cancers in children in particular, and I think the rates are something like 200 above expected range, there were no major public health - that is from the BMJ 1995: 200 times the rate.

MR TONY WOOD

It depended on the areas, some areas it was 50 times the normal rate of thyroid cancer, other places it was - I have not seen anything as much as 200 - but I would not be surprised. They were basically larger and earlier, they came after 2 years and they were not predicting them to come for 5 to 8 years.

DR BILL WILLIAMS

I think you said though that there were no other major public health hazards, it seems to me that the whole business of contaminating a large part of the environment and evacuating people - those are major public health hazards.

MR TONY WOOD

Please do not think that I have said that I think - I am trying to dismiss the Chernobyl accident as being a minor affair, it is not. It was a very major accident, with very major consequences, but you have got to look at the thing in perspective. The health of that community was not good in the first place, there was an iodine deficiency among the people in the Ukraine there, and this would have meant that they would actually have been more susceptible to iodine 131 than communities that did not have this iodine deficiency. So there was - I think - I mean I am not really competent to go into the health aspects in great detail, but the World Health Organisation and the UNSCEAR are both saying that the cancers - the other cancers have not really eventuated and it is unlikely that we will ever be able to detect over and above the normal incidence of cancers all other cancers any extra cancers associated with Chernobyl. That does not mean to say that there has not been any, but it does mean that they have not and they will not be seen above the normal incidents.

DR BILL WILLIAMS

In terms of iodine, what is your opinion. I mean you have obviously thought about this a great deal as far as - if we do embrace the full core melt down scenario and therefore we have to have an adequate emergency plan and according to the - I think it was the United States Nuclear Regulatory Commission or the FDA - that people would need to take iodine within an hour for world's best practice, perhaps even quicker than that. Does that not really mean that people - I am not sure what would the radius be - how many people in Sydney should have iodine tablets in their cupboards.

MR TONY WOOD

I do not think you would need to go - I mean I am sort of taking a guess here, but I do not think you would need to go out too far, in terms of kilometres.

DR BILL WILLIAMS

But as soon as ANSTO mentions that on their Website, is not everybody in Sydney going to want to have iodine tablets in their cupboard.

MR TONY WOOD

This is the problem; it is an educational problem. I know that iodine tablets are not widely distributed, and this is one reason why I suggested earlier on that John might like to consider the possibility that there be some public debate on this. Because if people have the opportunity to put them in their home, people should not be forced to of course. This whole subject requires a public education program and I think it would be in everybody's - the country's best interest and ANSTO's best interest, ARPANSA's best interest, if in fact the public had a better feeling for what the health effects are and the precautions that can be taken to minimise them.

DR BILL WILLIAMS

Going on from that and you brought up the subject dear to my heart of how people - health workers in the field are going to deal with it. I mean we have to have a far more sophisticated analysis of the potential dangers. I mean I live and work in a community where we do not have a nuclear reactor. If I was living within 20 kms of Lucas Heights, then I would expect that the - not just the local government, but the state government and the federal government and that ANSTO in particular would have provided me on the ground in the hospital and the clinics that I work in with the knowledge to cope with it. I mean I have got a bit of an interest in it, but I mean most health workers have got other things on their mind.

MR TONY WOOD

I have read a bit about Chernobyl and one group that I really hold in high regard are the medicos. People tend knock what the Russians did at Chernobyl, but in fact some of things they did were not very good at all, but a lot of things they did were top class, and I think there the way they handled the medical side of it was excellent, and their medical staff seemed to me to accept the fact that it was necessary for them to receive exposure and willingly accepted it, and I would like that would happen here.

DR BILL WILLIAMS

But it would be nice if the medicos were informed that were going to be in a position where they would be exposed.

MR TONY WOOD

This is all part of it, this is what I am saying, it should be part of the plan, the plan should be - we have got this educational program, if a doctor comes to work at the Sutherland Hospital, the first thing someone tells him, you may just have to work with radiation. If you are not prepared to sign a document to say you are prepared to do that, go away, we do not want you.

DR BILL WILLIAMS

Go and work in Broken Hill.

MR TONY WOOD

That is right, then you say, okay, you make sure that all the people, the nurses, the doctors, what have you, the ambulance people, all understand. I do not think they do now, I mean I cannot say for sure, I would be very surprised if they did.

DR BILL WILLIAMS

They would not, it is just not part of the game, and as you said yourself, ANSTO's been accused of having a culture of secrecy and you have certainly cast doubts about their openness and their candour in this regard, and I know from my own experience, looking at ANSTO's public information and looking at their Website about what to do in the case of an emergency, one is consoled that the plans are appropriate and adequate. From what you are saying that is simply not true.

MR TONY WOOD

I just saw a recent publicity release from ANSTO which said, our arrangements are all right. There are a few minor changes but nothing to do with responsibility, words to that effect, and I say, in my view, that is quite wrong. They have not been, to use the expression someone used yesterday, they have not been fair dinkum about their plan, and they have not been fair dinkum because they do not believe they would ever need one. Because they have convinced themselves on their probabilistic risk analysis that the accident would happen once in 300,000 years would only give you one month's exposure that you would get from background. How can you be serious about a reactor plan if you really believe that, and that is what they believe.

DR BILL WILLIAMS

I will leave you alone, I have just got one more question, and that relates - I mean you brought up the subject of September 11, and I am sure everybody has thought about it, and I do not think we have to go into a detailed security analyses about it, but if - my understanding that Lucas Heights is basically under the flight path - one of the main flight paths of Kingsford Smith, that is in the PSAR actually, it says that, 2,500 jets a month -

MR TONY WOOD

There is an altitude -

DR BILL WILLIAMS

Yes, they are not allowed to come under 2,000 feet, but people have been known to hijack aeroplanes and do nasty things with them. In the event of a big - a 767 - 400 tons or something travelling at 250 metres per second carrying 200,000 litres of fuel hitting pretty close to the spent fuel rods and/or the core, is it your understanding that it is a simple core melt down situation or because we have a major explosion, a fire which could last for a month or two, judging by what has happened in New York, that does not alter the parameters of that scenario, that there is a huge explosion dispersing contaminants in -

MR TONY WOOD

Yes -

DR BILL WILLIAMS

Because presumably no-one has really modelled it -

MR TONY WOOD

That is a very important point because these calculations of doses down wind, assuming fairly conservative meteorological data, like a pascal F stability category which is the most stable with a temperature inversion level which gives you the most dose, they are they figures. If you have - one thing that people do not often realise - the American aircraft that flew into the tower had around about 40 to 50 tons of fuel, planes leave Australia here going non-stop to the USA with 150 tons and others go up to Tokyo and Hong Kong with about 70 tons or something, so some of our aircraft are typically

carrying much more fuel than these other aircraft did. If an aircraft were to hit say this pool reactor, I just think it would boil away all the pool water, but there would be better dispersion and there would be - whatever else happened - there would be a full core melt down through just lack of coolant to the core, even if the core was not dispersed or distributed. But there would be an advantage perhaps, some people might regard it as an advantage, because you would not be - the release would not be under those stable conditions, the heat from this would punch a hole through the inversion layer, if there was an inversion, and you would end up with better dispersion conditions than you would have in the conditions that the accidents were -

DR BILL WILLIAMS

At a simple reference yes. I am not sure how reassuring that is. I know from the research that I have done looking at this because there has been some modelling of large planes, but hitting power reactors, bigger reactors. I have not seen anything about small ones, but presumably you can scale down the modelling, but this is something surely that the public needs to be told. ANSTO has done the modelling on this potential scenario.

MR TONY WOOD

So they say. Power reactors are very big and very - that is why I said in here - some of our gentlemen who have studied this from overseas might like to comment on whether they think the threat from a small reactor is less or greater than the threat from one of these big power reactors. I mean they have naturally a very high resistance I think to both types of attack - aircraft attack and the other - but I do not know whether they are prepared to comment on this at all, but I would like to hear if you are prepared to say something about that.

MR BOB BUDNITZ

I have two very different questions and so I will try to segregate my thinking about them. The first has to do with accidents quite apart from terrorists. Accidents. The second we will come to is the question about purposeful terrorists. So forget about the terrorists for the purposes of the first question, this is accidents. Generally the philosophy in accident analysis everywhere in the world and I know here, is to analyse certain accidents but to stop analysing accidents and a rough judgment of probability at

a certain cut off because you cannot analyse the most improbable accidents. Because I, as a safety analyst and I have been doing this for decades, have no idea what the most - what the worst accident would be. I just have no idea what the worst accident would be because in probability space you can always counter up something that is worse, that is less probable. And in that light it puzzles me about your discussion about this, which you called - whatever the words you used, it is surely not the worst accident, there is no such thing really, maybe there is, and therefore I wonder whether you have in your mind any probabilistic ideas about what sort of probability would be low enough so that it would be not necessary to go beyond.

I am just going to tell you a little anecdote, right after Professor Rasmussen of MIT published an the first probabilistic analysis - this was in middle seventies - and he was at a public forum like this, and some person in the audience who stood up and asked the question, thought it incredible that he was actually finding that the probabilities of these large accidents in the large power reactor were around 10^{-5} per year, that is about once every 100,000 years if you are just running them in perpetuity. It seemed awfully small and wanted to know why - what about accidents that might occur every 10 million years or every 100 billion years or whatever, and to try to bring it back into layman's term he said to the interlocutor, he said, well tell me what do you think is the largest accident - this was in New York city, what is the largest aeroplane accident in terms of damage you can image in New York city, and the person said, well the 747s carry about 500, it would be about 500, and Rasmussen said, no, no, no, how about if it landed in a stadium, so yes I guess you are right, probably 30,000. He said, well what if two planes crashed and they went into different stadiums both full. The person said, that is way too improbable for me, and yet that is possible too. Where do you stop.

The question is - I mean in real terms here, you have to decide, and by the way typically the regulatory authority decides, there is not anything precise about these cut offs, but the regulatory decides that a certain low probability or improbable accident is the one that will be the worst one, and then the applicant has the burden of analysing that accident and demonstrating what is what. And if it not acceptable, then they have to go back and do better. I am wondering if you have any ideas about what you think along these lines because you have suggested an accident that ARPANSA's own analysis shows is improbable below 10^{-7} per year as best I can tell. I mean I am not going

to argue the details because I have studied it and I cannot really tell down at that level, for all I know it is much less than that, but it is surely not 10 minus 4 per year accident. It is surely not a 10 minus 5 per year accident, for sure I have analysed, I have looked at that and I know that based on my analysis of their analysis, so where do you think it is.

MR TONY WOODS

Which accident are you saying is not greater than -

MR BOB BUDNITZ

The full core melt has 20 per cent leakage, is surely not a 10 minus 4 per year accident, I mean it is very less than that, not sabotage, not terrorism, just accident. I have looked at the analysis myself and I conclude, I conclude based on what I have read of theirs and what I brought to it in my own knowledge that such an accident just could not be that high a probability. It is just not so.

MR TONY WOODS

I wonder what you would say would be the probability of the Three Mile Island accident occurring because -

MR BOB BUDNITZ

We knew that at the time.

MR TONY WOODS

Probability turned out to be one, did it not.

MR BOB BUDNITZ

No, no, no, no, no. When an improbable event happens, it does not mean it is one. Let me tell you, if I take a deck of cards and put it down on the table and lay the first four, and I get four Kings, that is a very improbable event. I can compute its probability exactly can I not, the fact that it happened does not make its probability one, it is 4 times 10 to the minus 8. It is very important to understand this, when an accident happens it does not mean that its probability is one, its probability is what it is. That concept is so important that I cannot proceed with you until you accept that.

MR TONY WOODS

I accept that.

MR BOB BUDNITZ

Good, so the fact that it happened does not mean that the probability was not what we really think it was which is around 10^{-4} per year. In retrospect, it was not analysed in 1979 when it happened, but we now understand the probability of Three Mile Island accident around 10^{-4} per year, it did happen right, it is not zero, but it is not one either.

MR TONY WOODS

I am saying you cannot plug into your probabilistic risk analysis acts from the operators. There is almost an infinite number of variations for the things that they can do, and the reactor safety in my opinion depends to a large degree on the quality of the operating staff and the safety culture that exists at the thing, and a lot of this is not - in my view and you may well have different views - is not applicable to probabilistic risk analysis, I think there is a very important place for probabilistic risk analysis in trying to produce a good design and probably even to producing good procedures.

MR BOB BUDNITZ

Yes, that is for sure.

MR TONY WOODS

Once you come to talking about ultimate accidents, it is a deterministic thing, not probabilistic, and in my view the full core melt down for HIFAR is a sufficiently - it is highly unlikely, but it is sufficiently likely, particularly in view of the sabotage event, and that is why I got onto this sabotage -

MR BOB BUDNITZ

Let me come to sabotage in a minute.

MR TONY WOODS

You do not want to bring it in, you do not want to bring the sabotage in, but it is in whether you want it or not.

MR BOB BUDNITZ

I am going to ask - that is the next question - I am going to come to that in a minute, but we are talking about something else for the moment.

MR TONY WOODS

Yes, okay. My point is that once you are talking about the ultimate accident, you have to put probabilistic risk assessment aside and you have to start talking in a deterministic way.

MR BOB BUDNITZ

I just cannot accept that you have to put it aside in a sense that if you do there is no limit to what you can decide, why 20 per cent leakage, why not 100.

MR TONY WOODS

Okay, because it is deterministic, it is an arbitrary - as you are quite right there is always something you can find that is worse, but what I am saying is that if you choose a full core melt down of this reactor with a substantial breach of the containment you are asymptotically approaching the worst thing.

MR BOB BUDNITZ

Without arguing the case, I am going to then endorse something that my colleague Garry has said 20 minutes ago, and that is that there needs to be at least some mechanistic thing you can think of that can lead to it, and I have stared at this design, and I understand about earthquakes, but in terms of what - you are suspicious of, of affirmative human actions, it is real for me to see how an affirmative human mistake can drain that core quickly, can drain that water quickly, that looks tough to me. I find that very difficult to work though, and therefore if you are going to lose the pool, which is what would lead to your thing, it has to be something like an earthquake. You can argue about what the probability of these earthquakes is and also about the seismic capacity of the pool - of the pool's container, and I understand that - that is what I do for a living, but I find it really hard to find 10 minus 4 accidents per year, something in that range in which this affirmative error - the error by the operator leads to that. You might be right, but it seems to me that that is a stretch.

MR TONY WOODS

The history of reactor accidents does not support that.

MR BOB BUDNITZ

I actually think the history supports it quite well, the number of these errors that have happened and the way they have been analysed really help us to support that.

MR TONY WOODS

As you might have gathered from what I am saying now, we ought to be very good students of the reactor accident consequences and so forth. I am very strong on that point, but I do feel that if you look at the history of reactor accidents - and near misses too - that they have by and large they have not been able to be predicted by probabilistic risk analysis. And I think that what I am suggesting here is not the worse thing that can happen, and it highly unlikely but it cannot be discarded, and it is a judgment. It is a judgment that I make. You may not share that judgment, but that is the judgment I make.

MR BOB BUDNITZ

I was only trying to illuminate the judgment ARPANSA has to make with some sort of a notion about mechanisms and probabilities and that was as simple as that.

MR TONY WOODS

The point that came out of my paper I think was that if you can live with a full core melt down, and I think you can, then why bother about trying to find something that is less than that.

MR BOB BUDNITZ

I understand that, that is a different point and I understand that point. Just one question, Mr Chairman. That has to do with terrorism, and here I am puzzled by something quite differently. In my country we have been very careful not to discuss the probability of terrorist acts of various kinds. First, because no one quite knows to predict them. We have learned this recently, but I think commonsense tells you that has been true right along, because terrorists always have the initiative because they can pick the time, the

place, and the mode, you said that yourself. But then the question of judgment comes as to which size terrorist event need the design protect against. The design in the broader sense, not just the design of the hardware, but the security arrangements, the whole thing, and there there has been a continuing increase in my country in the size of the threat to which these reactors must show that they are okay.

Just to give an example, we did not defend - these are power reactors, they are way over 100 times bigger than this proposed new reactor - we did not defend against car bombs in my country until an unfortunate event – until the whole bunch of Marines in Lebanon, people probably remember that, and then right away we decided, there is a threat we had better protect against, and we did not want -all of our power reactors were protected against car bombs, truck bombs, in a way that they had not been before. They perceived a threat they had not perceived before and surely that is just -

MR TONY WOODS

They perceived it after the event.

MR BOB BUDNITZ

I am not arguing here, I am just describing a history, and now all of sudden in my country we have perceived a threat we did not perceive before September 11th and everybody in the room knows what it is. Nobody, this is a fair statement, conceived of a purposeful suicidal attack like that. I am just saying nobody in my country conceived of a threat like that, and you had better believe and I know that in my country were are thinking hard about how to protect against that, or whether or not the protection is already adequate and there is a whole lot going on, and some of it I do not even know, although some of it I do know and I cannot tell you about, but the question for you, and I know everybody in this room is concerned. What advice do you have for ARPANSA about that threat. If I stipulate for you the following probability which is that if you crash that American airlines plane that went into the World Trade Centre into that reactor that is under design here, my guess is that it is not going to take it, but I have not analysed it, I do not know, but I have a pretty good educated guess that it is not going to take it.

MR TONY WOODS

I would share that view.

MR BOB BUDNITZ

And you would share that. Now given that, what is your - what sort of threat - are you suggesting that the new reactor proposal should design against that threat or not. And if you are fine, if you are not then is there a lesser one or what. I am puzzled here because these arguments need to be specific because engineering needs to deal with specific design parameters. By the way, there are presumably refineries in Australia, right.

MR TONY WOOD

Refineries.

DR BOB BUDNITZ

Yes, yes. Without arguing there - I mean, you have got to have some here somewhere. I am a newcomer here and I do not quite know where they are but you can fly one into one of them and you cause a lot of havoc. Should they be designed for this threat. I do not know. I mean, it is a question.

MR TONY WOOD

No. As I think I might have mentioned in the - here we have to accept the fact that we cannot fortify, we cannot have armoured personnel carriers going around the place, we cannot fortify our installations too and nor should we. It is a risk we run. We have to accept that there is a certain risk that we run but my point is that I do not think that a successful - and this is where I disagree with security people - I think that - and having worked at HIFAR for many years and have many colleagues who have spent years of their life there we feel or I feel that the reactors are - in our society - are susceptible and we should be prepared to accept the fact that we cannot really design and fortify against it. We do not want to, we cannot. It is a risk we run but therefore - but we can do something about it and what we can do -

DR BOB BUDNITZ

So your logic, as you said, was therefore the emergency preparedness piece is the level of protection that provides whatever you can do given that you cannot protect against the -

MR TONY WOOD

The emergency plan -

DR BOB BUDNITZ

I understand.

MR TONY WOOD

- is the safeguard. That is what I am saying for the public. Unfortunately, it does not exist.

DR BOB BUDNITZ

I was not arguing with that. I just wanted to be sure that I clarified your thinking there.

MR TONY WOOD

Yes, you are absolutely right.

DR BOB BUDNITZ

Which is you are not calling on this reactor's proposed new design to be protecting through design against such a thing.

MR TONY WOOD

Exactly, exactly. I am saying we protect it with our emergency plan and that is why it is so important.

DR BOB BUDNITZ

Okay, that was very helpful.

MR TONY WOOD

Thank you.

DR JOHN LOY

The best-laid plans, and all of that. We're running our usual half-hour late, never mind. Can we move now to a presentation from the Australian Nuclear Association, Clarence.

DR CLARENCE HARDY

Thank you, Mr Chairman, you are going to forego the break. Because you are not giving us free tea and coffee so I think we could forego it. Mr Chairman, my name is Clarence Hardy and I am the secretary of the Australian Nuclear Association and will be presenting the association's submission to the panel today. The ANA thanks ARPANSA for its invitation to comment on its formal submission which it made to ARPANSA on 5 September 2001. The submission was prepared by a working group of ANA members chaired by myself. These members have expertise in reactor engineering, in research reactor operations, reactor safety assessment and management of complex projects. Furthermore, the members of the working group were chosen not to be currently employed by ANSTO or ARPANSA or any other nuclear organisation to avoid any criticism that we would have a conflict of interest.

Mr Chairman, at this point I would like to comment, for the record, on certain events which occurred during the forum meeting of Friday last week. I was surprised, I was disappointed and I was concerned at remarks made by several of the major organisations' representatives which presented their submissions to this forum. I have no problem with them criticising the process being undertaken by ARPANSA in relation to the construction application or the licence for siting. However, I deplore their attacks upon the integrity and the professional conduct of ARPANSA and in particular on its CEO and a number of its staff. I would therefore like to state that the Australian Nuclear Association has confidence in ARPANSA and in the integrity and professionalism of its CEO and its staff and I hope that the major organisations opposing the replacement reactor will desist in future from making personal attacks upon members of ARPANSA. Having said that, I would like to briefly tell you about the association so that the panel members and the public can understand the association's objectives.

The Australian Nuclear Association is a non-profit, non-governmental, incorporated, scientific institution comprising individual persons who were interested in the peaceful applications of nuclear science and technology. Its constitution does not permit company members as it was believed from the start that they might unduly influence its policies. The ANA holds regular technical meetings to discuss a wide range of topics in

this field and these technical meetings are held usually monthly in conjunction with the Institution of Engineers Australia. The ANA also organises national and international conferences to enable the state of the art in nuclear science and technology in Australia and overseas to be presented to Australian audiences.

I turn to my formal submission of 5 September and section 2, the general comments. First of all, we responded to the advertisement by ARPANSA for submissions on this application by ANSTO for a construction licence and this opportunity was welcomed because it allowed our technical experts that first opportunity to see the details of the design and operation of this major facility which previously had only been presented in brief outline in the EIS or the application for site licence. Under section 2 of our submission we stressed to ARPANSA that the specification provided to the tenderers by ANSTO required that the design and construction should be for a multipurpose research reactor which would have to be state of the art, given the constraints of firstly, the maximum power level should not exceed 20 megawatts, it should use low-enriched fuel, not high-enriched fuel, it should provide high-quality research and isotope production facilities simultaneously and it should operate 40 years at a very high level of availability. There is no other research reactor in the world which has this combination of requirements and constraints.

We also stress to ARPANSA in the submission that the basic design presented by the designers and ANSTO must be recognised as a theoretical design based on the experience and the modelling of the designers, the physicists, the safety assessors employed by INVAP, its consultants and the client. It is not a copy or an upgrade of an existing research reactor designed and constructed by INVAP but a completely new design to meet the stringent specifications and constraints. It has many differences to the previous reactor of this power level designed by INVAP and constructed in Egypt. Accordingly, we believe that ARPANSA must be satisfied that INVAP and its consultants have produced a safe design based on sound principles and have the capability to produce the required detailed engineering drawings, can construct all the equipment to the necessary high standard of quality of materials and that they can, in association ANSTO, a client, exercise a very high level of management and quality assurance.

It is obvious that ANSTO has made that judgment that INVAP and its consultants and contractors can achieve this design and can construct it to specification on time and on budget or they would not have signed the contract. We believe it is now the responsibility of ARPANSA as the regulator to convince itself independently that the design and construction will be safe and reliable beyond reasonable doubt. The ANA is not in a position to do this with its limited resources so that all we can do is to comment on issues that we believe need clarification or to identify areas of the design which need to be tested before freezing the design or commencing construction. We are very pleased to see that ARPANSA has in fact sent its staff to visit INVAP and its facilities and inspect the reactor in Egypt to get a feeling for its capabilities.

I now turn to the issues that we have raised from the viewpoint of engineering and operations. We have provided in our submission a list of 18 issues which we considered needed clarification or testing and in the time available I will only indicate a few of these areas in outline and be happy to answer questions on them if necessary. With regard to the containment, we would like to know how the 3 per cent permitted leakage was arrived at and how it can be tested. We are concerned about the shielding of ventilation filters, given problems that have occurred in overseas reactors. We are concerned about embedding important components in concrete. This was an issue which was raised in the scientific experts' report on the IAA. We would strongly recommend instrumentation of fuel elements so that their progress can be followed. We are concerned about the way the support of fuel assemblies is described in the detailed - that description. We are concerned about the dumping of the heavy water in the second shutdown system, we are concerned about potential flow instability and testing required. This has been a source of problem in several research reactors in the last decade.

Clad failure detection based on experience with HIFAR; we are concerned about that. We are concerned about emergency equipment; its availability, its response time. We are certainly concerned about the water seals in the complex bottom area of the reactor and we are concerned about the information provided during transfer of spent fuel from the reactor to the pond and the radiation levels to the operators. We are certainly concerned about the training of operators to operate a pool reactor rather than the type of reactor they have been used to and we look forward to seeing the responses of INVAP and ANSTO to these issues.

If I quickly turn to the issue of the proposed fuel; our understanding is that the proposal to use uranium silicide fuel at start-up and for a limited period has been forced upon ANSTO by the unavailability of a more advanced fuel containing uranium molybdenum which has greatly improved performance for low-enriched fuel reactors and which is more readily reprocessed. However, we do not believe it is sufficient to state in section 4.2.1 page 8 LBDO3 that uranium silicide is “Well established, being in use in many reactors around the world”. We believe it will be necessary to establish that the organisation that is actually producing the fuel has manufactured it in its own equipment and fully qualified the fuel of the proposed design before commissioning begins. This comment applies also to the proposed replacement uranium molybdenum fuel which has not yet been qualified anywhere although there is a good understanding that it will be qualified within the next 5 years, not just for this reactor but for other major research reactors in the world.

We turn to waste management now, item 5 of our submission. We have looked at this very closely and we have made submissions to all of the government’s opportunities to comment upon its proposals and we believe the Commonwealth Government has made sufficient progress in establishing a national low-level waste repository and starting the search for an intermediate level waste store, that these issues should not effect the granting of a construction licence if other factors are acceptable. The government should be congratulated for carrying out extensive community consulting on the repository over the last 9 years covering two different types of government. We also believe that there is an adequate inventory of the amounts of low-level and intermediate-level waste and that these amounts pose no significant risks to the public or industry workers either in the storage or in the transport operations. I might say in passing that we do not support the continued storage of these materials at their current sites spread throughout Australia.

We do not believe this is a satisfactory situation and in making a comment here on something that was discussed on Friday, you cannot give anyone a zero risk guarantee. Particularly not when we live in a radioactive world, when we have radioactive background radiation all around us and over the area of the repository and also there are radioactive materials being distributed around the world from fossil-fuel power stations.

There are 17 parts per million of uranium and thorium in coal and we burn coal in this country, millions of tonnes, and that uranium and thorium comes out of the power stations, for example, in the ashes and it is spread on the surface. It is not controlled closely as it is proposed in the government's low-level waste repository. I do not see the anti-nuclear organisations raising great concerns about these radioactivities and requesting zero release of radioactive materials from the fossil fuel industry.

Now we turn to safety issues. Our initial assessment of the preliminary safety assessment report was that it did provide a high degree of confidence that the proposed design and operations under normal conditions and under accident condition should meet the appropriate standards of radiological safety by a large margin both for workers and for the general public. On the issue of sabotage, our submission was sent to ARPANSA before 11 September and in it we commented that it was highly unlikely that saboteurs could gain sufficient access within the plant to cause the necessary damage to all three major protective barriers; that is the process plant, the protective systems and the containment simultaneously that would lead to major off-site events. However, we are pleased to find that ARPANSA has now started a major re-assessment of the risks and consequences of a major external sabotage event following the events of 11 September. But at this stage from our experience we would not believe that a major accident involving HIFAR or the proposed reactor would lead to major off-site consequences extending to the huge number of kilometres outside the buffer zone, as indicated as a possibility by some of the opponents at the forum on Friday last week.

So if I quickly come to conclusions, Mr Chairman, the members of our working group are satisfied that the basic design provided in the application for a construction licence should in principle lead to a research reactor suitable for ANSTO's needs and therefore the national needs provided that firstly, INVAP, its consultants and its contractors can first of all provide the necessary detailed engineering designs and tests. Secondly, these detailed designs can be manufactured with the required high-quality materials and workmanship with rigorous quality assurance procedures. Thirdly, that critical features, some of which we have identified, are tested before finalisation of the design and manufacture and fourthly, there should be full qualification of the initial uranium silicide fuel manufactured in the contractor's own plant and this must be undertaken

before installation and commissioning, similar qualification, further approval for any replacement advance fuel.

Our initial assessment to the PSAR provided us with a degree of confidence that the research reactor should meet the standards which are being set of radiological safety by a considerable margin and the members are satisfied that the government has made sufficient progress in establishing a national low-level waste repository and starting a search for an intermediate-level store, that these issues should not affect the granting of a licence if other factors are acceptable. Finally - and we did not discuss this in detail, we would be happy to answer questions - we believe the benefits of the proposed research reactor outweigh the cost, the potential risks and the potential consequences and justify proceeding. In the question time I would like to be assisted by Dr Don Higson who is a member of the working group and has particular expertise in radiation protection and nuclear safety. Thank you, Mr Chairman.

DR JOHN LOY

Garry.

MR GARRY SCHWARZ

Thank you very much. I think I am the main culprit for why we got a little behind in the schedule so I am going to ask one question only and this has to do with - you talked about the or gave a number of comments on basically design-related questions that you have, issues from the viewpoints of engineering and operations. You talked about having confidence in the designers, you talked about that there should be a number of tests and so on done to demonstrate applicability of certain design aspects of the plant. In terms of the regulatory process let me ask you this: what your opinion is. What you think, how far do you think the design should have progressed before ARPANSA should give a construction licence.

What I am asking you about is, looking at it from this point of view and that if you simply, for example, accept the commitments of the designers that yes, we will carry out these tests; yes, we will carry out these demonstrations; yes, we will give you these design details later then you can get yourself into a situation where the design is just proceeding a little bit ahead of the construction and an issue comes up and guess what,

to solve that particular problem, if you really wanted to solve it properly, you have got to go back and rip out a part of the plant that has already been built and you might find out that that happens to be a very expensive exercise and that is really not the way you want to go. So you accept the Band-aid solution which is what you would not have accepted if you would have had more design done before you actually committed to the start of construction for the facility. We have had those kind of nasty experiences back in my home country. That is why I raise it.

So I am asking you, with the benefit of the amount of review work that you have done so far of this particular facility what would be your suggestion to ARPANSA in terms of how to proceed. How much design should be done before you would feel comfortable that one could really proceed on a good footing with the construction of this facility.

DR CLARENCE HARDY

Yes, I can see that is a very reasonable question and I think you obviously will understand the way these projects of this kind, any major project which requires approvals along the way - how it proceeds. I believe that a very substantial amount of information has been presented. I was quite impressed and so was our working group on the enormous amount of information that has been now presented for the first time, I may say, in this degree of detail so that people experiencing reactor core design could see exactly how the core was proposed to be designed and it is based, as I said, on very sound principles. It has got to be manufactured though to a high degree of tolerance.

I think sufficient information has been presented to allow a construction licence to be awarded provided conditions are set down by ARPANSA or qualifications put as to this must be tested and they perhaps had not thought that it would have to be, but this must be tested, this must be clarified and these will be laid down just as conditions were laid down on the granting of a site licence on the - originally on the granting of the EIS. These conditions should be set down by ARPANSA but they should not require a full detailed design with full engineering drawings to be presented to them before agree to construct. That is not the way large projects are done almost anywhere in the world and the reason is there is an enormous cost involved in this. It is a significant part of the cost.

If you then are going to say at the end of the day when you have got all the details instead of 17 volumes you will have 117 volumes then you are going to turn it down. The investment is enormous, in millions of dollars have just been wasted if you do not approve it eventually and therefore I believe there has to be a reasonable combination of see what has been presented, have experts identify the problems - things that need to be physically tested either part-scale or full-scale, vibration testing, fuel testing and all there is to it and then approve the final detailed engineering drawings at a later stage. And I think it is entirely reasonable to then have the final PSAR. This is a preliminary PSAR. The final PSAR cannot be developed until later along the road and I think it is a staged operation and that is a reasonable thing and I believe sufficient technical information has been provided and possible problems have been identified and should be addressed.

MR GARRY SCHWARZ

Thank you. I will just give you something from my own experience, if you can think about, in this regard. We have gone through construction of a number of projects in Canada and they started out in the early days where basically there was very little information available, much less than what you have in your PSAR. And we had some rather nasty turns when we got along in the design and along into the construction and found that something did not work very well and we had to put on a Band-aid fix. In the latest project that we constructed basically a lot of the design information, the detailed design information, was required to be available at the time of construction license. I think quite a bit more than what you have here. One of the comments that was made to me by the project director part-way along as they were constructing this facility - he said, "I am very thankful to you the regulator that you were so hard-nosed with us and required so much design information up front because it made our construction life a lot easier and a lot more predictable".

I think what you find today is in the new projects that are being built around the world you would be amazed at how much detailed design information is available before the first shovel hits the ground, if I may put it that way, and this is actually in a sense - it is necessary because those people that are building these projects, the costing is so tight on them these days that they cannot afford to be very far wrong. So they have to have a lot

of information up front to be sure that their estimates are going to be right but they are not going to run into major snags in the project which they just cannot withstand. So it just happens to be a reflection of what seems to be going on in the industry these days but - and I just offer that as a comment to you, if I may put it that way. I have not gone through all of the PSAR in detail myself. You have done more of that than I have and I leave it at that. Thank you.

DR JOHN LOY

Thanks, Garry. Bill.

DR BILL WILLIAMS

Thank you. I have only got a couple of questions and it basically relates to this issue that you address at the end of your paper about sabotage. In your paper you point out that doses in excess of 200 millisieverts to the members of the public, when incurred at a high-dose rate, cause an average fatal cancer risk of the order of one in a hundred and then you go on to say that no accident capable of causing a dose is analysed in the PSAR and that even if the release was very large the weather conditions that would exist for such doses to be incurred outside the reactor site are improbable. But you do not say it is impossible. We heard from Mr Wood this morning who suggested that an event like a full core meltdown - that the people of Sydney could live with that. You introduce a note of uncertainty in my head there. Are you saying that you can conceptualise as an accident or a loss of coolant situation where high doses like that could occur.

DR CLARENCE HARDY

I would like to refer that to Dr Higson because that is his special field, if you would not mind.

DR DON HIGSON

Yes. Well, I think one way of looking at this is to say anything that is physically possible needs to be taken into consideration and of course you immediately have to relate this to the probability that it could occur. In this case, especially looking at a probability, just the sort of worst thing that could happen and if you say, Okay - except I have to say right now that I have not analysed the accident called for in John Loy's

paper, that is to - that the extreme terrorist event and the consequence of that but we have of course looked on many occasions at the possibilities of uncontained releases of radioactivity from reactors, case of HIFAR and other reactors apart from HIFAR. So to get the sort of doses that we are talking about here you would first of all have to say you have got a substantial core meltdown and you have essentially no containment at all. I am not talking about circumstance under which this could occur. We have to look at that as well. That it has to be at the beginning of a prolonged period of atmospheric inversion with the wind blowing in the same direction all the time and then somebody who is downwind, provided no emergency measures have been taken to protect that person. Theoretically, could get a high dose. If any of those circumstances did not exist you almost certainly would not get such a dose. For example, if the inversion broke or if the wind changed direction you would get dispersion of radioactive material or if that person was evacuated or just moved because, you know, people do not stand around for hours and hours and hours waiting to be irradiated even if they do not know that they are being radiated. So if any of those circumstances changed then these very high doses could not occur, would not occur.

DR BILL WILLIAMS

You are postulating the possibility of such high doses being delivered to people in the Sutherland Shire in the potential event of a loss of coolant, for example, in a major terrorist assault. Is that what you are saying.

DR DON HIGSON

I would like to say in respect of that - I do not know if I am answering your question, please tell me if I am not - but if, in the event of a very high - well, you know, substantially complete release of radioactivity or a very high release of radioactivity, I could not envisage any circumstances in which there could be an immediate health effect of radiation. And as you no doubt know there is a threshold for acute effect of radiation of 1000 millisieverts. The sort of actions that are considered in the PSAR in fact do not look at consequences, dose consequences in excess of the odd millisievert or so. The limit for the design base accident is 5 millisieverts.

As you probably know, there is no scientific evidence that doses of this level cause harmful effects. It is recommended by the by the International Commission of

Radiological Protection that risk should be assumed proportional to dose down to zero without any threshold but this is a recommendation made for radiological protection purposes. It is not meant to be used for calculating risk to people. You can use it for this purpose of course and many people will but at the sort of dose levels that are considered in the PSAR - as I said, there is no evidence that there would be any harm, radiological harm. I was specifically looking at the possibility of there being an event at which there is a real risk of - in which we know there is a risk of radiation-induced cancer.

DR BILL WILLIAMS

Yes. You have said yourself in the paper that the question of sabotage is not amenable to probabilistic treatment. I mean, presumably the risk, at least in the minds of the general public, would have increased since 11 September, of some major event potentially causing some release of radioactivity. I mean, I would presume a lot of people would have changed their risk assessment and since we cannot make a statistical analysis because it is sabotage rather than an accident then does that not, given the fact that under the ARPANSA Act that the regulatory body needs to establish net health benefit - does that not mean that if perceived risk has changed then we need to re-assess that equation of cost benefit to which Dr Hardy referred at the end of his statement.

DR DON HIGSON

I think we have always recognised that a large release of radioactivity could occur from sort of paramilitary attack even before 11 September. This was well known. In fact, there have been occasions long before 11 September when people have threatened to fly aircraft into reactors and either to try and extort money from the operators or the government and this is not new. So these sort of scenarios have been considered in the past and we are aware of this and obviously the events in New York on 11 September have made a lot of people even more aware of it. You cannot assess the probability of it, quite right, because it is deliberate action from people who one would regard as being not behaving normally. As I said, I could not envisage circumstances in which there could be immediate health effects from such an event.

I can envisage circumstances in which there could be - and this is what I am alluding to here - in which there could be a real possibility of doses which might - local to the

reactor - which might cause cancer but I could not see that these have been widespread. This would be, strictly speaking, a local effect. There could be measurable radioactive contamination of course from such an event because you can measure radioactivity at very low levels but not necessarily harmful. I would certainly take issue with any suggestion or suggestions that were made on Friday that harmful effects could be said definitely to occur at many kilometres from the reactor. I think that it would be a very local effect. You could not say that it could not occur but the concept that there could be widespread radiological disaster from such an event I think is an overstatement of the situation.

DR BOB BUDNITZ

I was pleased with your submission because it raised some reactor safety issues and that is what I want to talk about. You listed 18 issues in your submission from the viewpoint of engineering operations and you, in answer to Garry's question just a few minutes ago, suggested that in your view it was not necessary that every one of these questions be answered definitively but I was inferring that you thought that nevertheless you would want to have confidence in a lot of the words you use here. You seem to say this; that there was a solution in hand, even if the details had not been worked out at this stage. Is that how I was interpreting your answer to him.

DR CLARENCE HARDY

Yes, I think there are two classes of comment really we made; (1) we just did not fully understand what was in the 17 volumes and maybe we did not understand the wording or something and it should be simple to be clarified. You know, for example, how are the fuel assemblies held in the bottom supports. It was not quite clear. That is simple to answer but dumping of the heavy water and the time it takes, that must be a simple thing to answer to satisfy people.

DR BOB BUDNITZ

There was somewhere - you seem to imply, again in your response to answering Garry, that you, as a matter of philosophy - if you were ARPANSA for the moment - would be willing to accept a design at this stage that was not completely detailed provided that there was confidence a solution was in hand even if it had not been completely specified.

DR CLARENCE HARDY

Yes.

DR BOB BUDNITZ

I am just trying to understand that that was the sort of thing you were implying.

DR CLARENCE HARDY

That is what I am saying. For instance, this matter of water seals at the bottom of the reactor vessel with a number of penetrations going through. There has been a lot of experience about these. We just want assurance that these were designed and were to be built to best practice as used in other reactors and how often have they failed in other reactors and so on. This detailed information can be supplied. It does not need spending a million dollars to do that. So these are the kind of simple things that we were not completely happy about in reading 17 volumes.

DR BOB BUDNITZ

Okay, so that you clarified that. Now I have some specifics. One has to do with the dumping of heavy water. The way you have described it you - this is, by the way, the scenario is - you have the second shutdown system is called into play which is a very unusual accident but of course it is there in case the first one does not work and that is why we want it there and I concur fully with the notion that you've got to have something like that. You were concerned that the possible rate in which this dumping could occur might be insufficient to protect against the accident for which it is designed to protect and I am wondering whether something you knew or - you knew specifically about that or this was just sort of an open question of something that was not documented. Or did you really have some detailed engineering reason for raising that question.

DR CLARENCE HARDY

I think it was raised by people who had experience operating reactors and this was supposed to be a gravity-flow system, not a pressure-induced flow system because in case your pressure pumps failed or something. So gravity-flow through small pipes. We want to know just how big are those pipes, what is the time of flow, how long will it

take to dump it and is this judged by the safety experts to be satisfactory, that sort of thing.

DR BOB BUDNITZ

I understand. Thank you. Because after I read your thing I went back to the PSAR and read what they said and it did not have the detail that was necessary to convince me that it was there but that does not mean it is not there, to me. I mean, it is an open question that the designer needs to answer.

DR CLARENCE HARDY

Yes.

DR BOB BUDNITZ

Thank you, I just was not sure I understood that there was not anything more but you had actually done an analysis yourself and showed its inadequacy as opposed to not knowing it was there which is the same conclusion I came to. Next question along these lines - the next question I have has to do with the - you raised the question about the negative power co-efficient. It is your number 15 and your words say that the claimed negative power co-efficient of reactivity should be explained more fully. Is this based on some analysis you have detailed or at least a rough analysis in which you or your colleagues believed that that co-efficient was inadequate.

DR CLARENCE HARDY

I think its the view of our expert in this area who held that this was very badly explained if he, an expert, could not fully understand it -

DR BOB BUDNITZ

Okay.

DR CLARENCE HARDY

- what hope is there for people who were not such experts in it to understand this fundamental principle of a negative temperature co-efficient.

DR BOB BUDNITZ

The design of this reactor - by the way, most reactors that we use around the world - relies fundamentally on this physical principle and by the - physical principle is not engineering, it is a physical principle and therefore if it is correct it has much higher confidence than any piece of engineering. So it was not that you had done a detailed analysis but that you could not understand what in the world they were telling you in their -

DR CLARENCE HARDY

What we call plain English. It was not really plain English.

DR BOB BUDNITZ

Thank you, because again, if there were something more fundamental in that - that would be really important - that you had uncovered -

DR CLARENCE HARDY

No, we did not uncover anything fundamental.

DR BOB BUDNITZ

Okay, third one - I only have one more of these, Mr Chairman. I am looking at number 3.4. About instrumenting fuel elements. You wrote the suggestion, and I assume that is the suggestion that came from the IEA expert group - this is 3.4. The suggestion, which I assume meant the suggestion for the IE expert group, of providing more and more fully instrumented fuel elements during commissioning is strongly supported. Well, I read that suggestion too. In fact, it was one of the most - it sort of stuck out as a sore thumb to me, IEA report. The IEA report did not have too much to say about engineering but that was the one thing they did have to say. Well, I know something about that and I dug into it and it did not make sense to me and the reason it did not make sense to me - and I am wondering whether you or your colleagues can perhaps clarify this here or in something else you can provide. The reason it did not make sense to me is that it seemed to me that the concern that is raised would not be answered by the instrumentation called for. That is the sort of instrumentation that the IEA suggested would not be adequate in the tests, would not be adequate to uncover the sort of problem that they postulate. You cannot do that in-pile in this machine. If that is a real concern it has got to be done somewhere else, to me, and I do not know - because I

do not know enough about this particular fuel to know whether it is actually a concern, I just do not know and it would be a question I am going to ask ANSTO this afternoon if I get a chance, but I do not think that experimental thing they called for has gone, would reveal it in any event. So I do not think that that recommendation holds water. I wonder whether there is more that you could -

DR CLARENCE HARDY

We thought it would be a desirable feature and there have been quite a lot of fuel elements with uranium silicide and this general design operated for many years in other reactors, particularly in France which has done a lot of work on uranium silicide fuelled reactors.

DR BOB BUDNITZ

I understand that.

DR CLARENCE HARDY

However, there have been in it some instrumented ones and perhaps ARPANSA or someone else, ANSTO, should ask these operators who have had a lot of experience with this type of reactor, which ANSTO has not had – ask them do they feel there are benefits from instrumented fuel elements or does it just add another thing to go wrong. I mean, you can also make this suggestion; fuel elements are continually taken out and put in store and new ones put in, but the obvious possibility is you could bang them against something and damage the outer fuel elements. So the suggestion is that you put dummy non-fuel plates on the outside of the box, which is a long square box. That has a penalty because if it is non-fuel plates you lose neutrons. So is this a good idea or not. We thought in principle it gives you an added level of safety for damage of fuel elements in regular transfer and that is for someone to take a decision, whether it is ARPANSA or the designer or ANSTO the client. No, it is too big a penalty for a small risk and you need the frequency of how often have they taken out HIFAR fuel elements and damaged them in transferring them. If that is an acceptable risk then you do not run the penalty. So that was the suggestion we made.

DR BOB BUDNITZ

Okay, I would then have a suggestion for you because, let me say, the concern that the IEA group raised is a valid one. It was my assessment that the remedy they proposed, this instrumented approach, would not answer the question - could not answer the concern. Given that - and you can take it or leave it because I am not the only person in the world with expertise in this area - it seems to me that you might benefit the whole project. If you or your colleagues or somebody in your organisation, in your society with expertise in this area could do a little bit of work that really understands this technical issue and help eliminate it for the public because that might then help us all get this particular issue right. Either that there is some other better way to get this information or that some outer power testing is needed or perhaps the concern that IEA raised is, in the end, not so important; that is, that there is plenty of margin and I do not know the answer to this and I dug into it a little bit just enough to convince myself of what I said and more is needed here and I am just going to leave you with that. Really, more is needed to get to the bottom of it and, by the way, I am not sure I would not put the burden on ARPANSA to do that analysis there. ARPANSA has got -

DR CLARENCE HARDY

No, no, no.

DR BOB BUDNITZ

- to do the analysis.

DR DON HIGSON

They would not. I do not believe ARPANSA has that experience. I think it is the reactor operator -

DR BOB BUDNITZ

Whether or not; even if ARPANSA had the experience that - it is their role - is to ask the applicant for the proper support and then to review it. I was suggesting this since you raised it too, might be something you can do. I have a fourth one and then I am done, I really am done. It has to do with your comfort with the 10 minus five for a year, or you actually think it might be less, accidents. I raised this question with this question of Tony Wood just half an hour ago. Can you just give me a short discussion - please not at length - about the basis why you think that frequency is sufficiently comforting

for you; that such accidents would be less around 10 minus five per year which is what you run.

DR DON HIGSON

Can I just check what we actually said.

DR BOB BUDNITZ

Yes, yes. It is on the last page on the top line - top sentence.

DR DON HIGSON

Page 5.

DR BOB BUDNITZ

“In a sense, there is no accident capable of causing doses but it can be shown from it there are frequencies less than 10 minus five per year”, and then you then express comfort at that level. Do you see it.

DR DON HIGSON

Yes.

DR BOB BUDNITZ

By the way, I assume that what he is reading from and what I am reading from is available and it is available to everybody. That it is public, for sure. It is a public thing you -

DR DON HIGSON

Yes. Well, again, I go back to what I was saying a bit earlier that in order to have a dose at this sort of level - which is way above the level that has been tested by a design base accident - now we have got to have damage to the reactor. Got to have damage which will lead to a reactor core meltdown or substantial damage to the core and we have got to have essentially, I said earlier, no containment whatever. I do not just mean the containment is not good.

DR BOB BUDNITZ

No containment function, really.

DR DON HIGSON

I do not just mean it is not functioning properly, I mean it is not functioning at all, it is simply not there.

DR BOB BUDNITZ

I understand.

DR DON HIGSON

The sort of thing that if somebody had flown an aeroplane into it it would be demolished. A massive earthquake might cause this. Even a pretty big earthquake would have difficulty causing the sort of damage that I am talking about but, as you know, any sort of hold-up in any sort of compartment around a reactor can diminish the consequence of the action. So to get this sort of dose – pure, more than a hundred millisieverts or so, you would need to have, as I said, a substantial core meltdown and essentially no containment. I mean, I am not talking here about terrorist events, I am talking about accidents, what we might call random events.

DR BOB BUDNITZ

I agree. We are talking about non-terrorist events. I understand that.

DR DON HIGSON

Yes. I simply cannot think of any set of circumstances which would have these sort of consequences but has a probability higher than that. If you are looking at random equipment failures you have got to have a number in line and you get down to probabilities of 10 to the minus eight or thereabout. We are looking for something which is a common cause of failure of the process plant, the protective systems and the container systems and the most obvious one, in fact probably the most likely, is a big earthquake. The aircraft crash has been examined and the aircraft crash that could cause this sort of thing, if we are talking about random events, has a probability according to the PSAR of less than 10 to the minus six per year. So a big earthquake, okay. It has got to be bigger than the design base earthquake for the plant which has a probability of about 10 to the minus four.

I am told that earthquakes up to intensities which have probabilities of 10 to the minus five figure or less have also been considered and the plant has a substantial capacity to withstand these. So there is nothing I can think of and you may be able to think of something that I have not but there is nothing I can think of which has a significant probability which could lead to the extent of damage that I have just mentioned. In addition to all of this damage you have got to have the weather conditions and the wind direction et cetera that I mentioned earlier and they have got to be continuous from the time of the accident which makes it even less probable than just having the accident -

DR BOB BUDNITZ

Okay, thank you. I had supposed that that was what the logic was but you have now supported it. I mean that is that you have explained what you meant by this, thank you.

DR CLARENCE HARDY

Perhaps I could just make a brief comment more not for experts but for the general public. I think the importance of containment in a nuclear reactor, whether it is a power reactor or a research reactor is vital and that is why if containment is vital you can compare qualitatively the difference between the Three Mile Island accident in USA and the Chernobyl accident. The Three Mile Island accident was a disaster technically with a complete core meltdown, you know, the worst thing that has been predicted by antinuclear people for years.

The China Syndrome was on television, on films; complete meltdown but the total containment was not breached and as far as I have ever read there were no off-site effects of a total core meltdown. The reactor was a total loss but in the Chernobyl case where you had explosive disruption of whatever containment there was above the reactor and meltdown. That was a catastrophic accident and if there had been the containment remaining on that, the consequences would have been far less. But that type of reactor did not go in for major solid containment as opposed to western reactors. So qualitatively, that is the difference. Containment is essentially if you have a complete core meltdown in a research reactor. Maintain the containment you can minimise off-site consequences.

DR JOHN LOY

Thank you Clarence and Don for your submission and for responding to questions. It is, as you said, difficult to have a short tea break around here but I need to walk around and visit the room at the back. So can we take a 10-minute break and be back shortly after 11.45 to hear from the Department of Industry, Tourism and Resources. Thank you.

MEETING ADJOURNED

MEETING RESUMED

DR JOHN LOY

Now we have the presentation and questions of the Department of Industry, Tourism and Resources and Mr Jeff Harris is going to take the lead, I believe, for the Department. Good morning, Jeff.

MR JEFF HARRIS

Thank you, John. Let me introduce my colleague Dr Caroline Perkins. Dr Perkins and I have responsibility for implementing the Government's strategies for the responsible management of this, of radioactive waste, in Australia. Many Australians benefit directly or indirectly from the medical, industrial and scientific use of radioactive materials and a small amount of radioactive waste is generated as a result. In order to improve overall community safety and confident the Commonwealth, through the Department of - just to get our acronym right now - Industry, Tourism and Resources is progressing two projects to establish national facilities. These two projects are first, the national repository for low-level and short-lived intermediate-level waste and secondly, an above-ground store for long-lived intermediate-level waste, the national repository for low-level and short-lived intermediate-level waste. Australia currently has over 3,500 cubic metres of low-level and short-lived intermediate-level waste which is suitable for disposal in the national repository.

Currently, this is stored around a number of locations in Australia. ANSTO holds 1,100 cubic metres of this waste and you can see there that the very largest proportion, up the top, the CSIRO, is 1,950 cubic metres. That is largely made up of contaminated soil from research into mineral sands about 40 years ago. It is currently stored in about

10,000 barrels on the Woomera prohibited area. You can see some other quantities there but, as you can see, the States and Territories themselves are small generators of waste, 100 cubic metres; Defence holds, from past activities, 240 cubic metres and other Commonwealth Agencies have about 10 cubic metres. About 40 cubic metres of waste is generated annually in Australia and ANSTO produces around about 30 cubic metres. States and Territories again from all sorts of small bits and pieces, glassware, paper, clothing, medical sources and so on, about 5 cubic metres and some small amount of material from the Department of Defence.

In 1992 the Commonwealth, supported by the States and Territories, commenced a nationwide search for a suitable site for disposal of Australia's low-level and short-lived intermediate-level waste. The site selection process has been based on the code of practice for near-surface disposal of radioactive waste in Australia issued by the National Health and Medical Research Council, NHMRC. I should also add that this criteria is also consistent with international criteria. In January 2001 a preferred site and two alternatives in central north South Australia were identified for a national radioactive waste repository for low-level waste and short-lived intermediate-level waste. These three sites, which Caroline is pointing to at the moment, are in the Woomera - Roxby Downs area. These three sites are currently undergoing environmental assessment under the Commonwealth Government's Environment Protection and Biodiversity Conservation Act 1999. This is a typical site in South Australia and you might be able to pick out there very - probably in the centre there I think, is it not, Caroline - is a little tip of a bore hole that we drilled to test the groundwater and the geology of the site.

A draft environmental impact assessment statement is currently being prepared and we expect to be able to submit that to Environment Australia in the first quarter of 2002. A decision on the period of time provided for public consultation on the draft EIS will be made by the Minister for Environment and Heritage but we anticipate that there will be likely of the order of 30 to 40 business days. We will then prepare a supplementary report responding to any issues raised during the period of public consultation and we expect that this document will be submitted to Environment Australia in the second quarter of 2002. In the second half of 2002 we expect, around about the mid-2002, a decision to be made on the EIS whether it be to proceed, not to proceed or to proceed on

conditions at one of the three sites that we have selected. In the second half of 2002 after a decision on the EIS has been made we will be lodging an application to ARPANSA for the licensing of the repository. We expect that construction and commissioning of the repository will proceed after the licensing processes have been satisfactorily completed.

Caroline has put up here and illustrative picture of what a low-level repository will look like. It will have various barriers so it is a multibarrier system based on dry radioactive waste contained in containers which are appropriate to the level of activity, whether they be steel or concrete, with the host material being suitable to contain the radio nuclides and surface layers constructed so as to ensure minimum penetration of rain water and run-off. We have done a lot of modelling in this area and a lot of testing and we are very confident that we understand the hydrology of the area where the water comes from and where it goes to and it is a very arid area indeed out there.

The second project that I would like to tell you about is the national store for long-lived intermediate-level waste. In 1996 the Commonwealth government made an in-principle decision to establish a national store for long-lived intermediate-level waste. The need for a national store was supported by the Commonwealth State Consultative Committee on the Management of Radioactive Waste. In August 2000 the former Minister for Industry, Science and Resources, Senator Minchin, announced a national search for a site for the national store for Australian long-lived intermediate-level waste and sought the co-operation of the States and Territories. Unfortunately, in February 2001 the Minister announced the Commonwealth would site a national store on Commonwealth land for the storage of long-lived intermediate-level waste produced by Commonwealth Agencies. The reason for this is that there was a lack of unanimity amongst the states and the territories on the need for a national store.

The Commonwealth is now proceeding through our Department with the search for a site for a national store. This waste consists of about 400 cubic metres of operational waste from Lucas Heights, residues from mineral sands processing and waste from the Department of Defence and Department of Health and includes items such as radium needles, electronic valves, luminescent watch and compass faces, night markers and disused sources currently held in the Woomera prohibited area. The amount and type of

waste generated each year again is very low, less than 3 cubic metres. ANSTO produces about one and a half cubic metres per year and the amount of type of waste generated by the replacement research reactor will be about the same as generated by ANSTO. The national store will also eventually accommodate the small volume of long-lived intermediate-level waste to be returned to Australia from the overseas processing of Australia's spent nuclear fuel. From HIFAR we anticipate 20 cubic metres of waste in concrete and about 6 cubic metres of waste in glass will return to Australia by 2015 and 2020. For the replacement research reactor about 20 cubic metres of waste will be returned to Australia after 2025 in a glass matrix. That is about it.

To help us in identifying an appropriate site for the national store we have established an expert advisory committee called the National Store Advisory Committee, which has been appointed and advises on the search for the store. In July 2001 a public discussion paper was released. This paper looks at the criteria which could be used to decide on the site for the store. We have received about 140 submissions from the public about the publication and we are intending to release a paper responding to the public comment in the first quarter of 2002. Sites on Commonwealth land will be assessed against the site selection criteria during 2002. Some of the relevant considerations for the store include long-term safety of radioactive waste in the facility, the operational requirements for transport, safe handling, storage and retrieval of waste packages, the local environment and the security of the facility. The store will be an above-ground structure. The selection criteria for the store will differ somewhat from the criteria used for the national repository which is at below-ground trenches, as I showed you before.

The following factors will be taken into account with siting the store: geological hazards such as earthquakes, volcanic activity and landslides, local environment hazards such as flooding and fires, natural environmental features such as surface drainage, access to transport, support facilities in infrastructure, the social impacts of the facility, sites or areas of special environmental, cultural or historical significance, security at the site and land ownership and compatibility with adjacent land uses. The earliest that we anticipate that a site for the national store could be identified will be late 2002. Environmental assessment and licensing by ARPANSA would follow after that. Construction and commissioning would proceed after the site had been selected and

after the assessment processes had been satisfactorily completed. The national store itself will be designed to operate for a period of up to at least 50 years. Given the amount of the Commonwealth's holdings of this type of waste the likely generation in the foreseeable future and the fact that storage of waste is safe and practical a geological repository for the disposal of this type of waste cannot be justified at the present.

Mr Chairman, I would just like to reiterate that many Australians benefit directly from the use of radioactive materials and that does produce small quantities of waste. Over the last few years we have made significant progress on siting facilities for the management of Australia's radioactive waste. We have identified a preferred site and two alternatives for the national repository for low-level and short-lived intermediate-level waste in the central north area of South Australia and those sites are currently undergoing environmental assessment. A separate process has commenced to identify a site for a national store for long-lived intermediate-level waste generated by Commonwealth Agencies including ANSTO and we are progressing that at a steady and measured pace. Thank you.

DR JOHN LOY

Thank you. Garry.

MR GARRY SCHWARZ

Thank you very much for that informative presentation. I guess one of the things that we have heard in particular in the discussions on Friday were concerns by the public that your processes are moving a little bit slower than what they would prefer. They would in particular like to know that there is a definitive plan, definitive path forward for all of these wastes, at the time that say a construction licence might be issued for the new reactor and I recognise that when you get into a complex situation like siting of one of these repositories there are a lot of considerations that need to be taken into account and unfortunately these things tend to take time. When do you envisage - I guess there is two things; you have got the low-level repository and you have got the intermediate-level one. So for the lower-level one, according to your current plans, when do you expect that that would be available and going into operation if things more or less stay on track.

MR JEFF HARRIS

Yes. We anticipate that the repository itself will be operational in some time in 2003.

MR GARRY SCHWARZ

Okay and for the intermediate-level waste when do you feel that you would be through the siting part of the proposal.

MR JEFF HARRIS

We think probably the earliest there will be that we will have identified the site in late 2002. We will then need to go through an environment assessment of that which could take of the order of 12 months and will also have to undertake licensing processes with ARPANSA. So I suppose a couple of years after that.

MR GARRY SCHWARZ

So somewhere in the neighbourhood of 2004 to 2005 you would expect that that intermediate level facility might be available.

MR JEFF HARRIS

Yes. One of the key factors in the repository project has been the extent of consultation that we have undertaken with it. This has included a series of information days, publications, a series of publications of each milestone in the project, very extensive and lengthy negotiation or discussions with traditional owners around the sites. Some of those issues will be repeated also in the case of the store and where we have always that it is best if we consult as widely as we can and that is the process we will follow in that case as well.

MR GARRY SCHWARZ

So what kind of assurances do you expect you might be able to give to Dr Loy when he is doing his final determination on that construction licence issue with regard to the facilities. What might you be able to -

MR JEFF HARRIS

We will be pretty close to having - being able to say to Dr Loy that the methodology is sound, has been tested with the public. We will need to respond to comments in there

and we have not done that yet and we will be able to point also to the fact that the environmental assessment is well under way for the repository.

MR GARRY SCHWARZ

Would you be able to provide him with some fairly firm milestones, in terms of time, as to when different things you would expect to see happen -

MR JEFF HARRIS

Yes, yes. We can provide him with a timetable.

DR BILL WILLIAMS

I am going to refer to your submission and particularly where you refer to recommendation 27 which indicates that the Minister for what I gather is now the Ministry for Industry, Tourism and Resources, not 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 and associated issues. Given the fact that you have just told us that you will be able to provide further milestones to the CEO of ARPANSA on this matter can you clarify what you mean by time and consideration, what we should be looking at here.

MR JEFF HARRIS

I think there are two elements there, Bill. The first is the timely progress with the store and the repository projects themselves and I think we have gone through that in some detail for you here today and there is also a strategy paper which we produced for ARPANSA dealing with long-term management of long-lived intermediate-level waste.

DR BILL WILLIAMS

You say that you - this issue came up on Friday and there are obviously considerable legitimate community expectations on these matters. The issue of the position of traditional owners in regard to storing waste on their country, has the Department taken on board their opposition. Does the economics that they are opposed, that the traditional owners expressed opposition.

MR JEFF HARRIS

The traditional owners or in the case of the process we have gone through at the moment - those aboriginal groups, and there are quite a large number of them - those aboriginal groups that have heritage interests in those lands we have consulted extensively, with them, and each of the three sites that are going through environmental impact assessment has been inspected by these aboriginal groups and have cleared for the construction and operation of the repository. That is not to say that they might not wish to have the repository on their land but it does say that we have got a good degree of credibility with the aboriginal groups that we taking their interests into account.

DR BILL WILLIAMS

It strikes me that that is not entirely true; that in fact that there is substantial opposition - I mean, I know that there are - these issues are complicated, of course, but certainly there are significant bodies including the traditional elders, the Coober Pedy Cungajuda, have expressed opposition. These are not insignificant people and I am not even saying that you cannot override their position but that those people will represent an impediment to the timely consideration or the timely establishment of sites for the disposal of low-level intermediate-level waste.

MR JEFF HARRIS

You might have heard me incorrectly, Bill, but I said that that does not deny that some aboriginal groups do not want the repository on their land. But we have consulted with them and they have done heritage clearance inspections for us, quite a large number of groups, and they have cleared these three sites for construction and operation of the repository.

DR BILL WILLIAMS

What about with regards to the store.

MR JEFF HARRIS

In the case of the store, that is a completely separate process. At the moment what we are seeking to do is identify suitable sites and that is being done by desk audit. When we have those suitable sites then we will have to investigate them and in the same case

as we have done with aboriginal interests or pastoral interests or state interests we will be consulting with the relevant regional bodies.

DR BILL WILLIAMS

An issue that has been raised in some of the questions that the panel has been presented with, this one in particular from the Australian Conservation Foundation, asking DISR to identify the Australian port communities that will be required by DISR to receive reprocessed or conditioned nuclear waste from overseas for the next 50 years for transport to the national storage facility if the second Sydney reactor goes ahead and then they also refer to waste coming from Lucas Heights reactor spent fuel under the COGEMA contract. Have you identified ports that would be appropriate and consulted with public communities in that situation.

MR JEFF HARRIS

The issue of the transport of radioactive waste to the repository and the routes of the transportation and the risks and the safeguards that will be taken are all being addressed in the environmental impact statement. We have not consulted in particular with any port authorities at this point in time, no.

DR BILL WILLIAMS

There seems to be considerable opposition, both on Local Government basis and on State Government basis to transport and storing of radioactive waste in Australia's outback, certainly in South Australia. I understand there is legislation there opposing it.

MR JEFF HARRIS

Yes, it is interesting, is it not Bill, we do not see any protests around hospitals, when my mother might need treatment, we do not see any protests of radioactive materials being delivered to industry, but once that radioactive material becomes radioactive waste there seems to be an added concern. That concern does not seem to be reflected either in deliveries of chemicals or of petrol, so it is interesting, is it not.

DR BILL WILLIAMS

I am not so much interested in the interesting myself, I am more interested in the this fact that there is actually legislation opposing transport of waste, that in fact even if you

identified a site, which you have not actually done yet, despite the fact that the CEO of ARPANSA is proposing to sign off on it, a construction licence for a new reactor which will generate waste for the next 40 years, you do not have site, you have got State Governments, certainly the one in South Australia with legislation opposing it, that possibility, where do you go from there, I know that Senator Minchin when he was the Minister, the relevant Minister, he articulated a position that State Legislation would not be an impediment to the store process, and he sighted the ARPANS Act as prevailing over State Legislation, is that the case that there would not be a problem, that the Commonwealth Legislation would just simply override State Legislation.

MR JEFF HARRIS

It is not a case of Commonwealth Legislation overriding state legislation, the reality of it Bill is that the ARPANS Act existed before the State Legislation.

DR BILL WILLIAMS

So there would be no impediment there, the people of South Australia who have elected a Government with legislation opposing the transport of waste into their country.

MR JEFF HARRIS

We may need a bit of clarity here, as I recall at this point of time, and I may be incorrect here Bill, but my recollection is that the State Legislation deals with long lived intermediate level waste, not low level waste for example, and are you making a distinction here between a move of radioactive material, a movement of low level waste, and a movement of intermediate level waste.

DR BILL WILLIAMS

Let us talk about intermediate level waste, I understand the legislation refers to intermediate level waste, is that right.

MR JEFF HARRIS

To intermediate level waste, it refers at least to the storage of intermediate level waste in the state of South Australia, yes.

DR BILL WILLIAMS

You do not see that as an impediment, a potential impediment. Presumably the ARPANS Act would -

MR JEFF HARRIS

But I thought I have answered that question in the sense that, Bill, the ARPANS legislation empowers the Commonwealth to look after or pass to - undertake actions for the responsible management of radioactive waste, and that is what the Commonwealth Government is doing. Not only for the Commonwealth I might add. In the case of the low level waste repository as you know this is the national facility and this will help to collect all that waste that is in over 50 locations, in hospitals, in universities, as you know, and allow that to be stored in one place responsibly and well managed.

DR BILL WILLIAMS

I understand your position and why it is being proposed, I am just querying the timely consideration for those strategies. It seems to me from what you are saying -

MR JEFF HARRIS

Perhaps I could come back and just clarify that timing for you. In the case of the repository, we anticipate that we will have completed the Environmental Impact Assessment by mid this year, so that project, subject to clearing those necessary procedures, is on the timely path, and will then go through ARPANSA licensing in a timely way. I am sure John will give us timely consideration to our proposal. And in the case of the store I think we have advanced that in a very timely way in the sense that we now have a methodology paper out for public comment. We will be responding to those public comments, then we will be applying the resultant methodology to select a site, probably by the late part of 2002. Separately we have also provided to ARPANSA, to Dr Loy, a paper talking about the long-term management of Australia's long lived intermediate level waste.

DR BILL WILLIAMS

There is one final thing that is not essentially related to what we have been talking about up to now, and that is that - I know it is not the direct responsibility of your Department to deal with spent fuel rods as such, but in ANSTO's proposed routes and fall back positions for dealing with spent fuel rods - there is the option first of France falling back

to Argentina, and then potentially a third country. And then the question of home conditioning arose on Friday and Dr Loy has raised it as a potential issue for discussion here. If the fuel rods were not dealt with at Lucas Heights, then would your department actually have some responsibility for managing the spent fuel.

MR JEFF HARRIS

None at all.

DR BILL WILLIAMS

None at all. Just let me check something. Okay, thanks.

DR BOB BUDNITZ

I assume, as part of your basis, is that there is no high level waste streamed to come to you.

MR JEFF HARRIS

Yes, that is correct Robert. Australia produces low level waste, intermediate level waste in both short lived and long lived intermediate level waste, but no high level waste.

DR BOB BUDNITZ

I said that was unspoken - I wanted to be sure of that now. If the intermediate level waste facility is never built, just for the moment, and the store had to last for a very long time, what is the design basis lifetime for that store.

MR JEFF HARRIS

Of the current store.

DR BOB BUDNITZ

Of the store - the store that you would need to have with a very long – were the very facility never to be realised.

MR JEFF HARRIS

You are saying if we never moved to deep geological disposal, is that right.

DR BOB BUDNITZ

Let me just ask the question, forget the if, what is the design basis lifetime that you are designing into that facility.

MR JEFF HARRIS

We have not gone to detail design for the store at the moment.

DR BOB BUDNITZ

Do you have a criterion in mind.

MR JEFF HARRIS

Yes, we will be looking to ARPANSA which will be producing guidelines for the storage of long lived intermediate level waste, and we will be following those. I am sure that those guidelines will also be consistent with international practice.

DR BOB BUDNITZ

Which means hundreds of years or thousands, I mean I do not have any idea what you are pointing towards.

MR JEFF HARRIS

It will at least be for 50 years, will be the nominal design.

DR BOB BUDNITZ

It seems to me that the logic here is you have to have such guidelines before you can pick a site and a design with which to proceed because - the site and design of any such facility have to work together to provide the needed isolation and assurance, and without having that design basis - is it 50 years or is it 500 years - there is no engineering basis for carrying out such a design, so you have not got to that stage yet.

DR CAROLINE PERKINS

The intention is to have the store to operate for a period up to 50 years. Now during that time our intention is to move forward with a geological disposal facility.

DR BOB BUDNITZ

I understood that.

DR CAROLINE PERKINS

I mean you are making the assumption that if we do not site a geological disposal facility, the first store we site will have to house the waste indefinitely.

DR BOB BUDNITZ

I was not making any such assumption, I was just wondering what your design basis was.

DR CAROLINE PERKINS

We have said the store will operate for a period up to 50 years at least, that would be our design basis, and at the end of that time if we had not got a geological disposal facility we would have to assess the storage facility. I mean there is always the option of some other storage facility if the one in use did not prove to be adequate beyond that time. Storage is just that – storage. It is not disposal.

DR BOB BUDNITZ

You have in mind a 50 year duration for the operating lifetime of that facility.

MR JEFF HARRIS

Yes.

DR BOB BUDNITZ

I assume that when the design is implemented you will use that as the design basis for all the things you have to do, corrosion of the canisters and various inspection intervals and all that stuff.

MR JEFF HARRIS

That is right, yes.

DR BOB BUDNITZ

Just to be sure I am clear, it seems to me that after you have come up with the design, it is very important that you analyse that design to find out how long it will actually last,

and therefore at what period beyond the 50 years it starts getting into trouble. There will be some - if it is 50 years, now you told me, I do not want any problems, it could last a million years, I will not believe you. On the other hand, if you told me it will last 52 years, I would believe you, you know nothing is that precise, so there is going to be some time thereafter at which various events and processes will take place which there could be long term corrosion processes, there are any number of things that you will need to consider to work that out, and I think that as a matter of - not only commonsense but of public policy, people ought to be told. ARPANSA needs to be told, but just generally, what the actual performance of that thing is liable to be. How much margin there is, and then you will quickly find that there are some easy things to do that can extend that marginal life if you are careful, or not if you are not careful and you should consider those as a sort of - in an ALRA sense, as a sort of way of making the design even better than your minimum criteria.

Secondly, when you speak about and you showed the - you would not consider what you showed up there anymore than just a sort of of rough sort of conceptional cartoon of the actual thing, you do not even have a site yet, so you do not have a design. When you do that, have you thought about - the same question, the duration of that, the lifetime expected performance of that or how long it will remain it will have integrity and how it is need and so on.

MR JEFF HARRIS

Yes, we have got in addition to the review which will be taking place - let me first do that question and then we might just go back for a moment to the store. In the case of the repository, it is designed to have a 50 year working life, at the end of 50 years there will be a major review to determine its future. If the repository is closed at that point in time, then there will be a 200 year institutional control period over it. As part of the environmental assessment and as part of our own investigations prior to that, as I said we know a lot about the geology of the region and the hydrogeology of the region, and we have also had studies being done on various covers, that is layers that will be put over the top of it, and of course there is also the barrier. The other barriers that I mentioned being not only the solid nature of the waste, but also the initial containment and then the host material. But let me just return to the other question though. You are quite right in the sense that any well-managed radioactive waste management strategy

will have built into it continuing monitoring, not only of the store structure itself, but also the integrity of the containers, and that of course will be built into our strategy.

DR BOB BUDNITZ

On this particular topic I have had some experience because in California, which is our largest state, we have spent the last decade and I have been in the thick of it, trying to develop a site at a place called Ward Valley in the desert which would store our stuff. And dispose of it. And it has been unsuccessful so far. We were able to show that we have confidence that it would last about 500 years and probably longer, but of course it is very much dependent on the site and the rainfall and what that does to the engineered part. And I can assume, without knowing much because I have not seen any details here, that you are going to have to go through that and you are going to have to provide that to ARPANSA and they are going to have to review it.

MR JEFF HARRIS

That is right.

DR BOB BUDNITZ

And the current stage what I am hearing is that is still awaiting their criteria on which your thing will be based.

MR JEFF HARRIS

For which, for the storage or for the disposal facility.

DR BOB BUDNITZ

For the disposal.

MR JEFF HARRIS

We are still awaiting I think a code for the characterisation of radioactive materials to be put into the repository. I think that is right, but there is a draft available for that.

DR BOB BUDNITZ

I understand.

DR BILL WILLIAMS

When you were speaking earlier on you mentioned geological - presumably eventual permanent disposal. A geological repository, but I thought you said that that was not indicated.

MR JEFF HARRIS

Given the current quantities that we produce, the current inventory that we have got and the current volumes that we produce, it is probably not justifiable at this time. But what we have said is that in 2004/2005 we should return to the issue and have another review of the situation, including disposal techniques overseas, disposal facilities overseas, some of these things change through time, so we will go back and have another look.

DR BILL WILLIAMS

But as it stands at the moment it is quite possible that the waste that would be generated over the 40/50 year lifespan at the replacement reactor, there would be no requirement for permanent disposal, it could just be stored over that time.

MR JEFF HARRIS

It is usual also for material to be stored before it is disposed just for safe management of the material, so there always is a period of storage. But in this case when the material comes back it will go to a purpose built facility for the long term storage of it, and in 2004/2005, which is actually before the material returns, we will be reviewing the options for disposal of that sort of material.

DR BILL WILLIAMS

But there is no finalised plan, we would be talking long term potential storage -

MR JEFF HARRIS

The strategy at the moment is the safe storage and for eventual disposal.

DR BILL WILLIAMS

But when you say eventual disposal, you are cannot actually tell us what that means, there is no finalised plan, it is up in the air.

MR JEFF HARRIS

All I can tell you is that we will be reviewing disposal options in 2004/2005. You would be aware that for this sort of material we are normally talking about a geological structure of hundreds of metres in depth.

DR BOB BUDNITZ

Just one more thing, I meant to ask this the first time, but I am getting senile. The material from the HIFAR reactor that has been - the spent fuel so far is sitting somewhere in Europe, in France awaiting -

MR JEFF HARRIS

And Scotland and in France.

DR BOB BUDNITZ

And some of it is in Northern Scotland as well. The scheme is that it will be conditioned and then returned here.

MR JEFF HARRIS

That is right.

DR BOB BUDNITZ

Do you have criteria for its chemical and physical form that it must meet before return, so that it would fit the geological and engineering design of what you have to do next.

MR JEFF HARRIS

There are two elements there, the first is that ANSTO is setting requirements on what the waste - the standards that the waste will be conditioned to or reprocessed to and will have waste acceptance criteria that is appropriate for the store - safe storage of that material when it returns.

DR BOB BUDNITZ

Are those criteria - you said will have, so they are not in place yet.

MR JEFF HARRIS

That is right.

DR BOB BUDNITZ

Are those within the bounds of technology that is being used today to condition other fuel like this. In other words, one possibility is that the criteria you would need to store it in the places you are talking about, are outside of the bounds of current practice. And therefore it is new rather than existing technology would have to be used in Europe to produce this. Or maybe not, I do not know which.

MR JEFF HARRIS

I would have to defer to my scientific experts on that, but you seem to be conceiving of something that would be difficult to store, whereas the whole element - the whole nature of it is to put this material into a form that can be safely stored.

DR BOB BUDNITZ

I understand that, but I am just supposing something. That the engineered facility and the site which have to work together to provide this needed isolation may require a certain chemical and physical form for your fuel - for ANSTO's fuel which is either within or outside of current experience and I do not know the answer to that.

MR JEFF HARRIS

I suppose as we get that material back we will be aware of what features are required for it and will build those features in - will build an additional module on to take account of those features. In the case of the geology and hydrology of the area I should think that it is very unlikely there would be any special features that we would need to take care of, certainly the more usual ones for storage, such as earthquake, land slips, flooding, fire, all of those considerations will be taken into account of, but for example, the behaviour of the ground water 40 metres below the surface is probably less of a concern with an above ground store than it is in the case of our low level repository.

DR BOB BUDNITZ

In some though the details are still to come.

MR JEFF HARRIS

Yes.

DR BILL WILLIAMS

Do you have a selective body - the people who are going to be building the dumps, the low-level waste dump.

MR JEFF HARRIS

The repository.

DR BILL WILLIAMS

The low level waste, yes, repository.

MR JEFF HARRIS

No we have not, what we are anticipating is that the facility - the facility will definitely remain in Government control and be licensed and monitored by ARPANSA, but it will probably be privately built and privately operated.

DR BILL WILLIAMS

There have been concerns expressed about the manner in which materials containing plutonium were buried in low level circumstances from Maralinga and that the same people were going to be involved in that process with the low level waste repository, is that not true.

MR JEFF HARRIS

I suppose - let us go to Maralinga which is a rehabilitation site and not a site of - what do we call it - intervention and what is the other one - and practice, anyway if you want to talk about Maralinga, we are happy to do so.

DR BILL WILLIAMS

It was a question that was raised on Friday and I think with legitimate concern about inappropriate disposal or management of intermediate level long-lived waste.

MR JEFF HARRIS

I guess what you might be referring to is - Maralinga was a heavily contaminated area as a consequence of the British nuclear tests. In consultation with the traditional owners and the State Government of South Australia, the Commonwealth Government put up proposals to rehabilitate that site. This rehabilitation was agreed with the traditional owners and the State Government, and has proceeded over the last few years. The site has now been completed, the physical works on the site have completed. The land forms to which you refer contain less plutonium than is allowed for in the code or practice for the burial of radioactive materials in Australia, and secondly we are now at the stage of negotiating with the traditional owners and the State Government to hopefully hand that site back to them, so they may use that as a resource, either for ecology or for tourism, and they are currently undertaking a business assessment of that.

DR BILL WILLIAMS

But it is a site where long-lived intermediate level waste has buried in shallow burial sites, is that right.

MR JEFF HARRIS

Consistent with the code of practice for the burial for that sort of material in those sorts of quantities.

DR JOHN LOY

I think we may be getting a little bit off the track. I think there is a legitimate difference and I am happy to debate Maralinga any time any place, but perhaps not now, and certainly the point that is made of the difference within remediating and contaminated sites and constructing repository for the waste is a legitimate difference. I think the import of your question is that it has not been decided who will be your operator, that is a matter to -

MR JEFF HARRIS

That is correct, it will probably be done by -

DR JOHN LOY

By presumably a tender process at some point. I did not mean to cut you off, but I did not want to go down -

DR BILL WILLIAMS

It is not my personal beat here, there are a lot of people in the community that are not happy with the situation, the way that plutonium contaminated materials were buried in shallow disposal sites. I mean that is reality, I mean part of what we are doing here is trying to reflect public - genuine, legitimate community expectations about the fact that the people who did the job last time did not do it properly in the opinion of not just weirdo greenies, but people who are nuclear engineers, people with great experience in the field who have been very critical of the process, and I think it is only fair that those concerns are addressed in this forum.

DR JOHN LOY

I think they have been sufficiently for now, as I said I am happy to talk more about Maralinga at some other time, another place and I think that it is beholden on us to remember that the great contamination at Maralinga was not in the pits, it was in the soil, and what other way could you deal with the soil than the way it was done. And I think it has been done very well. Let us focus on what we are addressing here today which is the issues related to the construction licence for the reactor, and you put the points very well, Bill, and the stage in which it has reached.

DR BOB BUDNITZ

We are talking about the proposed RRR here today and one inquiry I was dealing with with you about the HIFAR fuel is not directly relevant, but of course it is clearly relevant and the reason that it is clearly relevant is that if there is a problem there it is going to cause a problem for the RRR were it to go ahead, and if not why there would be more confidence that the RRR itself and its conditioned fuel in a waste stream that would come back would be also within the bounds, and that was the concerns for us - I was worried about.

DR JOHN LOY

I think perhaps the issue of geological disposal is a very troubled one and part of the argument that you have made and is made here is we do have a small amount of this long lived intermediate level waste. In one sense you can argue therefore the problem is small, on the other hand, therefore the economics of geological disposal might be pretty

crook as well, so I think there is a discussion and a debate that has to take place there. The only hint I would make now, my own thinking is I reckon a design basis of 50 years is pretty short, and you might want to take that into account in your thinking. Thank you very much Jeff and Caroline for your presentation and responding to the questions.

Our final presentation before a lunch break is the Australian Safeguards and Non-Proliferation Office and Andrew Leask is going to take the lead in doing the presentation.

MR ANDREW LEASK

Dr Loy, panellists, good afternoon. My name is Andrew Leask and I am the assistant secretary of the Australian Safeguards and Non-Proliferation Office, or ASNO for short, a specialised organisation attached to the Department of Foreign Affairs and Trade in Canberra. ASNO is one of Australia's two Federal nuclear regulators; the other is ARPANSA with which we work very closely. I am here to explain ASNO's role in the approval process for the proposed replacement research reactor at Lucas Heights. Before going into detail, I would like to note that ASNO has responsibilities in regard to both the approval process for this reactor and its through life operations.

First of all I would like to outline ASNO's regulatory roles specifically with regard to nuclear safeguards, physical protection and security, and to explain how this work dovetails with that undertaken by ARPANSA. I will then detail the process ASNO and ARPANSA have developed for assessing the replacement reactor, finally I will describe the criteria ASNO will use to make this assessment. ASNO has developed from the Australian Safeguards Office created in 1974 following Australia's ratification of the Nuclear Non-proliferation Treaty. ASNO was established in August 1998 with the principal objective of enhancing Australian and international security through activities which contribute to effective regimes against the proliferation of weapons of mass destruction, that is nuclear radiological chemical and biological weapons. For administrative purposes ASNO operates as a division of the Department of Foreign Affairs & Trade. It was moved from the Energy and Resources portfolio to Foreign Affairs in 1994 due to the increasing international focus on non-proliferation and safeguards.

To ensure it has regulatory independence the director general, Mr John Carlson, is a statutory officer appointed by the Governor General responsible directly to the Minister for Foreign Affairs and reporting to Parliament. ASNO combines the functions of the Australian Safeguards Office, the Chemical Weapons Convention Office and the Comprehensive Test Ban Office. It also plays a role in preparing measures to strengthen the biological weapons convention. Nuclear regulation is a specialised business. Over many years ASNO has developed high quality core competencies and brings significant expertise to its part of the approval process for the replacement reactor. ASNO's director general, John Carlson, has over 20 years experience in nuclear issues and has headed the Australian Safeguards Office and its successor ASNO since 1989. He is an internationally recognised expert in the areas of safeguards and non-proliferation and has been appointed by Dr Mohamad Elbaradei, director general of the IAEA, to chair the standing advisory group on safeguards implementation. This is a group of international experts which advises Dr Elbaradei on IAEA safeguards issues.

ASNO staff have scientific, engineering and professional qualifications in physics, chemistry, nuclear reactors and nuclear technology. They have significant experience in the realms of domestic and international nuclear safeguards and reactor operations which includes IAE safeguards, inspections, operations of bilateral safeguards agreements, quality assurance and physical protection. ASNO expertise in these disciplines is recognised regionally and internationally. We, that is ASNO, have been invited to participate in the IAEA's International Physical Protection Advisory Service for requesting member states. We played a strong part in the development and review of infocirc 225, and we have been a significant contributor to the International Review of the Convention on the Physical Protection of Nuclear Material. ASNO has played a major role in the development of strengthened nuclear safeguards after the 1991 Gulf war and Australia was the first country to ratify the additional protocol giving effect to strengthened safeguards. Reflecting Australia's position in the vanguard of safeguards development this year we became the first country in which the IAEA have introduced the most contemporary form of safeguards which we call integrated safeguards.

I would now like to say something about legal and regulatory matters. The Nuclear Non-proliferation Safeguards Act of 1987 took effect on 31 March 1987. This Act establishes the statutory office of Director of Safeguards, one of the two statutory

offices held by John Carlson, and forms the legislative base for ASNO's nuclear safeguards activities. Our regulatory activities include issuing permits, auditing and evaluation, and nuclear materials accountancy. ASNO is responsible for nuclear safeguards and related physical protection in Australia which means we have to ensure that nuclear materials and nuclear items, facilities, equipment, technology and nuclear related materials are appropriately controlled and accounted for. Importantly we ensure that Australia meets its treaty commitments. While ANSTO is our most significant permit holder from the perspective of sensitive material, we also deal with uranium mines, universities, industry, the patents office, patent attorneys and other Government or State Agencies and Departments.

The specific regulatory activities include:

- 1) Ensuring that nuclear material, associated material, equipment and technology in Australia is properly accounted for and controlled, and ensuring that requirements are met under Australia's safeguards agreements with the IAEA and bilateral agreements applying to nuclear material and nuclear items in Australia.
- 2) Pursuant to obligations under the convention on the physical protection of nuclear material and relevant IAEA guidelines ensuring that appropriate security measures are applied to nuclear items in Australia.
- 3) Ensuring Australia's bilateral safeguards agreements are implemented satisfactorily, which simply put means ensuring that Australia's nuclear exports remain in exclusively peaceful use and are properly accounted for. Our conditions and monitoring are additional to IAEA safeguards.
- 4) Ensuring that all AONM, that is, Australian obligated nuclear material is subject to IAEA safeguards and that verification of non-diversion is carried out by the IAEA.
- 5) Ensuring that any nuclear items, other than nuclear material, transferred to other countries are properly accounted for, and that the relevant records of Australia's partners are consistent with ASNO records.

Domestically, control over nuclear material and associated items in Australia is exercised under the safeguards act by a system of permits for their possession and transport. As Australia's only nuclear facility, ANSTO is the permittee most inspected and regulated by ASNO. A common thread to ASNO's various responsibilities and a key to nuclear non-proliferation in general is the security and control of nuclear material on which I now wish to focus.

There are a number of regimes and arrangements through which Australia implements physical protection of nuclear material. First there is the Convention on the Physical Protection of Nuclear Material, or CPPNM for short. The Convention recognises that physical protection is the responsibility of sovereign States and that each State will implement a selection of measures according to its national requirements and the perceived threat. The Convention is intended to improve the protection of nuclear materials while in international transport and to promote international co-operation in response and recovery operations. It is now generally accepted that the Convention should be extended to cover domestic use, storage and transport. Indeed, in September this year the IAEA Board of Governors approved the physical protection objectives and fundamental principles drafted by an expert group, of which ASNO was a permanent member, as a prelude to revision of the Convention. And earlier this month in Vienna the legal and technical experts group called by the IAEA to draft a well-defined amendment to the CPPNM started work. Despite current limitations in scope of the CPPNM, Australia applies its principles to domestic use, storage and transport.

In addition to the CPPNM we have information circular 225, or infocirc 225 for short. This is a guidance document established by the IAEA which details specific standards and measures that should be considered for physical protection of nuclear material and nuclear facilities against theft and sabotage, and in contrast to the CPPNM, covers domestic as well as international use, storage and transport. Australia is a strong proponent of universal acceptance and implementation of the guidelines and, while they are not binding, ASNO applies these principles within its jurisdiction. Australia exports and imports nuclear material and equipment under a network of bilateral agreements for the peaceful uses of nuclear energy. These agreements require each party to apply

physical protection to all material and equipment which is under its jurisdiction, using measures equivalent at least to the recommendations contained in infocirc 225.

Part 14 of the Safeguards Act states that a permit will not be granted to an owner or operator of a nuclear facility unless the Director of Safeguards is satisfied that adequate physical protection can be applied to nuclear materials and associated items at the facility. In practice a permit holder must submit a security plan that is satisfactory to the Director of Safeguards before a permit will be granted. More specifically ANSTO's current permit to possess nuclear material requires as a minimum the application of the recommendations in infocirc 225 revision four for physical security. If this advisory document is revised again and that is likely in 2002/2003 then we will require ANSTO to review and up-date its security plan as necessary to ensure it complies with best international practice regarding physical protection.

On a new topic, I would like to outline how the two regulators ASNO and ARPANSA work together. They are complementary organisations where, specifically on the issue of security the dual scrutiny should strengthen the outcomes. As opposed to nuclear non-proliferation and physical protection of nuclear material, ARPANSA's main objectives are to protect society from unwanted effects of radiation and to protect the environment from harmful effects of ionising and non-ionising radiation. A basic requirement for the CEO of ARPANSA in assessing whether to issue a licence in relation to a nuclear facility is, quoting from the Website, "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". Thus ARPANSA is also concerned with sabotage at a facility which might cause unacceptable radiological consequences. While our fundamental objectives differ and our legislation is different ASNO and ARPANSA share responsibility for physical protection and security of the replacement reactor.

Last year the Director General of ASNO and CEO of ARPANSA concluded a Memorandum of Understanding concerning the respective regulatory roles of their two agencies. In May this year the MoU was updated to delineate our work on the replacement reactor. The MoU provides the framework for co-operation and the exchange of information between ARPANSA and ASNO to ensure that ANSTO's application to build and operate a replacement reactor is evaluated effectively and that

both organisations fulfil their individual regulatory roles. To this end ASNO and ARPANSA have agreed a process by which the security of the replacement reactor will be evaluated and monitored. Initially two assessments will be prepared. Firstly ANSTO will prepare a site security assessment, identify potential sabotage targets, such as structures and systems, including spent fuel facilities, and the physical and radiological consequences of successful attacks on these targets. The assessment will include the consequences of the impact of a large commercial aircraft on the facility. ARPANSA will review the assessment and advise ASNO on the outcome.

Secondly, and in parallel, a competent national authority will prepare for ASNO, ARPANSA and ANSTO a threat assessment identifying potential sources of attack, including a design basis threat. In compiling the threat assessment a threat definition will address; who is the potential adversary, what is the adversary's motivation, what are the adversary's capabilities. Threat assessment will include consideration of physical attacks, IT attacks or hacks, theft and sabotage scenarios, inside or assistant transport terrorism. Taking the site security and theft assessments into account ANSTO will prepare two security plan proposals. One for the construction phase and the other for operation of the facility. These plans should offer effective protection of the targets for which sabotage would have unacceptable results against the design basis threat. ASNO will assess the security plans against criteria agreed with ARPANSA and which satisfy the security requirements of both ASNO and ARPANSA. These agreed criteria which I will detail shortly are available and I understand have already been posted on the ARPANSA Website.

ASNO will give an assessment to ARPANSA who will draw on it when preparing their public reports. We expect the CEO of ARPANSA will take the assessments into account when making his decision on whether to issue a licence. The security plans themselves will have to be classified as would any other document that if released could increase the risk of a successful attack on the facility or result in more severe consequences. Nevertheless, ARPANSA and ASNO will examine documents and report carefully and make public as much as possible to ensure the security assessment process is transparent. However, our overriding consideration will be through life security for the replacement reactor and we will not approve public release of information which we judge could prejudice this requirement.

Turning now to the security plan assessment criteria, ASNO and ARPANSA have agreed ten broad criteria which ANSTO must satisfy and by which ANSTO security plans will be assessed. The criteria and their aims are:

- 1) Effective security management to ensure proper lines of responsibility are established using appropriately qualified and trained staff.
- 2) Detailed site security and threat assessments.
- 3) A comprehensive system of physical protection and security to ensure that the potential theft and sabotage targets are effectively protected against the design basis threat developed in the threat assessment. Furthermore, this will ensure that the security plan is implemented within a certified quality system, that acceptance testing of the individual components and the system takes place and that the performance of the system is routinely inspected, tested and evaluated.
- 4) Appropriate access controls to ensure that only authorised persons obtain access to sensitive information, nuclear materials and facilities.
- 5) Personnel security arrangements to ensure the trustworthiness of persons who have access to sensitive facilities, materials and records is suitably vetted.
- 6) Effective security of information management systems to ensure that all information where its unauthorised use could have an adverse impact on the operation of the security system or the materials and facilities the system is design to protect is protected.
- 7) Routine performance assessment is to be carried out properly to ensure the permanence of the security system is continuously monitored against the agreed ASNO/ARPANSA criteria and that under-performance will be corrected.

- 8) Accurate record keeping will be required to ensure all records associated with the security system are stored and retained to enable ready retrieval of documentary evidence of compliance.
- 9) Specific reporting requirements will be required. These will ensure the timely reporting of incidents involving either an actual or a suspected compromise of physical security, the results of investigations into any security breaches, the results of performance assessments of any changes to the security plan.
- 10) There will be ongoing reviews to ensure the security plan is effectively reviewed at a maximum interval of three years or as required in response to changing circumstances.

In addition to these broad requirements ASNO will also use more detailed criteria derived from sources, such as infocirc 225, which as I mentioned before are a set of guidelines for implementing physical protection. The Commonwealth's Protective Security Manual, which is issued by the Attorney General's Department, and which provides minimum common standards in protective security for all Commonwealth Agencies and contractors for the protection of official information and resources, for example, information that could lead to compromise of the security system needs to be classified and appropriately protected. The guidelines set out in the PSM are mandatory for Commonwealth Organisations. ISO 9000 series, which is a set of standards for quality management systems and is accepted internationally. Use of ISO 9000 will ensure high standards are maintained by ANSTO at all times and which in this instance will cover design, development, installation and the use of security systems.

We expect the security plans will follow the physical protection methodology accepted internationally and propounded by the IAEA. This methodology calls for the security system to include measures for deterrents, detection, delay, response, determining the trustworthiness of people granted access, and the protection of information that could assist an adversary in defeating the physical protection system. Assessment of the reactor's physical protection system is not a once in a lifetime process. Security will be reviewed regularly by ASNO and ARPANSA who will check that the security system is properly installed, test the system in operation, audit the operator and review the criteria

and the system, especially in relation to changes in threats and technological developments.

In summary, ASNO plays a key role in nuclear non-proliferation and the security of nuclear materials in Australia and abroad. We share common interests with ARPANSA in the realm of physical protection for the replacement research reactor and will work together to assess proposed security plans against the site security and threat assessments to be submitted by ANSTO. We have the expertise necessary to evaluate effectively ANSTO's licence application from the perspective of security and physical protection, and we are committed to continuous evaluation throughout the life of the replacement reactor. We will continually monitor ANSTO for compliance with the security plan and will demand best practice, particularly as threats and technology change. Where necessary we will require that ANSTO strengthens its security arrangement to ensure that the replacement reactor is suitably protected at all times.

That concludes my presentation. Mr Nick Doulgeris, who has been operating the power point for me, and I are happy to take your questions.

DR JOHN LOY

Thank you, it is important to get some of the detail about the processes and how you are going about it on the public record. Can I begin the questioning in the usual manner.

MR GARRY SCHWARZ

Thank you very much John. I've just a couple of questions for you. The first one relates to security plan proposal. You said that one of the requirements is that basically there would be two security plan proposals, one to deal with the facility during the construction period and then one to deal with the facility following that in normal operation. My first question to you is, have you received the plan so far for the construction phase of the project.

MR ANDREW LEASK

We have not received the formal plans. We have had considerable discussion with ANSTO in regard to the elements that we would expect to see in them, we have

discussed with them the strategy and the approach that they have taken or are taking, and at this stage they will obviously have to make that formal submission to us, so that we can make that evaluation and have a discussion before ARPANSA, as I understand it, ARPANSA actually issue the licence for the construct phase.

MR GARRY SCHWARZ

Like the submission that you are receiving now, is it also going to look down the road to see the measures that will be in place for the operating phase of the plant, not just the construction phase. Because sometimes some of the aspects of security change from the one to the other as construction proceeds, and there are things as you know - as the plant reaches its final arrangement, let me put it that way.

MR ANDREW LEASK

I would make two points, one is, as I said, there are two phases to the plan, so we are looking for two quite distinct proposals. However, as I also indicated, it is a robust process of constant review and revision and update as necessary. Therefore, in the first instance, we would look to ANSTO to address the matter of the construction phase to satisfy us and in turn ARPANSA that what we want for the long term is built into the design from the very beginning. Some detail that may be lacking. We also need to satisfy ourselves that there is security in place to ensure that sabotage, if I can use this term of phrase and I am happy for you to quiz me if you do not quite understand it, is not built into the reactor and that somebody does not try to sabotage the reactor, shall we say in the very early stages of its build or construction. We also have a requirement to satisfy ourselves that aspects of the physical protection system as designed and developed, which as I said is a national responsibility, are not compromised in any way by the use of uncleared personnel during the design and development phase, or indeed non-Commonwealth or non-Australian employees used during the design and development and build phase of the reactor. We have to guard against that possibility also and would expect to see such considerations taken into account in the first phase of the security plan.

MR GARRY SCHWARZ

You very well answered that particular question, thank you. I was just wondering how you were addressing the later and the beginning, and of course you want to look at all of

those things at the front end to ensure that nothing significant has been overlooked which then can be compromised in some way by your design later on. So you are doing it seems like an excellent job of doing that. One other question I might ask you is when you talk about routine performance assessments of the security, what do you generally have in mind is that.

MR ANDREW LEASK

I will tackle that question in the broad, if you want a little more detail I may ask my colleague, Nick Doulgeris, to furnish you with some more information. Part of a through life assessment for any system will involve a number of checks and balances in the audit and evaluation process. Clearly we need to make sure that the equipment is properly installed and properly maintained. Clearly we need to ensure through life and of course in the commissioning phase as well that the performance expected of the system is actually met, both at the individual component level and at the system level, and we will ensure that there are processes in place for first of all ANSTO to conduct those on a regular basis and report to us, but part of our audit role will be in the first instance to check that they appear to be doing their job properly by looking at the records, but of course we reserve the right and will exercise that right to do our own testing and evaluation of the system as it is installed.

I cannot put a timeframe on that in terms of the intervals at which we would inspect that system, however what I can say is that under the current arrangements with the HIFAR reactor and the other regulatory functions that we exercise at the Lucas Heights site. We are there several days every month and so there is no reason at all why on our regular visits we should not conduct aspects of inspecting the system or components of that system through the whole life of the reactor. We have a fairly structured process for auditing ANSTO and that will continue into the commissioning and life of the replacement reactor. Aspects of physical protection will feature in our regular audit and evaluation process.

MR GARRY SCHWARZ

Let me just get right to the point I guess with regard to performance assessments, and what I was really wondering was whether you actually do run full blown real time scenarios against the security staff periodically. Using perhaps police forces or

whatever, but actually what you do is you have - it is like a real terrorist intrusion or whatever, some kind of a security intrusion on the facility and you run that against the security system to be sure that it responds appropriately. I am just wondering whether you include that as a part of your overall mix of audits and assessments in your performance assessments.

MR ANDREW LEASK

You outlined a fairly comprehensive evaluation - practical evaluation process in your remarks. As far as I know -

MR NICK DOULGERIS

It was actually before my time in the office, but certain existing security when it was installed at ANSTO was tested and that was done by a random incident planned. ANSTO was not informed of the exact time, and they did test it to see how the system performed. I am not sure what instances have come since then, certainly that was not the only really full scale test of this - they have done the initial installation, but there are checks done on the system at intervals where we test - usually maybe portions of the system, not the entire system.

DR JOHN LOY

I can see there are about seven people in the room who want to ask this question, so I will ask it right now and what was given the entree about Garry's talk of a real life test to the system, I do not know how much you know about this morning's test of the system, but from what you know of it, do you want to comment on how it performed.

MR ANDREW LEASK

I think I would like to make a couple of comments, but before I answer your question John, I would actually like to respond briefly to the earlier question and the comment that Nick made. There is no doubt in the way that we would generate our testing and evaluation through life, that given recent events which were mentioned in some detail on Friday, that a greater degree of practical testing will be required and will be done. In regard to the events of this morning, I would simply like to note that no protected buildings were entered or damaged. Detection on entry was made when entry was made to the secure area and earlier in most other cases of entry. The incident was evaluated

by the security staff at the time, and an appropriate response to the evaluated threat was made. In the points that I showed a little earlier in regard to defence in-depth which I had touched on, deterrents and detection. Clearly in a sense deterrents did not work in that instance in the sense that some people chose to break the law and gain access to a Government facility. Detection was made and delay was effective and at that point today's trial scenario completed.

DR JOHN LOY

Did you have other questions, Garry.

MR GARRY SCHWARZ

No, thank you.

DR JOHN LOY

Bill.

DR BILL WILLIAMS

The chuckling behind you does raise the valid concern that in fact a mob of people got in and they were not of the intention to do any great damage, but if they had wanted to then they had certainly breached security quite spectacularly.

MR ANDREW LEASK

In regard to the issues that I am talking about, I would suggest to you that whilst they did gain access to Government property, nonetheless delay was effective and that the incident went no further than gaining access to the grounds and the top of a building I understand. Let us also point out - let me also point out that the threat was assessed by the guards or the security force at the time and an appropriate response was made before any damage was done, or any access was gained to any secure facility. Let me also point out that had the threat been evaluated in a different way as being potentially more serious, then a more - a stronger response could have been made by the forces that were there and perhaps we should be grateful that the incident this morning was assessed for what it was as not being a genuine threat to nuclear facilities per se at the site, and that nobody was injured or killed in that particular prank.

DR BILL WILLIAMS

I accept that we are all grateful that nobody was injured or killed or even worse perhaps that somebody did serious damage to the physical protection. One question on that would be, at what stage of the game did the threat assessment begin, I mean was it when the mob of people jumped out of the truck and started running through the gates, or were you ahead of them on that one.

MR ANDREW LEASK

I was not at the site this morning, I was on a train.

DR BILL WILLIAMS

I want to just ask you a little bit more about the physical protection. You refer to infocirc 225 revision four for physical security. If it is revised again and this likely next year we will require ANSTO to review and update its security plan as necessary to ensure it complies with best international practice regarding physical protection. Now this is presumably in a state of flux partly as a result of what has happened in the last three months. It seems to me that in fact - what you are saying it pre-empts construction licensing, that in fact - we are waiting for the plan, for the assessment to include the consequences of the impact of a large commercial aircraft on the facility. We have all been thinking about it now for a couple of months or more, I am really seriously concerned that we do not have a time line on that. That it is something - certainly there are security issues that I do not need to know about, but there are physical protection issues that I am extremely interested to hear about. I have done quite a bit of reading. I have looked at the Web. I have consulted with international colleagues on the subject of physical protection. I have listened to the IAEA - Dr Elbaradei - commenting that in fact reactors are obviously a terrorist risk and at this stage it sounds like there will be some form of document come out and Dr Loy will look at it and the public will not really see it until the licence has been given. Is that what is going to happen, or will you be providing it as a public document that people can consider and argue the toss about it.

MR ANDREW LEASK

I am not quite sure I understand what your question is.

DR BILL WILLIAMS

Okay, I will start again. The assessment will include the consequences of the impact of a large commercial - this is an assessment that you are providing for ARPANSA.

MR ANDREW LEASK

Based on the submission that ANSTO make to us.

DR BILL WILLIAMS

Right, and on the grounds of that Dr Loy will be considering that as part of the lead up to potentially licensing the construction.

DR JOHN LOY

I think the steps that I set out and that Andrew has also set out in his presentation, was there would be an ANSTO analysis that would be reviewed by ARPANSA and made available to ASNO and then the threat assessment process would simultaneously happen and out of that would emerge the final planning. I think we have said that we will endeavour to make what we can of those documents, which will not be the original documents but will be some assessment drawn from those documents and not containing material that would threaten the security, we will make those public and will happen before the licence decision.

DR BILL WILLIAMS

But what will the process be whereby the public can comment - potentially object to what is actually now the most serious concern people in Sydney have.

DR JOHN LOY

I guess that is something I will say more about in the next few weeks.

DR BILL WILLIAMS

You do not think that you should be giving a commitment or a time line and to allay the public's fears that undue risk to their health and safety is a potential -

DR JOHN LOY

I cannot issue a licence if I believe there is an undue risk to health and safety.

DR BILL WILLIAMS

Just briefly a couple of more questions which came up on Friday. Firstly, and it gets back to this question of net benefit again, and I presume you are the right person to answer this question or the nearest person to the right person, and that is that apart from my sort of home territory of medicine, the major justification for building this new reactor is Australia's sort of national interest and the role that we can play in terms of nuclear non-proliferation, and I have heard some extremely - a lot of controversy, a lot of argument about that. Can you specifically tell me in what way that a replacement research reactor would assist in advancing Australia's non-proliferation pursuits.

MR ANDREW LEASK

A substantive response on the national interest case was made by Government to the Senate Inquiry into the research reactor on two occasions, in 1998 and late last year. That information is on the public record and I would refer you to that.

DR BILL WILLIAMS

You cannot give me a two minute specific - here is an example where because we had a reactor we were able to put pressure on the Americans or put pressure on the Russians or something like that, there is no specific example you can cite.

MR ANDREW LEASK

I will read to you briefly from the statement that we made in the Senate Inquiry if I may. When considering the provision of a new research reactor national interest covers not only national security but also a broad range of other issues. Nuclear science is not an optional field of knowledge, but is an integral part of national scientific and technological capability. It underpins a broad range of scientific and medical research and access by Australian industry to advanced analytical techniques. It delivers critical health and medical benefits and is relevant to agriculture and environmental research and not least to the effective management of the uranium mining industry. Quite specifically when we deal at the international level - primarily through the IAEA which Australia regards as the prime agent of nuclear non-proliferation and the sharing of nuclear technology and expertise - we are able to bring a significantly greater weight of credibility to our influence, our discussions, our involvement and our leadership by

virtue of the technology that we have and hold at ANSTO. There is no doubt when you look at some countries who seek to influence and have basically no nuclear industry whatsoever that regardless of what you see in the press my personal view is that they are of not much credit.

DR BILL WILLIAMS

You say that quite confidently. So you ought to be able to cite at least half a dozen clear examples where that has occurred.

MR ANDREW LEASK

Those were made in the statement to the Senate in September last year.

DR BILL WILLIAMS

Okay, thank you. Last question, this was raised by the Australian Conservation Foundation on Friday. The matter of article 41 of Argentine Constitution which prohibits the import of foreign radioactive waste to their country, I gather that comes within your realms of expertise and consideration. Is this going to be a problem for the replacement research reactor, the fact that their constitution prohibits -

MR ANDREW LEASK

No.

DR BILL WILLIAMS

It is not going to be a problem.

MR ANDREW LEASK

No.

DR BILL WILLIAMS

Can you explain that in any more detail.

MR ANDREW LEASK

There is a clear difference in international law between radioactive waste and spent nuclear fuel.

DR BILL WILLIAMS

There is absolutely no question you could not find senior counsel, for example in Argentina who would challenge that in the Courts.

MR ANDREW LEASK

You could find lots of people to challenge it. I cannot predict an outcome of a Court of Law, all I can advise you is that in international law that that difference is understood.

DR BILL WILLIAMS

We would be sort of pre-empting a decision by a sovereign - another sovereign Nation to assume that they will end up countering their own Constitution to permit them to import our waste in the form of spent fuel rods.

MR ANDREW LEASK

I do not see any problem.

DR BILL WILLIAMS

Okay, thank you.

DR BOB BUDNITZ

The events three months ago in New York and Washington - I am an American – I say that again; the events have caused our Government to think carefully about the previous assumed threats and an assessment of just what these new events mean is now under way in my country. And I can only assume that that is true here, although I do not know and you have alluded to it briefly. The question is, if you find the need, is it under your authority that that process then will feed back to the design and ANSTO and INVAP and ARPANSA's need to review that design, is that how that works.

MR ANDREW LEASK

It could work that way, in the first instance the design basis really is actually conducted by a competent national authority, and that is done for ANSTO in the first instance, although we of course see the report and ANSTO have to bring forward if you like the measure that they will put in place and how they will counter that particular threat.

There is no doubt that really any of the key players in this process can at any time require the design basis threat to be revisited. It could be the Chief Executive Officer of ARPANSA. It could be the Director of Safeguards and the Director General of ASNO at any time. I mean the Government could through a number of its Committees and deliberations require that the design basis threat is revisited, and ANSTO have already been told to revisit it in the light of September events.

DR BOB BUDNITZ

Concerning the analysis, who is it that does the analysis of facility's vulnerability to various threats, is that the facility operator - let us say HIFAR as it is running today, or the new one were it to proceed. Does it work that you or ARPANSA asks them to do a certain analysis, they do it and you and they review it, or do you do the analysis yourself. I am just curious about how that works.

MR ANDREW LEASK

We obviously have a view and we understand the issues, but in the first instance it is up to ANSTO to bring forward a proposal that draws on the design basis threat which is common information to the Government - appropriate Government Agencies.

DR BOB BUDNITZ

Which they then - say for the existing reactor - believe is an adequate protection, and then you review that.

MR ANDREW LEASK

Then that will be reviewed by ourselves in conjunction with ARPANSA. We may or may not agree with the design basis threat. We may or may not agree with the processes and procedures and systems which are to be put in place. In which case we would draw that to the attention of the licence applicant and they would have to go back and modify their proposals. So the analysis in that sense is done by ANSTO in responding to the design basis threat and developing the systems, but also by ourselves in regard to our understanding of the design basis threat, any other information which we might have available to us through counterpart agencies and we would do our own analysis on the basis of what we think is appropriate. And in the light of that we will evaluate what ANSTO have offered.

DR BOB BUDNITZ

In that light - this is my last question because I too want to go to lunch - in that light one of the things that happened in my country three months ago, just after the terrible events in New York and Washington, was a realisation that safety documents then in the public domain could be of use to our enemies. To people who want to cause harm. Because safety documents by their nature consist of analysis of various things that might go wrong which then could lead to undesirable consequences and people who do not know much about a reactor can learn a lot from them, about what the vulnerabilities are. In that light we have had a re-evaluation in my country of some of these and some have been withdrawn from the public, although by the way if they are out there they might have been already taken, but on the other hand you know you can close the door now, and that - by the way people may know the US Nuclear Regulatory Commission's Website was down for about two or three weeks while all that stuff was cleaned off and that really was at least the benefit to any future misuse.

Have you thought about security along those lines for your - either for the existing reactor or the proposed new one. Just to say, I have in my office the PSAR for the RRR. You know it is that much paper, and anybody as knowledgeable as I – and there are a bunch of people around the world that knows how to read those things - can clearly see where some vulnerabilities might exist. That is just the nature of safety analysis. That is what we do for a living. That is what I do. Are you thinking along these lines in terms of where such information could fall into the wrong hands and what to do about it.

MR ANDREW LEASK

We certainly have, it is obviously a matter of judgment -

DR BOB BUDNITZ

Of course it is a judgment.

MR ANDREW LEASK

That you balance the line between information which builds confidence and allows analysis and comment verses that which to some degree undermines the long term

through life security. That is why I made - I chose my words very carefully in my report - talking about the through life security of the reactor and there is information which I would hope you do not have on the research reactor which we have classified -

DR BOB BUDNITZ

I did not mean to imply that the information that I have would be enough because there is a whole lot of detail which is of course not there, and thank God it is not there and I do not want it to be there. So there is some judgment to be made, is it you and your colleagues and your agency that are thinking this through.

MR ANDREW LEASK

Absolutely.

DR BOB BUDNITZ

I am not surprised and I am comforted to know that because this is a growing problem. By the way, in the old days if you wanted to get this PSAR you had to write to somebody and they send you four boxes of paper. But nowadays you can click it and it is on anybody's computer and anywhere in the world which makes it all the more accessible and therefore you think about this in a different way.

MR ANDREW LEASK

We have agreed with, in this particular case ARPANSA, who perhaps we might argue have a greater desire to be a little more open on some things than perhaps we would prefer. So therefore we have articulated and agreed with them very carefully which pieces of information must remain out of the public domain and therefore by default those which we believe could readily be placed on the public record.

DR BOB BUDNITZ

Do you think that co-ordination is working effectively.

MR ANDREW LEASK

Sorry.

DR BOB BUDNITZ

In your view that co-ordination is working effectively.

MR ANDREW LEASK

Yes, but we have to look at it in each case and on every occasion.

DR BOB BUDNITZ

Good, thank you.

DR JOHN LOY

Garry -

MR GARRY SCHWARZ

I have got one question to ask please. You indicated here that you have assessment criteria. Security plan assessment criteria, and what I was wondering was, do you also have some general design criteria; design requirements that the applicants have to meet. For example in Canada we have requirements and regulations that say something like there shall be an inner and outer security zone and inner security zone and it makes a few comments about that, without telling you it shall be like this, this, this and the other thing. But there are some general requirements laid out that will need to be addressed in a security plan. I was wondering do you have a sort of a similar approach, or do you rely entirely on whatever the proponent comes - the applicant comes to you with.

MR ANDREW LEASK

From what you said it sounds like our processes are very similar. We do take that approach. We do have that information. We have had discussions already with ANSTO in regard to the design of the facility and the way that the facility is zoned and how we control access to and from, obviously with a research reactor and the potential for scientists from overseas to come and work on it we have worked out how we would separate and segregate various areas and they can control access. That is documented, we have had those discussions with ANSTO, but that information is classified.

MR GARRY SCHWARZ

The sort of general design requirements that apply, are those publicly available. In other words, saying there should be an inner and outer security zone, inner security zone, that kind of level of detail, if I can put it that way, which is fairly general.

MR ANDREW LEASK

Yes, my colleague, Nick Doulgeris, is pointing out that the principles that you have alluded to are contained in the public document, amongst others, of infocirc 225 rev 4. So certainly the principles, but that document makes it quite clear that it is really talking about a smorgasbord of measures and each individual country needs to select from those. There are countries where - I am not quite sure what has happened since September - but certainly up until then guards, for example, were not allowed to carry side arms in accordance with the Constitution. So they did not, and therefore they have to build in other protective measures to reduce access and increase delay.

MR GARRY SCHWARZ

That is right. I guess I am just coming from the point that - you may want to consider that for the benefit of the public there is a certain level of information that you can put out to them which gives them some further level of assurance in terms that there are good security provisions available at the plant. I mean it does not give the details, and may be as much as saying, how much of that document, for example, do you follow because you may not follow all of it quite rightly, it is aimed at something that goes for everybody, but anyway that is about all that I wanted to say on the matter, thank you very much.

DR JOHN LOY

Thanks Andrew and thank you Nick for your presentation and response. Just before we go to lunch I agreed that Stephen Greenwood might have three minutes - Stephen Campbell of Greenpeace will have three minutes to inform us of his view of the events of this morning.

MR STEPHEN CAMPBELL

Before I do that I just want to make one point about the difference between spent fuel and waste. Of course that is defined by international convention, such as the International Convention on the Physical Protection of Spent Fuel and Nuclear Material,

documented in the International Atomic Energy Agency which clearly says which clearly says that spent fuel, if it is not being reprocessed for materials be taken out for further use is waste, so the material entering Argentina will be waste and therefore will clearly be in contravention of -

DR JOHN LOY

Thank you, you have made that point.

MR STEPHEN CAMPBELL

Okay, thank you. In terms of Greenpeace's peaceful direct action this morning, it is important to note that ANSTO, and this is one of the clear points you should take into account, ANSTO has announced on the Website at the moment that they are - they have increased security vigilance since September 11th, I think those are the words. But our little test of their increased security and vigilance really took about eight or nine minutes. Twenty six odd people dressed a nuclear waste barrels walked through the front gate, distributed information and leaflets to workers on the site in relation to alternate technologies that should be established at ANSTO. Within about three or four minutes a paraglider flew into the exclusion zone above the facility and buzzed the facility for about half an hour.

Within about seven minutes there were two teams of climbers on top of the reactor building who dropped banners saying "nuclear never safe". One team on top of their weather tower which dropped a banner saying exactly the same thing, and another team on top of building 27 which is the dry spent nuclear fuel store where there is approximately 600 spent fuel rods stored at the moment deploying a banner which said the same thing. It took less than 10 minutes. Security were scratching their heads. They had absolutely no idea what to do. In terms of ASNO's assertion that security on site made a threat assessment and responded appropriately, I would have to say that my view of that is that that is balderdash. They did not see anybody coming and they did not respond in any way whatsoever, so I will just leave you with that.

DR JOHN LOY

Thank you.

MEETING ADJOURNED

MEETING RESUMED

DR JOHN LOY

Welcome to this afternoon's session and welcome to ANSTO who are going to present and will respond to questions as we have established our procedures pretty thoroughly in the last day and a half, so could I welcome Professor Helen Garnett who is the Executive Director of ANSTO and who is going to lead in the presentation.

PROFESSOR HELEN GARNETT

Thanks John. I am going to use power point, so I am going to be working from here. If we get the technology warmed up. Okay, the title of the presentation this afternoon is safety and security of the replacement reactor. If I can start, the requirements, the project requirements were indeed for a world class facility which was high performance, reliable and available. That we provide for extensive neutron beam research capabilities, diverse and broad irradiation capabilities, and most importantly in the context of today that it would meet all the Australian regulations and IEA guidelines on safety. The subordinate requirements were that it was a full type reactor and that in part was due to safety assessments. That it would have a nominal reactor thermal power limited to 20 megawatts, that it would have unimpeded access to the top of the reactor pool and fuel enrichment would be less than 20 per cent.

The major features of the design are that it is a 20 megawatt open pool reactor at the bottom of a 12.8 deep reactor pool. The core is cooled by demineralised water and reflected by heavy water that is contained in the cylindrical reflector vessel surrounding the core. There are two thermal neutron beam and two cold neutron beam assemblies with an additional beam assembly for a possible future hot neutron source. There is a totally separate guide hole for the instrumentation and access for university and other research users to undertake the neutron experiments, and there is the capacity to irradiate targets from small to large volume in size in a range of positions to provide the diversity that we believe is essential in the planning of a facility which will have a life of several tens of years. Again, appropriate for today, is that it has a highly reliable and duplicated reactor protection system. This is an architectural drawing of the building

and you have a visitors' centre, an area where people would normally come. You have the guide hall which will have the instruments with appropriate laboratories and then deep down underneath this structure there is the pool and the reactor pool.

In regard to safety our approach has been to learn from international experience. To meet all Australian standards and IEA guidelines for research reactors. To design for defence in depth. To meet the commitments that were made when the EIS - Environmental Impact Statement - was put forward and then subsequently approved by the relevant authorities and to meet the commitments and conditions that were associated with the site licence application. Also, there has been, subject to a wide range of international reviews and considerations that we have taken, and the safety assessments have been put together in a comprehensive safety assessment, the preliminary safety analysis report, or PSAR as we tend to call it. In addition we have prepared a non-mandatory probabilistic safety analysis which like all PSA's will of course be appropriately updated and a subsequent version of that would come forward if the construction goes forward with the final safety analysis report which would be part of operational licence processes.

Security: ANSTO relies on the threat assessments and scenario assessments from a variety of intelligence and security agencies and these have all been involved. There is a comprehensive use of deterrent systems, physical security systems, access control and appropriate monitoring and this is to be scalable to meet changes in threat assessment. It is our belief that the security systems that are part of this facility meet ASNO and ARPANSA requirements. I think it is probably important to stress that these security assessments were taken out as part of the early design reviews and have been reviewed as we have gone through the detailed design process, and were part of the original PSAR, the analysis that went with the PSAR. However, we recognise that subsequent to 11 September it was appropriate to re-look at these safety assessments, security assessments and indeed ARPANSA asked us to do so, and this review has been undertaken, again in conjunction with the same sorts of people that were involved in the early assessment. These being appropriate experts to look at terrorist attack and sabotage, the various systems, and indeed the assessments has taken into account large commercial aircraft crash as well.

As a result of this more recent system, looking particularly at the defence indepth systems, changes have been made to some of the detailed engineering parts of the design to enhance access control and protection against threats that the relevant authorities believe we should be protected against, and confirmation has been made that the consequences of any event would be consistent with the emergency planning arrangements, as have been detailed elsewhere. Another important issue is indeed the design verification process. Clearly it is important to ensure that not only we have appropriate design - detailed engineering designs - but also that the component construction is in accordance with the standards that have been set, and so we will be making sure that specific component construction, quality and testing be subject to approval by ARPANSA. That there is a variety of processes in place, there is comprehensive design, acceptance and verification procedures which will include the use of specialist consultants with expertise at appropriate places.

There is comprehensive inspection and testing program which allows both witness and hold points for these appropriate processes to be gone through, and as I have said all processes in the design verification process will be subject to ARPANSA concurrence. If we look at a little bit more detail then at this inspection and test program, the program is meant to address factory acceptance, testing of systems, components and structures, recognising that these components will be made at a variety of places. Then for pre-operational site testing of installed components and systems, then cold commissioning prior to fuel loading, hot commissioning of reactor systems, that is after fuel loading, because one takes commissioning process through a series of stages, and then performance demonstration tests to satisfy the contract performance acceptance criteria which clearly spell out the standards that are to be met.

The features of this part of the program include integrated planning, execution, review and approval of these inspection and test activities - they are not just any old inspection and test activity - be undertaken in accordance with the quality assurance program, including a graded approach to ensure that the quality assurance requirements are matched to the safety significance of the components of the systems and structures. There will be complete documentation and recording of the inspection and testing activities to provide transparency and traceability for ARPANSA. There is also, as I have said, provision for the identification of various levels of program control points,

and this allows both ANSTO and ARPANSA to be appropriately involved, and there is provision for independent experts and expert agencies to be involved as appropriate in the monitoring and program at the request of both ANSTO and ARPANSA.

Spent fuel management is clearly something that has been taken into account. The Government decision of September 1997 was that HIFAR spent fuel would be shipped overseas, some of the elements to the United States on a return policy and some to France for reprocessing. The spent fuel management strategy for the replacement reactor is based on the continuation of this proven strategy which has been approved by the Government for the management of HIFAR spent fuel. We will be storing on site for the minimum time appropriate to meet operational requirements, and that includes clearly the cooling and the requirements that are required for transport, and taking this into account the spent fuel storage capacity which is within the pond, within the reactor building and subject to all relevant security systems, will be for a capacity of 10 years.

The waste from the spent fuel of the replacement reactor will eventually be returned to Australia. The first lot to come back somewhere around 2025 in the form suitable for storage as long lived intermediate level waste in the national storage facility as proposed by the Federal Government and being progressed by them. This diagram is indeed in the PSAR but I thought it is probably appropriate to put it up again today to show that the strategy for fuel is in fact, as I have said, operational storage before shipping and this, or our intent is to start with uranium silicide fuel and then to move to the uranium molybdenum fuel which is well and truly along the way, at an appropriate time, both of these sorts of fuel will be sent to COGEMA and the waste subsequently returned.

In the unlikely event that there was an issue here, which we do not expect, particularly given that the relevant authorities in France - Electricity de France - has just renewed its reprocessing contract in COGEMA for many years into the future. We ensured in the contract that indeed that there was a requirement for the contractor to arrange for alternate arrangements and so in that contractually bound to provide back-up arrangements and this is to provide an alternate solution which complies with our requirements that there be no direct disposal of fuel in Australia, no reprocessing in Australia and no indefinite storage of fuel in Australia.

Coming now to the safety design criteria. I have said it is an open pool reactor which in itself has many inherent safety features. Summarising these, the reactor operates at low temperature and low pressure. The large open pool gives easy operational access to the core and reflector. The large volume of water in the pool and the service pool provides both shielding of the radiation and availability of large amounts of cooling water for all types of normal and upset conditions. The reactor is able to achieve cooling by natural circulation, even if the forced cooling flow is stopped for whatever reason. It does not require external support. There is both a primary and a secondary shutdown system which each independently are capable of shutting down the reactor, and I guess lastly in the context of safety, one of the issues that has not only been the safety of the facility, but in accordance with ALARA principles to reduce emissions and the comment here is that the emissions of tritium are extremely low due to the fact that we will be using a light water reactor, it is not heavy water, as a coolant, as well as the fact that there will be a lower generation of other gases radioactive emissions.

The design concept for safety is defence in depth and when I am talking here about the reactor I am talking about the reactor facility inside a building, and there are barriers and protection levels for accident prevention. There is conservative proven design. There is the maximisation of inherent safety features, the facility is designed to be simple and safe, and we have, as I have said a moment ago, taken account of ALARA principles in considering the whole design of the plant in the segregation of areas, material selection, the nature of the shielding, the vacuum systems, the operation and the maintenance, indeed in the whole context of the - not only the design of the facility, the operation, the maintenance and the long term operation of that.

Moving now into more depth on the safety design criteria, looking at the safety functions, I stress again there are two independent and diverse shutdown systems. There is a natural circulation for decay heat removal and there is containment. All systems important to safety are subject to the highest level of control and verification, along the process that I have described, and they are designed to be highly reliable. The safety standards to which the facility is designed follow ARPANSA's regulations and the relevant IEA recommendations for the design of research reactors, and the safety analysis has been performed according to ARPANSA's regulations and the IEA safety series guidelines.

If we look now at the first shutdown system, if I can use the pointer to - looks like the pointer has gone - here we have a cross section showing you fuel elements and what you have is the plates. Four plates in a cross shape configuration, one, two, three, four, which are the safety plates, plus there is a central regulating plate, each of these guided in channels. These are designed to rapidly absorb neutrons and in the normal operating position they would be withdrawn and above the core. If they need to be inserted, if indeed the reactor power is shutdown they are inserted immediately by gravity. They are also able to be inserted by compressed air and it simply shows you the compressed air system. This a fail safe design system with an insertion time of these plates of less than one second, and the design is a proven control rod design.

The second shutdown system relies on reflector drainage by gravity, draining through here. It is simple and reliable, it is independent and diverse. The estimated drainage time for all of the reflector drainage is 15 seconds, but indeed only 50 per cent of the drainage is needed for it to shutdown. It is sturdy against earthquakes with a drainage tank and lines below ground and within the concrete block and meeting appropriate seismic requirements. There is an emergency make-up water system which keeps the core covered with water, even in the unlikely event that pool water is lost and of course there are appropriate detectors to detect any loss of pool water. This emergency make-up water system injects water into the chimney and this is done automatically if the reactor pool water reaches the upper edge of the chimney there is no need for any trigger signal. It also can be done manually.

Turning to seismic, the structure is in rock, it is a concrete box founded on the rock with substantial concrete shear walls and the structure is designed to remain elastic under a SL2 level earthquake, this being an earthquake which is a one in ten thousand years severe earthquake event. Indeed, the seismic design has a substantial margin beyond the SL2 level event. This is a curve showing you the seismic hazard spectrum and there has been a lot of talk about the IGNS spectrum, this is the IGNS spectrum. This is the spectrum that the NRC would use which is somewhat more conservative in most of this area and indeed the seismic design has a curve which has been adopted follows this curve to this point and then follows the IGNS curve down at this low period. The containment system provides the final safety barrier for events which could lead to the

release of radioactivity. It is a physical barrier of some considerable substance, in the walls sealed cable penetrations and air locks. There is a containment isolation system and there is a containment energy removal system, and again here is ground level as such - the containment barrier is all around the relevant parts of the facility.

The safety analysis that has been undertaken had several objectives. First of these was to demonstrate that the proposed design fulfilled the safety requirements as had been set out by Australian regulators and the IEA safety guidelines. The safety analysis also ensured that analyses were performed of the response of the plant to anticipated operational occurrences, design basis and beyond design basis accidents. The safety analysis is in agreement with ARPANSA's safety assessment of controlled facilities and IEA 35G1, and the safety analysis that has been presented identifies, describes and evaluates all of the relevant safety systems. The way that the safety analysis was undertaken was to screen all initiating events within 12 generic groups, to present the defects in depth features and those actions at level one, which is prevention by design, and at level two, which are control measures for each initiating event. These were discussed, both in terms of likelihood, consequence and design base sequence.

With regard to human error, there have been included as causes of initiating events in the safety assessments, and explicitly for a specific range of identified potential errors, so we are being conservative in design, operation and maintenance. The safety assessment, as already indicated, had accompanying it a level one plus probabilistic safety assessment which, as I have already said, is not a mandatory requirement. The conclusions of the safety analysis are we believe that the facility has inherent safety features, has a robust design which is effective in preventing accidents and in mitigating the impact of any failures of plant systems. Further, with the safety and security assessments there is no credible external event which has the potential to affect the safety of a reactor facility.

The plant will shutdown safely, even for very severe seismic events with a return period of once in ten thousand years and beyond, and for all design basis initiating events there is no core damage occurring to the reactor and the plant is safely shutdown. This reactor safety system performance we contend exceeds all regulatory requirements for reliability, and even for those accidents that are so unlikely as to render them beyond the

design basis the consequences are sufficiently minor as to not to require any off-site response or any off-site counter measures. For those beyond design basis accidents that can potentially damage the core, the analysis, and this includes again security and appropriate threat analysis, has shown that their total likelihood is over two orders of magnitude and impact below the regulatory level.

So to summarise, the replacement research reactor design is based on concepts of defence indepth and follows international guidelines. We have attempted to maximise inherent and passive safety features. The safety analysis is consistent with ARPANSA and international standards. There will be comprehensive design verification throughout construction and commissioning. The security provisions are based on Australian and international guidelines. They are based on defence indepth and they are adaptable to changes in threat assessments and the spent fuel strategy is based on a current proven process. Thank you.

DR JOHN LOY

Thank you, a very succinct statement for the ANSTO case and obviously we are going to have a few questions. Unlike the way we have handled it previously, what we would like to try and do is perhaps to pick up a theme and follow it through with the different panel members rather than simply have the panel members go through their entire list of questions set out one at a time, we will try and see if we can follow it through a few themes. I am pleased to welcome the team from ANSTO who are standing ready to assist with answers to questions.

MR GARRY SCHWARZ

Thank you very much John. I am going to start the questions off with - on the subject of adequacy, of what we call back in Canada special safety systems which namely are the containment system, shutdown systems and what we typically call emergency core cooling system. What I am going to start off with is looking at the shutdown systems. With regard to the first shutdown system that you have, it seems to me that - if I recall correctly and maybe I do not recall quite so correctly - but anyway one of the fundamental rules is that you try to maintain the shutdown system fully independent from any process systems. I notice in the particular design that you have, the shutdown mechanisms for the first shutdown system are the same as what you use for your

process control, certainly to some extent. So I would like you to comment on that and indicate to the panel why you believe that that particular design project you have taken is acceptable.

DR JOHN LOY

Perhaps it would be best if you could come to the podium and make sure that we can hear you, and can you give us your name.

MR MARK SUMMERFIELD

Mark Summerfield, safety and licensing manager. The only common feature between the shutdown systems and the process control is actually the control plates themselves, and this is not an uncommon occurrence in reactor designs. The shutdown mechanism which actually drops the rods and control plates into the core is completely independent and completely overrides the process control system to the reactor control monitoring system. There is - on the control rods - there is an electrical magnet which is released, in addition there is a compressed air supply which forces the rods down and in addition the stepper motor which moves the rod up and down normally loses its power, and once it loses its power the outer cylinder - details of the design are available in the PSAR in chapter five section 5.3 or 5.4 I believe, so the - that is the point we are arguing the fact that - the actual how to shut down is completely independent to the normal process control.

MR GARRY SCHWARZ

What kind of assessment are you doing to ensure that you have got -

MR MARK SUMMERFIELD

We have done a full failure mode and effects analysis on both the first shutdown system as a shutdown system and also on the controller drive mechanism as a system, and that these are - were done as part of the design development for systems and have been refined at this time from the detailed engineering phase.

MR GARRY SCHWARZ

Are you able to do all of your testing of the - or do testing of the various components to achieve -

MR MARK SUMMERFIELD

There is a complete mock-up of the controller drive mechanism at presently being constructed in Bariloche in Argentina and that will be subject to a full test program, including not only the initial 'does it work', but doing hundreds of cycles up and down through the performance curve and hundreds of drops to ensure - and even with the most extreme limits of tolerance, as in assuming someone sets it up at the minute, at the extreme end of its allowance - it still drops under required situations.

MR GARRY SCHWARZ

What I was going to get at was testing during normal operation of the reactor.

MR MARK SUMMERFIELD

There will be a requirement - there will be an operational requirement - these are still to be finalised, but it is expected there will be a requirement for there to be a full drop test on the control rods every time there is any kind of touch instant or any time any maintenance on those to ensure they shutdown. In addition, the normal process for - INVAP have been suggesting the normal process for shutting down is when you reduce the power down to the very low level, the final 10 per cent shutdown is done by the trip, that is still being discussed as part of the operational philosophy. There will be of course full commissioning tests once the control rods are all installed, and then subject to appropriate testing throughout the life of the plant.

MR GARRY SCHWARZ

So during normal operation, what kind of frequency is that roughly when you would shutdown the plant, is it once every few months. I just need one fast answer, there is nothing to elaborate on. Do you expect it about once every three months or so. How often do you expect to be shutting down as part of your normal operations. You have to shutdown to refuel, correct.

UNIDENTIFIED SPEAKER

We normally shutdown every four weeks.

MR GARRY SCHWARZ

Okay, that is all I wanted to know. If I may go on to the second shutdown system because you talk about the fact that you have two fully independent and diverse shutdown systems, and indeed you do have two independent systems and two diverse systems, now my question about the second shutdown system is, is it fully effective on its own.

MR MARK SUMMERFIELD

Yes it is.

MR GARRY SCHWARZ

For all accidents and areas.

DR JOHN LOY

Perhaps for this line of questioning both you and Mark should be up there ready to go. Sorry to interrupt Garry.

MR MARK SUMMERFIELD

Your question was, is the secondary shutdown system fully effective under all circumstances.

MR GARRY SCHWARZ

Yes, in the absence of the first shutdown system.

MR MARK SUMMERFIELD

Yes it is.

MR GARRY SCHWARZ

For all events, including your loss of control events, whatever events you have postulated, the second shutdown system is fully effective as an equal to the first shutdown system, is that what you tell me.

MR MARK SUMMERFIELD

For all events for which the failure of the first shutdown - the initiating events and the failure of the first shutdown system is within the design basis, yes the second shutdown will fully cope with the situation.

MR GARRY SCHWARZ

But what is usually understood by people when you talk about an independent second shutdown system, is that that second shutdown system can take and cope with all accidents equal to the first shutdown system without the first shutdown system acting, and that is why I am asking the question. Can that second shutdown system do that.

MR MARK SUMMERFIELD

Yes because what is going to happen in the event of any incident which exceeds the trip parameters for the first shutdown system, and if the first shutdown system fails to work, it will then hit the trip parameters for the second shutdown system, and that will then work.

MR GARRY SCHWARZ

I am sorry, you are misunderstanding me, I am telling you that the part of the philosophy behind two shutdown systems is that as one set of accidents that you look at you do not take account of the first shutdown system, that is the way that you determine whether or not the second one is actually capable of doing the job, you forget about the first one, so I am asking you question again, is that second shutdown system fully effective on its own.

MR MARK SUMMERFIELD

Yes it is.

MR GARRY SCHWARZ

It has sufficient speed.

MR MARK SUMMERFIELD

Yes it does.

MR GARRY SCHWARZ

When you talk about it takes 15 seconds to dump, or half of that.

MR MARK SUMMERFIELD

Fifteen seconds is the time to fully drop the water to the dropped level in the reflector vessel which is half the vessel, that is not the time required to actually initiate the shutdown of the reactor, that takes a few seconds.

MR GARRY SCHWARZ

My understanding from comments that I have seen is that indeed the second shutdown system is not fast enough to be able to counter some of the accidents that you look at.

MR MARK SUMMERFIELD

Well it is, but we are at this moment looking at ways of making it faster to give us a higher level of assurance, but it is fast enough.

MR GARRY SCHWARZ

Okay, that is another issue. The second shutdown system has the same number of trip parameters basically as the first shutdown system then.

MR MARK SUMMERFIELD

No.

MR GARRY SCHWARZ

How are you making the argument then that it is fully effective - as equally effective as the first system, if it does not have the same number of trip parameters.

MR MARK SUMMERFIELD

Because a diverse set of trip parameters that are a few in number, such as the - what we have been doing is assessing on the basis of failure of the first shutdown system and on certain other parameters, such as the over power, but it is our judgment and the analysis of the case that we are doing at the moment is that it does need to have a full range of all - it does cover the full range of all accidents, but it does not need the full range of parameters to cover that. It does not need equivalent identical parameters, that is the common approach adopted in other power reactors and other research reactors. I know

the Canadian approach is a different approach, but that is a common approach adopted on power reactors I am familiar with.

MR GARRY SCHWARZ

I think there is only one power reactor that I know of that uses that approach, and certainly you are quite right, that approach would not be acceptable in Canada. My basic comment then in response to you is this, that although you have two independent and diverse shutdown systems, certainly we would not - I would not, speaking from the Canadian approach, we would not accept that you have two fully independent shutdown systems because you do not have the capability in the second one due to the lack of trip parameters so that it can fully handle all events on its own. Another question, if I may ask, is one of reliability of the second shutdown system, what is your reliability requirement for the second shutdown system.

MR MARK SUMMERFIELD

Again, the secondary shutdown system is subject to an FMEA but your point earlier on that it is not fully independent - if the question is it is fully covered by the - you do not need to do the identical trip parameters to be fully independent and cover all the full sequences. That is what the point I was trying to make such as the first reactor protection system has a larger number of trip parameters to give the optimised response which would be a reasonable way of putting it. The second reactor protection system fully covers full potential incidents or potential initiation events but uses a more select bound in limits on it. So it does cover all events and it is fully independent in that extent and it is - when you are talking about the reliability, as I said, there is also FMEA, failed mode effect analysis, has been performed on the second shutdown system and the reliability of that is again subject to the requirements and criteria set out in the ARPANSA RAPS for a safety system.

MR GARRY SCHWARZ

That is what, 10 to the minus 3 on availability -

MR MARK SUMMERFIELD

10 to minus 3, yes, I believe, and in fact -

MR GARRY SCHWARZ

One of the difficulties that has been brought to our attention by some of the public comments is that there is some concern that the reliability might not be able to meet the reliability requirements because you cannot test the dump valves in service.

MR MARK SUMMERFIELD

Yes, you can. You do in every shutdown, its dump valves will be tested.

MR GARRY SCHWARZ

No, in service. When the reactor is in service, on-line, you cannot test the dump valve.

MR MARK SUMMERFIELD

As I said, every shutdown is once every 28 days. The dump valves will be tested.

MR GARRY SCHWARZ

No, I hear what you are saying but I am telling you that, as I understand the design, when the reactor is in operation you cannot test the dump valves.

MR MARK SUMMERFIELD

That is true, yes.

MR GARRY SCHWARZ

That happens to be one of the features that a lot of reactor designs do have, that you can test these things in service so that you can easily demonstrate your 10 to the minus 3 unavailability but you have got a large number of valves there. You cannot test them in service so there has been a question raised about whether or not you could actually meet that 10 to the minus 3 unavailability. I am just passing on that particular comment.

MR MARK SUMMERFIELD

As I said, the position at the moment in the reliability of that is that we have more valves than necessary and every shutdown those valves will be tested, cycled, also because of the ball valves to ensure they meet reliability so they will be tested 12 times, 13 times a year. I mean, I would question any suggestion than they are not being tested

in service. They are not being tested at power but they are certainly being tested in service and I do not think it makes any difference to the valves themselves whether or not the reactors are powered when you test them or whether it is not.

MR GARRY SCHWARZ

I think, given that, you know, if you are shutting down basically once every 4 weeks or something like that then I would be inclined to agree with you. You would have a high enough test frequency but you might not be able to demonstrate that, yes. Yes, I agree. I guess the only point that I would make to finish on is that typically regulators regard shutdown systems as next to God and if there are any questions on shutdown systems I know certainly the practice in our country is that there are basically no significant questions unresolved regarding shutdown systems before a construction licence is given. That is just fundamental. That is it. In your particular situation, for example, if there was a question that arose regarding the speed of the dump which you have alluded to and you said, "Well, we're looking at some way of fixing that", the regulator would say, "That's got to be done. All the design has got to be done, the design requirements have got to be nailed down. We have to know exactly what you've got before a construction licence is given", because it is too fundamental to the safety of the facility. You cannot play around with design changes especially if you are not sure whether or not they are going to be significant design changes after the construction licence is given.

So it kind of goes like that and that is a part of the general philosophy that regulators usually have with regard to construction licences. They are very unhappy about granting construction licences unless they have good confidence in the design at the point of construction licence and by good confidence in the design I mean that basically they are confident or reasonably assured that there will not be a need for any significant design changes after the construction licence is given because, as you can well appreciate - and that is something that is of benefit not just to the regulator but of benefit to the designers and the applicants as well because if you can imagine that you get 2 years into the construction and suddenly you find that, "Oh-oh, need to make some sort of a significant change and that means that I've got to rip out a whole pile of equipment that I've already installed" - well, that tends to be a very difficult type of a decision that has to come along.

So I am just saying to you the applicants - I would not be terribly surprised if the regulator over here - and the regulator over here I do not think is a whole lot different from the regulator where I come from - says on any particular issue where he is not sure that there is not going to be a need for some significant design change to say, "Hang on a minute. Before I'm going to make a decision on a construction licence I've got to have that clearly sorted out and I've got to know exactly where we're going".

MR MARK SUMMERFIELD

I take your point. I think the important issue here is that the system is performing satisfactorily as designed but for us to proceed for the next 4 years and not take advantage of improvements that are possible would not be sensible. So we are talking here about margin, we are not talking about safety and I think it is important for us never to turn our back on an opportunity to make things better. That is the point I was making.

DR BOB BUDNITZ

Could I pursue a question about the shutdown system -

DR JOHN LOY

Please, yes. Let us run the shutdown system right down.

DR BOB BUDNITZ

On the slides and in the PSAR and in the response to one our panellist's questions you make the point that the shutdown system will be designed to the SL2 earthquake with significant margin. Have you done engineering analysis to quantify how much margin there is or another way of saying is what is the input value or the point at which you think you might start getting significant failures or is more work to come on that.

MR MARK SUMMERFIELD

Perhaps we will ask the consultant who knows about the seismic -

DR JOHN LOY

Would you identify yourself, please.

MR PABLO ABBATE

Yes, good morning. My name is Pablo Abbate, I am the design manager for INVAP for this project. The design of this system has been done such that they remain elastic when subject to the SL2 earthquake. Nevertheless, we have carried out analysis beyond that seismic levels and we are confident that we can accommodate earthquakes as much as twice that value and even a little bit larger.

DR BOB BUDNITZ

And they are going to stay elastic there or they can -

MR PABLO ABBATE

No, no, no, but perhaps it is good to be aware that the first shutdown system, the control drives themselves are the basement of the reactor. This means that the acceleration levels from them are much less than what you would have normally in other reactors where the drives are over the pool, particularly Canadian's design have this -

DR BOB BUDNITZ

So they are designed to be elastic at the SL2. You wrote that down.

MR PABLO ABBATE

Yes, that is right, yes.

DR BOB BUDNITZ

The margin then is you are getting some inelastic but they are still -

MR PABLO ABBATE

That is right. What we have analysed are the support structure of the drives, the five drives that are in the basement of the reactor and also the mechanical behaviour of the reflector tank and the core itself and the guide boxes where the plates move. And the flexions are (inaudible) we have today are very, very low and the force provided by the compressed air that is injected into the system to force the shutdown is more than enough to counteract any friction effect that may appear as a consequence of the

earthquake. Nevertheless, we are also doing some testing and shaking tables of the drives.

DR BOB BUDNITZ

Without arguing about how it is going to come out because this testing is still coming -

MR PABLO ABBATE

Just now we have and last week before we left Bariloche the manufacturing of the control drives and there was talking to do some trial tests and starting all these very, very comprehensive verification and testing to reflect the wear and tear that would occur in the system along the lifetime of the facility. We are very well - I think over 2,000 sequences and movements of the motor and whatever is there.

DR BOB BUDNITZ

Okay, so that great but that is new information compared to what I have heard before.

DR JOHN LOY

Let us try and sort of focus on more technical safety analysis at this point of the discussion and then we might move into some of the issues about fuel and wastage and so on we go later on. So I will let you two rip for a while and Bill and I will sit quietly.

DR BOB BUDNITZ

It is my turn to jump on the PSA. I studied the PSA in detail, I do this for a living. In fact, what I really do for a living is seismic PSA but I do a lot of other PSA too and I wrote a report for Sutherland Shire Council which perhaps you have seen in which I commented favourably about a lot of things and I think it was a very nice job in a number of ways and that is important to say, but there were three or four things where I was troubled and I want to be sure to pursue them here.

The first is that you are missing a fire PSA. It is not there and that is important. The reason it is important to me is that we very commonly - we have 105 power reactors in my big country, whatever the number is, and very commonly the fire PSAs produce core damage frequencies that are larger than anything else or at least as large as anything else. That is a very common finding. You can just go read all of our analyses

and I can point you to it and it is very uncommon for a fire PSA to produce numbers very much lower than everything else. That does happen in a few of them where the designs are particularly specially emphasising separation but it is very uncommon that the fire PSAs you know are much, much, much smaller than anything else.

In our typical core damage frequencies, as I am sure you know - these are big power reactors, of course - are 10^{-5} to sometime 10^{-6} . And just so everybody understands what the fires are that are of interest in power reactors and that is not the same as yours, I know, typically, it is electrical equipment and cable which catch on fire for one or another reason. Sometimes - there is no such thing as spontaneous because there is some cause but no - it is sitting there and all of a sudden it catches on fire. It is a short-circuit or sometimes transient fuels that are left by mistake but more commonly it is just various electrical faults that occur from time to time and you get a fire and it knocks out equipment and even though all of our reactors by definition - and I can insist, I believe it is true - meet all of our regulations. Of course they do or they would not be running. So they meet all of our regulations as your design and your SAR seems to show that yours would. These are beyond the design basis and the core damage frequencies are often 10^{-5} and sometimes more per year.

So absent an analysis that shows that you with your equipment, your cables, your electrical equipment, your transformers and so on - absent an analysis that shows that your separation produces lower frequencies; I am not willing to say here that the fire PRA is not going to be much bigger than everything else because everything else. I have got it on my screen - this is kind of a new system they set up here - you know, everything else is less than 10^{-6} per year. In fact, for internal events it is less than 10^{-7} per year. I would be surprised if fire is lower than that although I am willing to accept the possibility of your separation if your separation really is what the PSAR supports because I have studied the PSAR and it looks like a very nice modern design. Like the sort of modern design that we have done in the best of our newer stations. So I am going to challenge you that until the fire PSA is done you have got confidence that it meets the design basis but I would not have a lot of confidence that it is down by 10^{-6} per year, never mind a 10^{-8} or 10^{-7} per year and I wonder if you have a comment about that.

Then let me just make two more points about the PRA and we can talk about them all together. Secondly - and I wrote this in the thing that I wrote Sutherland Shire Council - core damage frequencies for internal events are around 10^{-7} per year and yours is a little below that. Typically, a PSA makes a whole lot of approximations. I mean, you have got to make approximations in order to get on with the analysis in which various small effects are lumped together or are made or are done approximately so that the analysis is manageable. Otherwise you had not have put 10^{-5} to the 55th sequences or something. And in the course of that typically all sorts of things are screened out around 10^{-7} or so. Which are fine if your core damage frequency is 10^{-6} or 10^{-5} but if your core damage frequency is less than 10^{-7} then screening those things out is obviously not fine. I mean, you know, I am not arguing that it is a big risk here. 10^{-7} is a pretty small risk, if it is true, but until you have shown that that screening criterion that you must have used and which I tried to pull out of the analysis, out of the write up but it was not really very satisfactory and, until you can show that that is really robustly screening out only stuff that is much smaller than that then I tend not to believe a core damage frequency around 10^{-7} per year. Without arguing - but the fact is the two do not matter very much because it is such a small number but it is just the end detail does not seem to make sense to me.

And then number 3 is that in any event you quote uncertainties, sort of 5 to 95 per cent uncertainty confidence in your state of knowledge of the core damage frequency. Then are factors of 3 and 4 and that seems to be too small to me. Just we do not typically get factors that - we do not have as much confidence in that. And the reason is because the knowledge of the actual performance of hardware and the uncertainties in them and the way they combine is for you a design. You have not built it yet. After 20 years of operation you might have more confidence in certain failure rates than you have now because it is a design. Secondly, there is all the complex problem of working out what the dependencies are between failures of hardware which produce uncertainties, numerical uncertainties that tend not to be so small.

So those are the three issues where I think the PRA is not necessarily - how shall I say this - right, without arguing and I am not arguing for a minute that, you know, it is a factor of 10 or 100 larger in the end. I do not have a basis for that, I think it is just a feeling. Having said those three things I have two more things to say. The first is as

best I can tell, you have done a pretty good job on the HRA, the human reliability analysis piece. I have studied it in detail, I know a lot about it, I thought it was pretty good but you know and I know, anybody in this business knows. That the human reliability analysis has a great difficulty in trying to quantify errors of commission which could get you into trouble. So the way you try to do that in PRA is try to think up those scenarios that can get you into trouble and see if there are any of them that are important. I tried that and I could not find any that looked like you omitted which made me feel good but of course I did not have the knowledge you have.

So I wonder if you could then respond on that one as to whether you too have done - because I could not draw it out of the write-up - whether you too have done a systematic search for the sort of scenarios where an error of commission get you in trouble and assured yourselves that these are not really big ones that will bite you. As opposed to a lot of little things that generally have other means of protection even if the error commission occurs. You know, there are lots of sequences where if you have an error commission there is another way. You have additional protection, either hardware or something else or procedure to bring you out of it and so those are the places where to me the PRA was not as complete or whatever and I wonder if you want to talk about that.

DR JOHN LOY

You say errors of commission.

DR BOB BUDNITZ

You see, errors of -

DR JOHN LOY

Just clarifying the accent, that is all.

DR BOB BUDNITZ

Yes, excuse me. Errors of omission are you are supposed to have turned the thing and you did not. And we give a lot of information about the way operators and maintenance people make those errors and the quantification of them is not exact but we feel pretty comfortable about how that analysis is done in these analyses. It is the areas of

commission in which a mental thought process leads you to do the wrong thing that are more complex.

DR JOHN LOY

There is a whole group of issues about that in the PSA.

DR BOB BUDNITZ

Yes, there is a whole set of issues.

PROFESSOR HELEN GARNETT

(Inaudible)

DR BOB BUDNITZ

Yes. No apologies.

PROFESSOR HELEN GARNETT

Unfortunately the one person who would be able to (inaudible) was rushed to hospital today (inaudible) this morning and so really what we can -

DR BOB BUDNITZ

I hope he or she is well.

PROFESSOR HELEN GARNETT

On issue of the (inaudible) analysis I would -

DR JOHN LOY

Can you use the microphone, please.

PROFESSOR HELEN GARNETT

On the issue of the fire analysis, I believe firstly that the issue of separation as you have mentioned is as in essence the approach that has been taken but in addition to that a relevant analysis is actually being prepared by INVAP and is currently in internal review and will be available.

DR BOB BUDNITZ

So that is to come.

PROFESSOR HELEN GARNETT

We did not believe it was necessary, in the context earlier on of the - given the separation off issues as been said - but we have additionally done it. We would normally have put it forward as part of the PSA that would be developed between now and an FSAR in accordance with guidelines.

DR BOB BUDNITZ

I understand. Just let me describe something. You are, of course, correctly relying on the PSAR as the fundamental basis of the licensing submission. But in a number of places you have relied on the PSA as well to make cases about how much margin you have got and until you have done this bit I am not willing to buy off on that margin yet, okay. As opposed to whether it is the licensing basis, a different question. Thank you.

MR ANDY WILLERS

My name is Andy Willers. I work for ANSTO. You raise a number of points. On the fire work, yes, there will be analysis forthcoming on the fire side of things. The basic question is whether or not we can safely shut down the reactor in the event of a fire. We believe the answer is yes. The set-up of the safety systems is such that any anomaly will result in a shutdown of the reactor. We do not need the electrics to start up pumps or start up any emergency cooling like that.

DR BOB BUDNITZ

Yes, I read that in the PSAR.

MR ANDY WILLERS

With regard to the low frequencies and the removal of event - postulated initiating events - yes, that was an issue in terms of at the start of the PSA you look at the frequencies of the postulated initiating events. The low frequency ones you say, "We'll, put to one side because we are expecting a core damage frequency of 10^{-5} ". It came as quite a surprise to us to see the frequencies for core damage at the end of it. We will be revisiting the initiating events that we removed. With regards to the

uncertainties, the data that we have used for the PSA has been essentially taken from IAEA generic databases.

DR BOB BUDNITZ

Yes, you know, I understand. That is not bad at this stage.

MR ANDY WILLERS

And for a design PSA that we have at this present time we believe that is as good as we can go.

DR BOB BUDNITZ

Yes, and without dispute. I was just worrying that you'd believe those – you should not believe it.

MR ANDY WILLERS

We will be certainly looking to see as the PSA develops to a full operational PSA the inclusion of greater uncertainties due to interactions and human factors or kindly errors of commission. At the present stage for the errors of commission in the HRA again what we have here at the present time is a design PSA. We will be updating that as we go onto FSAR becomes an operational PSA. To bring in all the factors that at this present time it is not possible to put in with any degree of certainty.

DR BOB BUDNITZ

Okay, in which case you are liable to find - this is a prediction - you are liable to find some places where they are going to pop up and look bigger than the other numbers you are using. They are going to lead you to some procedural changes. I predict that. In other words, that you will find places where there are errors of commission that you identified where the way to overcome that is to provide better training or instruction to the operators or something like that so as to alert them to those possibilities. That is a prediction that that then will assure that the safe operation will - you will not be trapped by that.

MR ANDY WILLERS

That is one of the benefits of the PSA.

DR BOB BUDNITZ

That is in the interim process in taking the design through the regularisation of all the procedures in the training and the like.

MR ANDY WILLERS

Yes.

DR BOB BUDNITZ

So I just want to know - and you know, I hope you will say yes - that you have a process in place, or are contemplating a process in which that (inaudible) thinking is going to find its way back into the way the operators will be instructed.

MR ANDY WILLERS

Yes. What we have here is essentially the bare bones of a PSA. We intend to carry on building on this PSA and strengthening it as more information becomes available, yes.

DR BOB BUDNITZ

Okay. Good.

PROFESSOR HELEN GARNETT

Again, I might just comment that in the context of HIFAR - I mean, we have a PSA which is probably more extensive than PSAs for most research reactors and -

DR BOB BUDNITZ

It is a pretty good PSA.

PROFESSOR HELEN GARNETT

- and it is a living document and we learn from it. So I think the same approach should be taken.

DR BOB BUDNITZ

Mr Chairman, I have one more PSA question. It has to do with - and I wrote this in the thing I wrote for Gary Smith sitting over there for the Sutherland Shire Council - this

has to do with aircraft and we are not talking about terrorist aircraft. This is just not a terrorist, just an aircraft crashes by mistake and the probability that that happens is very small. Anywhere in the world, you know, buildings that - and reactors just do not get hit by aircraft very often but the probability is not zero and so there is a methodology that one uses to work out what the probability is that such an event might happen for a small plane or an intermediate plane or a big plane.

For your reactor, if the design is executed properly, you do not have to worry. You would not have to worry about aircraft smaller than the Cessna 500 to achieve design basis because it has been designed for those but aircraft larger than that are then of course (inaudible) basis and that is the question. And what I commented on is that the methodology that you were using, that you cited, for working out what the probability per year is for a big one hitting you by mistake seemed to be very old-fashioned. And there is a new methodology out there and I even cited what it was and since I was on the team that developed it I have an axe to grind here, but be that as it may, there is a new methodology which was published by a team of us in the US about 4 years ago and I was going to commend it to you because I think it provides a much firmer basis than the one you used in your thing for working out whether larger planes than a Cessna 500 have an accidental chance of getting in trouble. Okay, and of course there is the other thing you know; if it is designed for a Cessna 500 that does not mean that a plane 10 per cent bigger than that is going to damage the reactor. So there is a response side too and that is all in that same report working out some of the damage response capabilities as in this advance report that the US (inaudible) published, I cannot remember, in 1997 or so.

MR ANDY WILLERS

To answer your question, the HIFAR PSA that has existed for a number of years used essentially what you would call the old methodology. When you mention that there was new methodology we went and revisited our aircraft crash likelihoods and we found a decrease in actual aircraft -

DR BOB BUDNITZ

Oh, I didn't know how it was going to come out, just -

MR ANDY WILLERS

The reason we have found a decrease was because for the HIFAR work we had lumped all the aircraft crash statistics into in-flight crash. That is all the ground incidents again.

DR BOB BUDNITZ

But that is surely pessimistic.

MR ANDY WILLERS

Yes.

DR BOB BUDNITZ

Yes, I mean, I misspent part of 1997 on this topic and so I know a lot more about it than I ever wanted to know. The fact is that you ought to do it right. It is not complicated. It is probably 2 weeks' work for one person and then you will have a much better picture for yourself and for ARPANSA and for the public as to whether those accidents are in fact a big concern or not.

MR ANDY WILLERS

The easy answer is aircraft crash in that manner is not a big concern for the reactor.

DR JOHN LOY

That covers safety analysis, reasonably broadly defined, questions at this point. Have you got any others, Garry.

MR GARRY SCHWARZ

I have got one more on PSA.

DR JOHN LOY

One more on PSA, go for it.

MR GARRY SCHWARZ

Thank you very much. First of all, I would like to say I think that is really a good initiative that you have undertaken to do the PSA so early in the -

DR BOB BUDNITZ

I agree, absolutely.

MR GARRY SCHWARZ

- in the process for this reactor. That is certainly something that is really noteworthy. However, now, if I take and put on my regulator's hat I have to tell you that regulators always have a built-in suspicion or distrust of a certain level with PSAs, especially when they are used to define initiating events and try to categorise them into frequency categories. I guess, if I may add to that the fact that with the talking about your PSA and saying that, "Wait a minute, it looks a little bit optimistic, like almost to the order of two orders of magnitude" -

DR BOB BUDNITZ

I did not say that.

MR GARRY SCHWARZ

But you were close.

DR BOB BUDNITZ

I did not say how optimistic it might be. I just don't know.

MR GARRY SCHWARZ

He does not know, that is fair, and so of course that to me as a regulator heightens my suspicions a little bit, okay. If, let us say, the real core damage frequency is 10 to the minus 5 instead of 10 to the minus 7, then what you will find is that you have got a number of events that you should be considering in your design basis set that are not there right now or event combinations that should be in the design basis set that are not there right now. So that is a bit - I would say the dilemma that is facing the regulator over here right now, because a number of comments have been made and there has been a little bit of suspicion cast on the PSA and its somewhat optimistic results in some areas and I am just sitting here and I am wondering how are you going to get around this particular situation because if there is one thing that you want to be reasonably certain on at the time you hit the construction licence is that you have got your design bases set right and that you have got them analysed and you have demonstrated that you meet all the safety requirements.

DR BOB BUDNITZ

Yes, that is a fair comment.

MR GARRY SCHWARZ

So - and maybe Bob can help me out on this one but I am wondering whether it might be appropriate to have somebody come in to help you validate the PSA. Somebody who has got a lot of experience in doing PSA and also knows a lot about reactor operations because sometimes what happens in when you do a PSA is the people doing them are coming more from a design background and not an operational background. They do not have that operational input to it and so some of the assumptions that they make with regard to some of the failure rates of equipment or even performance of operators are - well, they are sort of more in a theoretical line, do not have that sort of operational side thrown in which sometimes makes the numbers a little bit different from what you originally thought. I mean, for example, I presume that you, probably for - looking at the availability of power supplies at the site you actually looked at what is going on at the site and you used real site data for that kind of thing. For example, the guys tell me that they get a number of trips every year out there, reactor trips, because of power perturbations on the grid.

DR BOB BUDNITZ

(Inaudible)

MR GARRY SCHWARZ

Yes, well, however, but that kind of thing is an example of what, you know, you need to be - you need to be realistic in your PSA. So that is my only comment.

MR ANDY WILLERS

If I could just comment on the supply of power to the reactor; from a safety point of view the reactor does not depend upon it. So we, in our assessment - we would assume we have off-site power in any circumstance where it matters.

MR GARRY SCHWARZ

Yes, I understand that, but I guess the thing is once you lose power you basically have to shut down the reactor, okay. It has got to trip, right.

MR ANDY WILLERS

Absolutely -

MR GARRY SCHWARZ

And the thing is every time you have one of these you put a certain stress on the plant and you got a certain demand on your system. So it is a comment that to ensure the actual PSA reflects those kind of things. You do not know necessarily how it is going to come out. I am not saying it is going to come out bad, I am just saying that you want it to reflect reality.

MR ANDY WILLERS

Sure and I think that is a very fair point and I think all, as the PSAR develops into the FSAR we will need to consider getting further opinion, I think, from other sources to make sure we have got everything.

MR GARRY SCHWARZ

What the regulator typically has done - you do not have a past history here so much but if you go into countries like Canada and most other countries in the US as well - they started off with a lot of deterministic requirements in terms of this is a design basis set that you have got to analyse. Like it or lump it, here is what you have got to analyse, here are the consequences that you have got to meet and now as PSAs have come along that has resulted in some taking and adjusting maybe of some of the events into different consequence categories in what were initially there but amazingly by and large it has not resulted in much shifting. One of the reasons for that is that you initially started off with design basis events, let us say a large loss of coolant accident; they had a certain consequence limit attached to them and now even if you were to argue successfully that, "Oh well, that particular event should be over here somewhere in the consequences, could be a lot larger", I think we would have a difficult time selling that to the public, for example, that that is really the case. So that has been basically sort of said, "No, irrespective of what you think the frequency might be that is the consequence limit that you have got to meet". I appreciate that here you are starting with a sort of a

clean piece of paper, all right, and you are using your PSA to basically try to categorise events but I just caution you, do not get too carried away with it, okay. Do not get too optimistic with that because in a sense it is a lot better for you to demonstrate to the public how really good and safe your plant is and what depth of safety you have and throw in more design basis cases rather than starting to argue with people that, "Well, this shouldn't be a design basis case because well, it is sort of on the edge of our probability spectrum. It has gone over the edge of where we consider design basis cases need to be". You may find that it is actually to your advantage to put more in the design basis envelope. It is easier to convince the regulator that you have got a really good design and it is easier to convince the public as well.

MR ANDY WILLERS

Can I just add that the safety case is predicated primarily on the deterministic side of things, the probabilistic side of things. It is a useful additional tool. Where we are also finding it useful is in specifying reliabilities of particular safety systems. So the initiating event frequencies, while they are useful to give you an indication of their generic-type likelihood - it is mostly the deterministic side of things. What you say is regarding if we can lump it in and to the deterministic analysis do so we are doing, yes. It is much easier to argue with the regulator that yes, it is within the design basis, we would survive it, rather than arguing two different opinions on the likelihood as five times 10 to the minus 6. No, it is not, it is one times 10 to the minus 6.

MR GARRY SCHWARZ

Thank you. No, I have not had enough time to really dig into it. I just got the impression that from what I had seen that yes, deterministic but sort of PSA-based in terms of where you threw the - how you sorted out the events in terms of what you considered as initiating events and combination events after that.

MR ANDY WILLERS

It is a mixture, as I said. Primarily, we try to put it in to the deterministic side of things and then the PSA we use as a secondary back up .

MR GARRY SCHWARZ

That is fair, that is fair.

PROFESSOR HELEN GARNETT

If I could just comment there; I think the issue of the experience of those sorts of things you talked about, about outages and all sorts of things. With 50 years of operation that has been taken into account as well but I mean, clearly, as the PSA has developed as time goes on through to what would be required to go in with an FSAR, all of the sorts of things that you have talked about including appropriate views will be taken account of.

MR GARRY SCHWARZ

Okay, thank you. I would just add that you say that operations have been taken into account. Okay. Some of the numbers I have seen in there for some of the reliabilities of equipment that you have we have not been able to demonstrate back home. That does not mean that you cannot do it here but I am just saying that it was far enough and it was not - we were talking about a small amount, okay, so that is why you say that. I looked at some things and they just seem to me to be optimistic from what I had seen.

DR BOB BUDNITZ

Can we switch to earthquakes.

DR JOHN LOY

I was about to switch to earthquakes.

DR BOB BUDNITZ

We are about to switch to earthquakes. That is another thing that I do for a living. By the way, I had a small earthquake in New Zealand a week ago Saturday, it shook the whole building I was in south of Queenstown. Others in the building had never experienced an earthquake but I am from California so it did not mean a thing to me and the building rode it out fine. Generally, in our large power reactors we are not very concerned about the response of structures to earthquakes because that is not where the action is. It is the response of the equipment and of course the large piping and the vessel and generally in our reactors the large vessel, large piping are very strong. They are so strong you do not have to worry about it. And so it comes down to the equipment and if you look at all the seismic areas with which I am familiar for water reactors and it

is certainly is true of the Candus that is where it comes down to questions about the seismic and equipment but here you have done a different situation.

Because whereas in a light water reactor the fundamental thing that has got to be there is the vessel, here the fundamental thing that has got to be there is your pool and the pool is a structure and that is both here and there. What is good is that structures are analysable more confidently than equipment so that that analysis can be done, there is a lot of experienced people understand it and others can review it and so on. On the other hand, it is real important there has got to be a lot of margin there. I mean, it is no use whatsoever if that thing gets you in trouble just above the design basis. It has got to have a lot of margin and so I want to ask the question just starting about seismic, about the pool, about what you know about the design and how much margin above the design basis you think your pool is going to achieve or you already know from its design it will achieve. Because that is the bottom line here if you get in trouble. I cannot think of any other way to get the pool trouble with the sort of frequencies that matter.

MR PABLO ABBATE

As you know, the reactor pool is composed of a shell, a metallic stainless steel shell that is embedded in a reactor block that has something like 2 metres' width and is constructed in reinforced concrete. This means that it is an unusual type of vessel compared to traditional vessels you would have in a nuclear power plant. In a traditional vessel you have your pressure inside and air outside and here you just do not have any pressure inside other than 10 metres of water column and you contain that shell with the concrete. This means that the behaviour of the pool in case of a seismic is mainly related to the behaviour of the structure that contains it, that is a massive block that I would bet you could tilt the whole structure and it will remain there without a single crack. It is really very massive. This characteristic is due to the sense that we need that amount of concrete for shielding purposes, not for structural purposes. In that structure that we call reactor block we have the pool itself, in below that the control drives and attached to that the second shutdown system. This means that that whole lot moves as a single structure and there is hardly any relative displacement between these parts.

The core itself, it is in the centre of the reflector tank. That is a cylinder so it is very, very stiff and it is attached to the bottom of the pool itself so it also provides a very, very stiff system that there is a minimum of deflection. We were talking today about the control rod plates for the fuel. So all those equipment behave actually as a single system. We run what we call the supersystem that was a 1 G system on all these structures and we were not able to have any indication of failure. We saw particularly the control rod drives, the seals below the pool and also the beam cubes to see whether there was any relative movement between the reflector tank and the shell of the pool where a crack could develop and water could drain but actually the whole structure is really very, very stiff.

DR BOB BUDNITZ

So even with that level there is, you feel - I mean, ultimately you are going to write this up and submit it, I suppose, but you feel that even at that level there is still some margin.

MR PABLO ABBATE

Yes, and the other thing that came from that, this sort of analysis - and it is good to know - is that when you run those cases and you see there is some weak point you go and reinforce the site in that weak point even if that is very, very unlikely.

DR BOB BUDNITZ

That is the benefit of doing it now, of course. I mean, that is one of them.

MR PABLO ABBATE

So -

DR BOB BUDNITZ

What is the natural frequency of the holding tank.

MR PABLO ABBATE

I am sorry, I do not have that figure in mind, no.

DR BOB BUDNITZ

I am going to guess it is a hertz or something. I mean, it cannot be higher than that - it could be -

MR PABLO ABBATE

It is in the safety analysis report in chapter 5.

PROFESSOR HELEN GARNETT

If I could just comment - I mean, we have provided additional analysis to ARPANSA and that analysis is in addition to that ANSTO was doing. It is an independent analysis of using different codes of INVAP for -

DR BOB BUDNITZ

Yes. I am not so worried about arguing about whether it is .37 G or .41 G. I mean, I understand that somebody has got to settle that and so on but I am just concerned that you have a strong demonstration that there is lots of margin in that one thing because the whole thing depends on it. You would not build it and no one would licence it if you did not have a lot of margin.

INIDENTIFIED SPEAKER

(Inaudible)

DR BOB BUDNITZ

Of the pool.

INIDENTIFIED SPEAKER

(Inaudible)

DR BOB BUDNITZ

I do not know, that is for him to figure out. Yes, now I have one more, this about earthquakes still. As I have studied it except for the confidence we already spoke of some minutes ago about the control rod drives there is very little else here, as I have tried to draw it off, where if the earthquake causes damage to equipment that it gets you in trouble. That is if the control rods shut the chain reaction down and if the pool integrity remains so the water is there, it looks to me like there is not much else where

the earthquake can - any other important sequences. Is that right or did I understand that right. Are there other sequences that can get you in trouble and there - you do not care about power, it runs without power. Is there anything else. Did I miss something.

DR BILL WILLIAMS

(Inaudible) shutdown.

DR BOB BUDNITZ

Okay, how about one more; earthquake-caused fires. Have you thought about that. That is the other place. Again, I did not see much about the write-up about that so that is - I mean, just I would ask if I was ARPANSA, so I am sitting here pretending I am, I would ask that question. That is, you really need to have to write down your reasoning why earthquake-caused fires are not going to be the one thing that gets you. If the rods can go into the pool and the pool is okay. Because we have had a few places in our machines when we found those things we had to fix them and the time to fix them is now before you build it rather than have to do something later. And there is a whole database that you can be steered to about what earthquake-caused fires are due to. It is electrical. No surprise, it is electrical. You just have to be sure that you learn about that. Thank you, I am done with that.

DR JOHN LOY

(Inaudible) safety analysis to tackle at this time before we move on to -

DR BOB BUDNITZ

Other points

DR JOHN LOY

No, no, other safety -

DR BOB BUDNITZ

Yes, I have got a couple more. Low power or shut down operation. I tried to figure out from the PSAR what the likelihood might be that you would get in trouble after the reactor was shut down during that brief period between when it shut down and when you have got fuel running out and so on because people have been surprised in other

reactor analyses to learn that there are some configurations right after you have shut down that can get you in trouble. And I did not, without arguing that I said did not, I did not dig into it enough to see but I was concerned that you had not done that part or had not written it down in a way that convincingly showed me that there were not any important sequences in that period. You say, "Gee, but the rods are in". Right. The control elements are in. So I am wondering, have you thought that through and can you say with confidence and can you defend to them that there are not important sequences that get you in trouble when you shut down after the rods go in. Is there anything there that is obvious or not obvious.

MR PABLO ABBATE

I would like just to comment on as we have these two shutdown systems with a high capability, each of them. During shutdown conditions both of them will be actuated. So even -

DR BOB BUDNITZ

I was -

MR PABLO ABBATE

So you will have a -

DR BOB BUDNITZ

- it shut down.

MR PABLO ABBATE

No, but what I am just trying to stress is that if you - even if you go and move a rod with your hand and not following a procedure, the second shutdown system will by its own keep the core in a subcritical condition. So you will not be able to have a critical accident in that case. So even with all these control rods out and the separate shutdown system itself it is capable of keeping the reactor in a shutdown condition for as long as you want.

DR BOB BUDNITZ

Okay. I mean, great.

MR PABLO ABBATE

So that is one point and the second one is related if you think about cooling. One of the issues that was discussed this morning was about you raise or you put one of these fuels in the air, you can have a problem specially if it is hot and related to that the core is contained inside the chimney and this chimney together with the primary cooling system pipes act as a secondary containment to the reactor pool. So actually you could drain completely the reactor pool and even in that case you will still have the whole covered with water.

DR BOB BUDNITZ

Well, you do not want to do that though.

MR PABLO ABBATE

If you want, we can do the test and that system has some gravity water, drip-water drain by gravity over this chimney so you could keep the core in healthy conditions for as long as you want.

DR BOB BUDNITZ

Okay. I must plead guilty either having missed that in the PSAR or you did not write it up in a way that I understood or maybe it is not in there or some combination.

MR PABLO ABBATE

Three years we have with this project altogether.

MR ANDY WILLERS

Sorry, just in case I did not understand you right, are we talking about those accidents that occur while we are operating the low power state.

DR BOB BUDNITZ

No.

MR ANDY WILLERS

Or in the transition from the full power to completely shut down.

DR BOB BUDNITZ

No, no, none of those. I was imagining it was shutdown. Shutdown, that was always. And I will just ask the question are there other safety issues when it has been shut down. Like, for example, an inadvertent withdrawal or and I understand the argument, I just had not - either it is in there and I missed it or it is not in there or I do not know what but you answered it, okay. With your forbearance I have one or maybe two more and this is one that again I wrote down when I sent something into Garry Smith a while back. You rely in some of the accident scenarios which are looked very well probable and a set of containment systems for the event CRS which is contamination ruled system and then the other one which is called the containment pressure and vacuum relief system, CPRVS. You rely on them and there is no discussion of a reliability analysis for them. Have you done one. Do you feel as if you have confidence that those systems are going to be reliable in the circumstances in which they would be called on which could be more not the benign circumstances of everyday operation. I did not see that and wonder whether you have any comment about that.

MR ANDY WILLERS

Firstly, they are not part of the safety system -

DR BOB BUDNITZ

I know.

MR ANDY WILLERS

- react to that energy management -

DR BOB BUDNITZ

No, I understand that, right.

MR ANDY WILLERS

We are providing three diesel generators any one of which is 100 per cent duty. So the reliability comes out of the provision of three and two of them are always on line and if we do not have two on line we do not operate.

DR BOB BUDNITZ

It is a remote event to call on in any event, so I guess that the answer is that it is your two out of three that provides that -

MR ANDY WILLERS

One out of three.

DR BOB BUDNITZ

Of course, I am sorry, one out of three.

MR ANDY WILLERS

We only want - we only need -

DR BOB BUDNITZ

You only need one out of three.

MR ANDY WILLERS

- and even if it does not operate it does not compromise the safety of the reactor. We still have a pool full of water.

DR BOB BUDNITZ

No, no, I understood that. I was just -

MR ANDY WILLERS

So it is very much defence in depth, this one.

MR GARRY SCHWARZ

I just have a small question on full blockage. I think for the full blockage case you looked at basically three plates that would melt out in a full blockage case and some of the comments that we had from the public domain said, "Well, basically, what's the basis for assuming only three particular plates." and there was some concern that the event - how you could possibly wind up with more flow blockage would be that if somebody made an error when they were installing the fuel during the changing of the fuel elements, fuel bundles, they banged against the side of something or another, one of

the structural pieces; piping, whatever, and there was some damage created and then that would then result in a some flow restriction which would take and melt out some of the elements and I seem to recall that your response to that was, well, you would have good procedures in place to ensure that in fact this kind of damage should not happen during installation of the fuel, if I remember correctly, and when I read that I said, "Yeah, I can appreciate that there would be good procedures in place", but I was wondering whether there was not something else that you would do beyond just procedures to ensure that in fact - or there was some check you could do when you installed the fuel to give further assurance that no damage would occur because, you know, procedures are great but unfortunately sometimes procedures are not followed and I can give you some horror stories on that which we do not have time for this afternoon but so I was just wondering if you had any comment on that. Were you thinking of doing something beyond just procedural control, just, you know, administrative control.

MR ANDY WILLERS

I guess in looking at that possibility, yes, you have training of staff, you have procedural control, you have positioning of your equipment before you move anything and all those things. If, despite all of that, a fuel element is still damaged then that could lead to that possibility. It is stretching the imagination but not beyond all doubts. So we took the view that - "Let us assume that this quantum of damage occurs such that the fuel element still goes into position but nevertheless, there is a flow disturbance when it is in position and then you start up and eventually if there is overheating in that channel then you may get some failure of the fuel in some small location".

Again, we took an extremely conservative view of that and said, "Well, let's assume we have three plates melting. In practice, in reality, that would not happen. You would get very localised melting and you would detect it. So you might be looking at less than a plate equivalent but in terms of presenting an argument which is believable in the extreme circumstance then we took the three plates.

MR GARRY SCHWARZ

Yes, I mean.

DR BOB BUDNITZ

You are saying three plates is not mechanistic.

MR ANDY WILLERS

I am sorry.

DR BOB BUDNITZ

You don't think that a three-plate damage is mechanistic.

MR ANDY WILLERS

I cannot imagine how you could get to the point where you have three full plates but let us take our imagination a leap beyond and make it as bad as we could possibly imagine and that is when we came up with three plates.

DR BOB BUDNITZ

Even so.

MR GARRY SCHWARZ

I mean, with my imagination I could say, "Well, the worst that can happen is you melt all the plates".

MR ANDY WILLERS

Well, you have got to -

MR GARRY SCHWARZ

There is a reason -

MR ANDY WILLERS

- get the fuel element into place. I mean, if it is that bad how would it go in. It would not go in, you see.

MR GARRY SCHWARZ

No, I am just saying that I think along with - I am just suggesting that along with your premise that that is the worst-case scenario that we can have, is three plates melting, you

need to have something to go along with that to say that “Hey listen, I'm sorry. No matter how we damage this thing we cannot cut the flow down any less than that which, you know, would at maximum melt out three plates”. So if you kind of follow my argument - because otherwise you can always be challenged on the three plates, why only three plates.

MR ANDY WILLERS

So we need to substantiate that argument, the logic of it, a little further perhaps. I would suggest that - the other thing that happens of course is when you diminish the size of some channels the other ones get wider. I am just being reminded that delta P across the core will pick up any substantial change in flow.

DR BOB BUDNITZ

In time

MR PABLO ABBATE

We can detect a flow blockage (inaudible) not detect a single channel that (inaudible) we have (inaudible) be able to (inaudible) the reactor because the (inaudible).

MR GARRY SCHWARZ

Okay. Are you going to demonstrate that in some way during commissioning.

MR PABLO ABBATE

Sorry.

MR GARRY SCHWARZ

Could you demonstrate that in some way during commissioning because that is something that would be very valuable for you to do because then you can really check to see how sensitive your detection equipment is and you can see if - you know, how much you can go where you may be able to detect down to, you know, further than that.

DR BOB BUDNITZ

I was hearing something else. Each time a new start up, about once a month, occurs, I was hearing that when you start the flow, when you start your low - you know, your ascension, you would detect it at that stage.

MR PABLO ABBATE

That is right. Actually -

DR BOB BUDNITZ

I mean, that is what I was hearing.

MR PABLO ABBATE

You could start the pumps and do a trial every time you do a fuel reshuffling. So you could be capable of seeing whether there is any fuel block and also find that both of them are properly locked. Looking for those two -

MR GARRY SCHWARZ

Yes. I mean, that is the kind of thing that you - I mean, that is a really good idea. That is the kind of thing you should do to kind of substantiate your case, like, "Hey listen, we're not going to see total blockage". You are not just relying on an administrative control, you have got something else there to back that up in case one fails on you.

DR BOB BUDNITZ

I understand.

PROFESSOR HELEN GARNETT

I think elsewhere we have already indicated that we would be demonstrating this during any commissioning.

MR GARRY SCHWARZ

Yes, and that is the time to basically calibrate the system, yes.

DR JOHN LOY

I was going to say that I have drunk a little bit too much water and I would like to stop for 5 minutes and let everybody stand up and relax and take a walk around and then to

deal with that situation and we will return and start talking about spent fuel and waste. We will start again at 4.25.

MEETING ADJOURNED

MEETING RESUMED

DR JOHN LOY

My aim is to complete the proceedings around about quarter past 5 which is another 45 minutes and to move to some other topics and I will give Bill the floor to start asking some questions about spent fuel and waste.

DR BILL WILLIAMS

Yes, I will try and encapsulate the concerns that were expressed on Friday in particular by various community groups and organisations about this issue although I have to say it is pretty complex and ACF have presented a whole list of questions and I am sure I will not be able to do justice to that in this forum alone but just to refer to the - let me just see - this is from the Environmental Assessment Report in February 1999. One of the recommendations which I am sort of referring to is that the reactor construction number 26 is - was 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, essentially to Dr Loy, and it seems to me that there are some outstanding and unsatisfactory aspects to the plans for the management of spent fuel rods.

The first question I have is in relation to the actual fuel that is going to be used. There seems to be some doubt at this stage what sort of fuel will be used and that will certainly obviously have an impact on how spent fuel will be managed. Can you clarify what the situation is there. It seems to me at least at the moment that the uranium molybdenum fuel is unqualified and uncertified and yet much of what you are saying about how the fuel will be dealt with, the spent fuel will be dealt with, depends on it being uranium molybdenum.

PROFESSOR HELEN GARNETT

Uranium molybdenum fuel development is well under way and it is going through appropriate processes and all relevant tests to date have shown that it is appropriate. The plans of those that will be appropriately manufacturing it are that it will be available between 2003 and 2005. We have not planned on its immediate availability. The reactor would start off with uranium silicide fuel, both of them. There is no change to the reactor configuration. They both would go into the reactor in the same way.

DR BILL WILLIAMS

The actual management of the spent fuel rods.

PROFESSOR HELEN GARNETT

There is no issue. Again, I put up a strategy earlier on. The uranium silicide fuel as well as the uranium molybdenum fuel would go to COGEMA in accordance with our current management strategy and I showed a number of other pathways that were sort of what we would call redundancy which would allow those to be managed.

DR BILL WILLIAMS

Yes, I will refer to that flow chart in a minute. The uranium silicide, from what you have presented - COGEMA is only agreeing in principle to deal with that fuel. It is not as if you have got authorisation to do that.

PROFESSOR HELEN GARNETT

No. COGEMA - I guess we have used the words in principle - COGEMA have indicated that quantities of uranium silicide fuel will be accepted and that is indeed part of an exchange of letters pursuant to our contract.

DR BILL WILLIAMS

Is that only in the context of them being able to mix it with a certain amount of uranium molybdenum fuel.

PROFESSOR HELEN GARNETT

It is in the context of them being able to co-process with a variety of fuels.

DR BILL WILLIAMS

But they cannot just do it on its own.

PROFESSOR HELEN GARNETT

They do not -

DR BILL WILLIAMS

So they will need -

PROFESSOR HELEN GARNETT

They would never. They have got other uranium silicide. You must co-process it and the will co-process it but it can be co-processed with HIFAR fuel, it can be co-processed with uranium molybdenum fuel, it can be co-processed with a variety of other fuels.

DR BILL WILLIAMS

Right, okay. So let us just assume that the uranium molybdenum - which at this stage is still unqualified - that it does not and following your flow chart that it does not come into being as the fuel for the replacement reactor. We are looking at sending it to Argentina and there seem to be some insecurities about how Argentina will deal with that, how INVAP will deal with the spent fuel if they have it, if they have to deal with it.

PROFESSOR HELEN GARNETT

The first comment I would make is that the uranium molybdenum fuel development is going extremely well and those that are closely associated with it including the companies that are putting - working as teams and putting their money in - have absolutely no reason to believe whatsoever that the uranium molybdenum fuel will not proceed. There is a lot of experience in fuel development has being done with uranium silicide fuel has been developed. There is a lot of experience and the programme is going very well and there they have got very little doubts about the process at all. So that is the first thing I would say, is the development process is going extremely well. The second issue is though that yes INVAP are contractually obliged to provide solutions and there is a number of opportunities or a number of solutions which are shown on that flow chart. So and we do not believe that there are issues there. There are clearly opportunities to handle the fuel in accordance with our requirements.

DR BILL WILLIAMS

Are there secure processes in Argentina for dealing with that fuel if it came to that fallback position. I mean, I am following your flow chart here, I am not making it up.

PROFESSOR HELEN GARNETT

Yes. The Argentinians have got working facilities but I mean, you might appropriately ask the Argentinians but we are satisfied that they have indeed got the appropriate facilities and are moving forward appropriately to be able to handle if that indeed was necessary.

DR BILL WILLIAMS

They have full authority -

PROFESSOR HELEN GARNETT

But I have also pointed out there are in other international options and we have mentioned that in our submissions too.

DR BILL WILLIAMS

Yes, I will come to those in a minute but -

DR JOHN LOY

Do you mind if I interrupt to just clarify that a bit more. I think it is an important issue for a number of people. Your contract with INVAP says that it will arrange the conditioning of the fuel if that becomes necessary, in Argentina, I understand. So it is a relationship, a contractual relationship, between you and INVAP for that to happen.

PROFESSOR HELEN GARNETT

Backed up by intergovernmental agreements.

DR JOHN LOY

Okay, but as I understand it, the facilities that you refer to are not INVAP's per se. They belong to someone else. Is that right or -

PROFESSOR HELEN GARNETT

They are CNEA facilities.

DR JOHN LOY

So it would be. Are those facilities themselves licensed and authorised to do this kind of work.

PROFESSOR HELEN GARNETT

I think that is for INVAP to answer, if they wish to answer.

MR PABLO ABBATE

As you know, Dr Loy, Argentina has two nuclear power plants, a Candu and a Siemens power reactor and together with those facilities there is a technological complex around them. Part of that complex was a fuel processing facility that has huge hot cells much more than we would require to allocate this processing technology and also with respect to the technology itself, Argentina was involved in plutonium separation and fuel manufacturing since early sixties. And there is a core team that is working now, that is in this technology, because it is also a very good commercial business, we think.

DR JOHN LOY

Perhaps again, to clarify my understanding; what happens to spent fuel, Argentinian spent fuel at the moment.

MR PABLO ABBATE

Argentina spent fuel for the moment is stored in pools. Pools in one of the facilities and once they have decayed sufficiently they are put in dry walls.

DR JOHN LOY

Okay, so there has been no conditioning process for long-term storage -

MR PABLO ABBATE

No.

DR JOHN LOY

Okay, thanks.

DR BILL WILLIAMS

So at the moment Argentina does not have an authorised functioning commercially viable processing operation for spent fuel.

MR PABLO ABBATE

What we have is - you know the issue related to the authorisation as you are putting on the table - is related to handling large amounts of radioactive stuff and liquids and things that could occur during the process. This facility I am talking about was built for other means but with that in mind. So the design itself, it is really - it is licensed for handling much more radioactive volumes than the ones related to the spent fuels of the RRR. For example, we have used one of these cells to load one of the spent fuels so far in nuclear power plant and take examinations, cut rods. So this means the licensing of the facilities related to the capability to handle large amount of radioactive products and that is already there.

DR BILL WILLIAMS

Yes, but presumably there would be specific steps, authorities -

MR PABLO ABBATE

Yes, yes.

DR BILL WILLIAMS

- that would have to be sought and this is in relation to foreign spent fuel which I know there is controversy about this issue, but some people have argued and certainly senior legal counsel in Argentina have argued that it would qualify as radioactive waste from another country which is one of the things that generated considerable concern on Friday but there could be potential problems there.

MR PABLO ABBATE

The only thing I can talk here is that our company is fully supported by the Argentine Government, it is aware of the contracts we have in place and the President himself has backed up the company.

MR STEVEN MCINTOSH

Steve McIntosh for ANSTO. On the article 41 question, INVAP sought and obtained an opinion from the Argentine Nuclear Regulatory Authority as to whether the import of spent fuel for the purpose of conditioning with the resulting waste to be re-exported contravene the Argentine Constitution and was told that it did not. The former Minister for Industry, Science and Resources received the same assurance from the Argentine President on a visit earlier this year and I note that the recent Senate Committee felt it was appropriate for ANSTO and INVAP to rely upon those assurances.

DR BILL WILLIAMS

I will revisit that in a moment but, I mean, really, I accept and I have heard that before but it still strikes me that in fact there is potential controversy and there is no certainty there.

MR STEVEN MCINTOSH

If I can just add that the basis for the opinion of the Argentine Regulator - well, I take your point that if there is - being a lawyer myself - if there is two lawyers there is three opinions. But the basis for the opinion of the Argentine Regulator was that the joint convention on the safe management of spent fuel and safe management of radioactive waste has already been adhered to by Argentina and in Argentina treaties are self-executing. So that treaty is now part of Argentine Law and has been since 1998, I believe, and so that has been part of Argentine Law since 1998 which enshrines that distinction in their law and that was the basis of the advice that INVAP received from the Nuclear Regulatory Authority.

DR BILL WILLIAMS

Okay, I will leave that part to the lawyers.

PROFESSOR HELEN GARNETT

Can I just comment on your issue of authorisations. I think you are making some assumptions there. We have also been advised by the regulators in Argentina that the facilities are there. They are adequate and appropriate, as Pablo has said.

DR BILL WILLIAMS

Yes, it is not so much that I am making assumptions; these are concerns that have been generated through legitimate community -

PROFESSOR HELEN GARNETT

I think some countries have different step-wise process. They are different in different countries and I think that is all I am trying to say.

DR BILL WILLIAMS

I want to just go back to the actual process because in the - during the 2001 Senate Inquiry there was a document, some correspondence from an employee at INVAP, which described the CNEA has having developed a novel method to eventually process its own research reactor fuel elements which can also be useful for ANSTO project. The present demonstration programme has a duration of 4 years starting 2001. That is the process we are talking about, presumably.

MR ANDY WILLERS

Yes, we were just consulting on a common answer there. The process is being developed internationally and that is shared with Argentina.

DR BILL WILLIAMS

(Inaudible)

PROFESSOR HELEN GARNETT

No. The Argentines are in fact using processes that are in fact common knowledge, they are published and it is not still in development. They are processes that are available.

DR BILL WILLIAMS

All right, just following along the flow chart then. Whatever the fuel, if the COGEMA route becomes unavailable and Argentina processing technology becomes unavailable, then INVAP is contractually committed to provide an alternative solution which complies with ANSTO's requirements of no direct disposal of fuel in Australia, no reprocessing in Australia, no indefinite storage of fuel in Australia. There is two things that come up immediately there from the - firstly, what is the - who is the third country.

Russia was mentioned as a potential country. Surely we need to address that because the process is not certain - where the spent fuel will go and secondly, about no indefinite storage of fuel in Australia, in a way from what we heard this morning - well, at least 50 years of storage of fuel in Australia is what is being proposed. Which I know is not indefinite but -

PROFESSOR HELEN GARNETT

Okay, I will start with the back up. I think again there is some misunderstanding there. What is contemplated is storage in an intermediate-level store over a long period of time of the processed material, material that is returned and that can be answered further by ISR. The issue with regard to third countries or anything else - I mean, I think we would contend very strongly that there is a management strategy which involves COGEMA. COGEMA are not intending to go out of business tomorrow. They have recently signed long-term contracts with Electricite de France and they have other contract, other customers and that agreement with France is backed up by an intergovernmental agreement which the French government themselves have recognised is in fact an obligation on them. And so when we have talked about second and third steps we do not believe that even those under international law are even feasible or practical or would need to be there.

I mean, we would have been quite happy in moving forward and saying that there was the one solution because of the assurances that are in place through the French system but you do have a statement on a second and you have a statement on a third and when you talk about a third there are a number of countries, other countries, who can do certain things. There is the UK who has got commercial processing. Yes, the Russians are moving into processing. The Japanese are opening a new processing facility. There are variety of other opportunities if indeed one ever needed to go that far. We do not believe you will.

DR BILL WILLIAMS

Just on that point about COGEMA, I mean, we are talking about sending spent fuel rods to France for the next 40 years. I must admit from what I heard on Friday I am not so confident that the French are going to want to go on, and going to be allowed by the

European Commission, to continue to reprocess and create enormous stores of plutonium in their country on the European continent.

PROFESSOR HELEN GARNETT

That is the position that has been put forward but I think what you have been told also is that certain OSPAR Convention, et cetera, stops them. In fact, the OSPAR Convention only holds the countries that vote for and agree to and neither the UK nor France are voted for or agreed to that, those limits, and therefore at the moment they are not binding on either of those countries. What the both of those countries independently have said is that by 2020 - okay, so that they are already looking into the long-term themselves - that by 2020 they will have done things that meet certain emission levels. But they have not agreed and the OSPAR Convention has no sway or no hold over either BNFL's facilities or COGEMA's facilities.

DR BILL WILLIAMS

Would you acknowledge though that the countries in Europe that are not going to be reprocessing and even some of the - or certainly one big economy and that is the Germans are moving away from the nuclear industry that that, the French and the British are going to come under pressure in the future for -

PROFESSOR HELEN GARNETT

I think the Germans have just agreed even though they have said they are moving away. They have got facilities that are going to operate for another 30 years and indeed those facilities have contracts for reprocessing their fuel with COGEMA.

MR JEFF HARRIS

Jeff Harris from ITR, just reinforcing the point that Helen made in response to your assumption, I presume. The above-ground store for intermediate-level waste will be constructed in a purpose-built way so that can handle the long-term intermediate-level waste which is the form in which the spent fuel rods, the waste from that, will be returned to Australia. What we were talking about this morning, as I recall, was what the duration of the building might be. That does not mean at all necessarily that the products within that building will be stored in there for that entire 50-year period but that is a design assumption that we are building on.

DR BILL WILLIAMS

Okay, final point on the flow chart then. At the time of the Senate Inquiry, as I understand it, there was a recommendation that, in the light of the growing opposition overseas, that ANSTO prepare and fully cost a contingency management plan for spent fuel conditioning and disposal within Australia. This plan should fully describe the technologies to be used should Australia have to manage its spent fuel wholly within Australia. Now I know that you say that it is going to go to France and we should not worry about it too much but that was the finding of the Senate Inquiry and I am wondering whether you have actually taken heed of that recommendation or whether you think that that is just completely unnecessary.

PROFESSOR HELEN GARNETT

Senate Inquiries are Government processes and there is a response from the Government that would have been tabled if we had not had elections and it is not for me unfortunately in this forum to comment on what or presume what the Government response might be but indeed there is a Government response on that particular issue and I can assume that it will be consistent with previous decisions of the Government that that would not be something that Australia would consider.

DR BILL WILLIAMS

Would Lucas Heights have the potential to condition that fuel if it came to it, if option 4 on your flow chart came to be.

PROFESSOR HELEN GARNETT

The issue is that that has been ruled out, as I said, by Government statements previously and it is not something that we are considering.

DR JOHN LOY

Can we just get that 100 per cent clear, Helen, because I think it is important. Is there any distinction made between the term “reprocessing” and the term “conditioning” in regard to Government policy in this area or is it all explicitly ruled out, both reprocessing and conditioning just so there is no semantic argument about that. Well, probably a bit more than semantic.

DR BILL WILLIAMS

No, it is not semantic. I have understood that they were actually different processes that we are talking about.

PROFESSOR HELEN GARNETT

I think, as clear as I can be, John, saying that I cannot pre-empt in necessarily what will come out from the response of the Government but my understanding is that it will stick to exactly the position where letters have been written and statements have been made that indeed Australia's strategy is that the fuel goes overseas for appropriate processing, reprocessing, conditioning; whatever word you wish to use, before it would come back to Australia to go to an appropriate intermediate-level store.

DR BILL WILLIAMS

Excuse me, there is no legislative reason why it could not be conditioned at Lucas Heights. I mean, I understand what you are saying, it is not Government policy at the moment but we are talking 50 years of generating these wastes and spent fuel rods. What is to say with the changed Government or change of personnel in Government that that could not change. We are talking 50 years of generating highly toxic materials here.

PROFESSOR HELEN GARNETT

The bottom line is we do not have the facilities. I mean, we are not in this business.

DR JOHN LOY

Okay, but I think part of the question goes to there is a form of prohibition about reprocessing in the ARPANS Act but there is no term "conditioning". Whether a parliamentary draftsman would see the distinction in the process that we see -

DR BILL WILLIAMS

Between reprocessing and conditioning.

DR JOHN LOY

Yes.

DR BILL WILLIAMS

But they are dramatically different processes.

DR JOHN LOY

Well, yes and no. Certainly in terms of their objective in a power programme where the objective is to recover useable material, however you might be sceptical about its economic value, but it is another debate - whereas the intention in the case of Australian fuel is to get it into a form where it can be - the waste product can be safely stored. But all I am trying to say is that, yes, there is a clear - the word is used in the ARPANS Act to forbid reprocessing or to prohibit it. The word "conditioning" is not used in the ARPANS Act.

DR BILL WILLIAMS

Yes, and they are two significantly different processes. To reprocess something versus to condition something, they are two different things.

DR JOHN LOY

Yes, okay.

DR BILL WILLIAMS

That will do on that subject.

DR JOHN LOY

I think the other major issue that has obviously been raised over the last couple of months is the risks arising from terrorism and sabotage. And everyone is aware that I wrote to ANSTO and asked for some further analyses to be done in relation to the targets within the proposal and consequences of attacks and that work is being completed and will be reviewed by ARPANSA. And we heard this morning from ASNO and from Tony Wood about issues of sabotage. So I think they are - they are very fresh and important in people's minds and, Bill, if you would like to take up questioning on that issue.

DR BILL WILLIAMS

Yes, it was a very interesting submission this morning - well, statement - by Tony Wood who essentially was of the opinion that ANSTO's failing in its duty, I suppose, to the public to assure them of the fact that there is no undue health risk to them and that they should consider a loss of coolant accident. We then got - and he actually described the potential radiological hazards associated with a loss of coolant and a potential meltdown. We argued a bit about accidents so we moved on to sabotage and so just looking at the PSAR page 16 point 5(2), you say sabotage is not amenable to probabilistic treatment but is countered by information from the intelligence agencies on its likelihood. As part of proving the integrity of the design provisions consultants in terrorist activity and explosives were involved in assessing the threat to the reactor from a range of explosive devices.

The result of the assessment was that none of the attacks would threaten the integrity of the reactor core or create radioactive releases greater than those analysed from other beyond-design basis accidents. It goes on and security threats are assessed elsewhere but the design of the facility is such that response systems are scalable to meet foreseeable changes in the threat. This is dated 1 June 2001. Is that still your absolute position on radioactive releases and the integrity of the reactor core.

PROFESSOR HELEN GARNETT

I guess I said in my opening presentation that there has been substantial reviews post 11 September. That has involved all of the relevant authorities from those that were involved in threat assessments and those that are involved in terrorism and sabotage and things which is not our expertise. But it has involved all of those and the assessments still stand up with that analysis that you have just read out.

DR BILL WILLIAMS

On 16 point 5(8) you actually say 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. What does that mean. What, if there is damage to the core there is no risk to the public still.

PROFESSOR HELEN GARNETT

The statement is the design analyses are with large aircraft has been done and those assessments do not change the fact that the emergency plans and all of the criteria which we have previously said we would meet would be met and that has been done, as I say, involving the relevant security and threat assessment authorities.

MR MARK SUMMERFIELD

We have done deterministic analyses of a large aeroplane crashing into the reactor, destroying the containment, destroying the reactor block and leading to release of radioactive material into the environment.

PROFESSOR HELEN GARNETT

And it still does not change -

DR BILL WILLIAMS

And it does not represent a hazard.

PROFESSOR HELEN GARNETT

No.

DR BILL WILLIAMS

So let us just get this straight; a 400-tonne 767 travelling at 250 metres per second carrying - how many tonnes was it - 150 tonnes of fuel hits the concrete block or something close to it, causes a massive explosion and massive fire which then burns for a month -

PROFESSOR HELEN GARNETT

Yes.

DR BILL WILLIAMS

- the core melts, the spent fuel rods are damaged, dispersed-

PROFESSOR HELEN GARNETT

All of the assessments are being done involving aircraft and the assessments show - and that is with the appropriate authorities for review. It shows that indeed the doses to the public would not be such that any change to the emergency plans are necessary.

DR BILL WILLIAMS

There would be no - would there be release of radioactive iodine into the environment that would potentially put public at risk and would require -

PROFESSOR HELEN GARNETT

No. I am saying that the emergency plans which are in place which require for the replacement - which require no evacuation et cetera are shown to be adequate. I cannot comment any more because the - all of the security assessments are with appropriate security authorities and are being appropriately reviewed but I can tell you that the 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.

DR BILL WILLIAMS

Is that going to be on the public record, the documentation and modelling. You have talked in your letter to the editor of The St George and Sutherland Shire Leader on 10 October, you refer to accident scenarios involving jet aircraft published in the EIA for the second Sydney airport of Holsworthy and I am wondering is that the modelling we are relying on or is there something more extensive, more detailed.

PROFESSOR HELEN GARNETT

I just said that the modelling that has been done post 11 September reviewed taking account of the threats and relevant experts to do with aircraft, aircraft crashes, size of fuel loads and all have been quantitated and that is all in the documentation that is part of a classified document that is with the security authorities.

DR BILL WILLIAMS

That is really extraordinary. I mean, there is a lot of information on the public record on the worldwide web about major aeroplane crashes involving reactors and they certainly do not give me that sense of security.

PROFESSOR HELEN GARNETT

Those are to do with power reactors and again the inventory, the whole size of the research reactor is a very, very different beast.

DR BILL WILLIAMS

You have modelled it for a research reactor, 20 megawatt reactor, and you can confidently say there would be no - well, let me just go to your emergency at Lucas Heights Science and Technology Centre on your own Website. "Studies undertaken by ANSTO and independently by the Nuclear Safety Bureau have indicated that there would be no need for evacuation even for the worst-case credible accident. If such a hypothetical accident were to occur the only measure that would be considered would be precautionary sheltering for the period of the release. Nevertheless, stable iodine tablets which block the uptake of radioactive iodine into the thyroid are held by the New South Wales Ambulance Service for administration to emergency workers". Why are they - in the emergency plan why would emergency workers need them. Is that because they would potentially have to go inside the facility or is that because they are going to be exposed more because they would be outside. Why are not the public going to be exposed, I suppose that is what I am asking.

PROFESSOR HELEN GARNETT

I guess in that emergency workers might be closer to or in the facility. There might be a need and that is what that says.

DR JOHN LOY

I wonder if it would be useful - I mean I know there is still work to be done on these analyses and there are sensitive issues involved, is it possible to at least sort of sketch out the parameters for how you approach doing this study, and I do want to say that we will be putting a version of it on the public record in whatever appropriate way we can and when we can. But I think it would be useful if one of your people could say what are the parameters you look like - that you took into account in the size of the aircraft and the impact upon the concrete structure, the engines, the fuel load, and that kind of broad issue -

DR BILL WILLIAMS

The size of the explosion, the fires were burning a month later in New York, high intensity, I mean Bob told me this morning about iron beams, you know great big rods of iron, a month later being pulled out of the core of the fire which were red hot, and you are telling us that an explosion involving - not only the core, but potentially - quite a substantial inventory of long lived radio nucleides, including radioactive iodine, strontium, cesium, plutonium, is not going to produce a risk to the public. The public are not so stupid that they do not want to hear more about this. I think it is extraordinary that you will not release useful public information which has no impact on security issues whatsoever, so that it can be analysed by independent people, including colleagues of mine who know a lot more about it than I do.

PROFESSOR HELEN GARNETT

I appreciate the fact that people may wish to know, but the documentation that is to do with security assessments et cetera is handled by the security authorities and it is appropriately classified by the security authorities. At this stage I am not in a position to release that. What I can say in relation to aircraft is that I think one has to take into account the size of the target, the nature of the target. It is not a power reactor, it has got a few kilograms compared to tons of uranium in inventory, that there are very significant differences, and that the structures are different, and the heat loads are different, and if one wishes to, yes the World Trade burnt, but did the Pentagon, no, and they are built differently, and I think that is something that one needs to take into account when one is looking at impacts and assessments.

DR BILL WILLIAMS

How can we take it into account if it is not on the record.

PROFESSOR HELEN GARNETT

They are being taken into account in the assessments by looking at both security and the threats and the assessments. We will do our best, but we are not in the hands as far as releasing security information. But we will do our best at the appropriate time, ARPANSA have to receive the documents, and clearly there will be some discussion as to what can be released, but right now I am not in a position to say anymore.

DR JOHN LOY

But it is an analysis undertaken of a large aircraft with a substantial fuel load.

DR BILL WILLIAMS

All right, there are just two other points. The other thing that has not actually come up, we have heard about vehicle bombs and we have heard about - I think Tony Wood's submission refers to the possibility of someone dropping a couple of backpacks of semtex into the reactor. One of the things - we are talking 50 years, it is not that much more than 50 years since the end of the second world war, I am thinking modern weapons, I am thinking conventional weapons, I am thinking developments in weapons, technology, laser guiding, that sort of thing, bunker busting bombs which can already penetrate 20 feet of concrete getting into the wrong hands. Apparently the Defence Department in the United States has a 160 of them, does not take them very long to increase the power and specificity of that technology. Presumably it ought to be part of the risk analysis and the consequence analysis. What about that, what about that possibility of a conventional weapon being used, I mean laser guided, should not that be part of it - the analysis.

PROFESSOR HELEN GARNETT

I can only comment that you need to ask those questions to the appropriate security and threat assessment authorities. We rely on them and we have relied on them in what is being done. I would also comment, and I am sure that it was said this morning, I was not here for ASNO's presentation, I am sure that they will commented on that indeed the systems are both - they are multiple but they are also scalable, and just the same as we have responded over the past 50 years in various things at Lucas Heights. If indeed there is a necessity, I am sure that the authorities at the time will require relevant changes. But indeed the assessments have been done, they have been done taking account of modern systems, up to date and what is available, and they have certainly taken account of, as John has said, of aircraft - a large aircraft with fuel and all sorts of things on board.

DR BILL WILLIAMS

One more question. You speak with great confidence that there is no need to worry. Clearly many members of the public still are worried and many of their representatives

still are worried. Would it not be not unreasonable, given the potential risks that we are talking about and we cannot know for sure, for ANSTO to go back to the issue of siting. If we talk about defence indepth, then surely having a reactor sitting so close to a large population centre, so close to a large airport for 50 years, if you have not really gone into that siting analysis, then it does not seem like you have covered all the bases. We are going to have it at Lucas Heights and there is no question about it.

PROFESSOR HELEN GARNETT

I do not think that at all was the issue, and indeed again the assessments show that the level of hazard is two orders of magnitude below that which is required even by New South Wales hazardous industry. And in regard to issues and plant that surround the safety and the security of the facility and the security indepth and the systems that will be in place will ensure that that level of assessment is retained.

DR BOB BUDNITZ

One of the things that has puzzled me in studying the documentation so far is I did not see a reviewable consequence analysis given a release because the PSA did not do it because it was not necessary because the probabilities were too long. It seems to me since - presumably this sort of analysis has been done for some assumptions it may not be very difficult to do just that piece and release it. On Friday, and some of you were here and some of you were not, it was reported by somebody the consequences after 80 kilometres recorded by Dan Hirsch. He did not say 80 kilometres, he must have said 50 miles because he is an American like me, that consequences after 80 kilometres were quoted as being - and nobody said what they were. I said right here in this seat that I did not believe that because I know enough about that myself for reactors that more than 100 times bigger and we do not have anything like that. I also said, because I am an open-minded person, that if anyone would show me such an analysis and I could review it, I would be happy to review it. Maybe I am mistaken.

You need to understand that you are - people are saying, people said to us on Friday that 80 kilometre consequences exist. You could help us all by producing and releasing and allowing for review your analysis, and if I could review it I might feel confident more, perhaps I will not, and if I just could review it, perhaps they would feel comfortable, perhaps they will not. Because after all you know reviewing scientific analysis is

something that people can do separately on their own. It would be of benefit if what I would call a Green's function analysis - you know the Green's function is; postulate a picacurie I know how to scale that to a nanocurie, a millicurie or a kilocurie. You postulate a picacurie of various things and tell us what happens over there because these things are pretty linear. And that could go a long way towards allowing an independent assessment of the consequence side.

I myself find it hard to believe that 80 kilometre consequences exist. However, I have not seen an analysis with proper account of the site, the topography, the weather and the chemical nature and the physical nature and the thermal nature by the way. There is a big difference, the thing about Chernobyl was there was a lot of heat, a lot of energy, and you likely do not have that, although I could imagine you might, and that could help a lot. You are sitting here, without having released that so it cannot be reviewed. And that has nothing to do with whether it came from an aircraft, although of course it might, and the reason it might is because the thermal piece of it is important, but anyway I will just leave you with that idea. I am of a mind that, absent that, these questions are going to continue to arise and I truly would love to review it.

PROFESSOR HELEN GARNETT

The issue is, as you have rightly said, there is a big difference between what happens when you have got an aircraft and you have got thermal components - I mean this is part of the issue, but indeed analyses are in the EIS for some -

MR BOB BUDNITZ

I could not get my arms around - the EIS analysis was not all that hotsy tots, okay.

PROFESSOR HELEN GARNETT

They are there, but clearly what we can do we will attempt to do in regard to this particular issue.

MR BOB BUDNITZ

I will be first to understand the sensitivity about these terrorists questions - it is extremely important that we do not do anything that would provide useful information to our enemies. That would be nuts.

DR JOHN LOY

Okay, I should have asked this question during the earthquake session. But can you tell me the significance of the damping factor that is taken into account in the analysis.

MR BOB BUDWITZ

Good question.

DR JOHN LOY

There is a kind of debate about the fact that the current ANSTO spectrum uses a seven per cent damping factor and I gather these used to be a five per cent damping factor. Is this significant or is it just a matter of technical judgment, or does it have any impact or what.

PROFESSOR HELEN GARNETT

As I am advised and as I believe seven per cent is more conservative than five per cent, and we went to that after looking at what you might consider international practice and decided that we would be even more conservative.

DR JOHN LOY

I would have thought from my old physics days you liked having higher damping because it stopped the vibrations quicker, so I would have thought having the higher damping factor was a good thing in terms of stopping vibration.

DR CLARENCE HARDY

(Inaudible)

DR JOHN LOY

Is the analysis highly sensitive to this factor -

MR BOB BUDNITZ

It depends where you are in the structure. It is not a big factor.

PROFESSOR HELEN GARNETT

(Inaudible)

MR BOB BUDNITZ

Look, if you don't have lots of margin, which you do, then you should go back and make sure you put in lots of margin. And if you do it does not make much difference and so, as I said about the pool, because that is really the essential thing, you had better have lots of margin.

PROFESSOR HELEN GARNETT

As Pablo said, he has done the modelling up to 1G, which is a hell of a lot more.

MR BOB BUDNITZ

I would have a lot of confidence that you have a large margin, or you are really going to not be able to run this thing.

DR JOHN LOY

A last question I think. With Pablo sitting here looking at me I am not quite sure how to ask this and I will ask it of ANSTO. Are you satisfied that your contractual arrangements with INVAP are robust in the light of the current state of the Argentinian economy.

PROFESSOR HELEN GARNETT

Yes I am. I think first of all one has to realise that INVAP is the company that has its - relies and has relied in regards to its business - on business internationally. It deals with the US in space satellites et cetera. Our contract with them is in US and Australian dollars, and very much the whole way they have operated, we have been monitoring the system, what has been going on, but yes we are satisfied that there are - INVAP is in a position to continue to provide quite satisfactorily.

DR JOHN LOY

There is at some level - in relation to INVAP - some form of Government guarantee. A lender of last resort, or something.

PROFESSOR HELEN 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, but it is backed up as is any commercial contract appropriately.

DR JOHN LOY

Thank you. I am going to draw the proceedings to a close now.

UNIDENTIFIED SPEAKER IN AUDIENCE

(Inaudible)

DR JOHN LOY

You have put a number of questions forward and in most instances I felt that the questions that have been asked have picked up most of the spirit of the questions that have come forward. There are some specifics in questions that have come forward to us and we will get responses back to you on those where there are specific issues, but I think the spirit of the questions was I believe well and truly covered by the way the panel questioned and I do not think we can - it was vigorous and intense I thought.

Where to from here, I have agreements with my colleagues on my left and right, they will give me a report as we have described in the procedures. That will be in most cases brief reports I expect that will focus on their views of what took place over the two days and how they see the major issues that might see still needing to be resolved. I hope to have those reports with me by 5 January and to publish them immediately, and at that time I will also publish my own if you like, not review or report, just a brief commentary on what ARPANSA might be doing as a result of the issues that have been discussed in the public forum and where we take them from here, and obviously that includes the sabotage and security issues that have been of particular interest over the few days.

I draw the proceedings to a close. Again I thank all the participants from Friday and from today. As I mentioned on Friday some of you were not entirely in agreement with the procedures of the forum, nonetheless I think people have participated in a really terrific spirit and a vast amount of information has come forward which will give me and my staff a lot to think about over the next little while and I am sure will contribute

to very useful reports. I thank the staff from ARPANSA who have organised the two days. The forum secretary has brought a great deal of experience in organising events of this kind to bear, so that the two days did run as smoothly and effectively as they did and the many people you see seated at the table on your right are the people who have brought it about and I thank them very much. Finally the three panel members, that have still got a bit of work to do, so I will not let them off entirely at this point, but from the United States, from Canada and from Victoria.

I guess what reward in a sense was in it for them - it was rigorous and it was hard work and I very much enjoyed their questioning, it has brought out a lot of issues for me and I have also very much enjoyed their company and thank you very much to Garry, Bill and Bob, so with that thank you and a Merry Christmas.

MEETING ADJOURNED