Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

Public hearing

Audience publique

Canadian Light Source Incorporated: Application from Canadian Light Source Incorporated for an amendment to its Particle Accelerator Operating Licence

Centre canadien de rayonnement synchrotron incorporé : Demande du Centre canadien de rayonnement synchrotron incorporé visant une modification à son permis d'exploitation d'un accélérateur de particules linéaire

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Public Hearing Room
14th floor
280 Slater Street
Ottawa, Ontario

Salle d'audiences publiques
14e étage
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Commission Members present

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Dr. Moyra McDill
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Ms. Lisa Thiele

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Canadian Light
Source Incorporated:
Application from Canadian Light
Source Incorporated for an
Amendment to its Particle
Accelerator Operating Licence

11-H5.1 / 11-H5.1A / 11-15.1B
Canadian Light Source Incorporated
CNSC Staff

THE CHAIRMAN: Okay. Good afternoon. And let's now proceed to the next item of the agenda for today in its application from Canadian Light Source Inc. for an amendment to its particle accelerator operating license. Marc.

MR. LEBLANC: Yes. This is a one day public hearing. The notice of hearing 2011/8/04 was published on April 7th of this year and a revised notice was published on May 4th to provide more details on the nature of the application.

Submissions from Canadian Light Source and CNSC staff were due on April 8, 2011. I also know that supplementary information had been filed by -- well, in fact one supplementary information has been filed by

Canadian Light Source -- oh, as well as staff since the first publication of the agenda.

The public was invited to participate either by oral presentation or written submission. May 9th was the deadline set. And the Commissioner received no requests for intervention.

June 1st, 2011 was the deadline for filing of supplementary information. And I've already noted that supplementary information have been filed by CNSC staff and Canadian Light Source.

THE CHAIRMAN: Okay. So let's start by calling on the presentation from CLS as outlined in CMD H5.1, 5.1A and 5.1B.

And I understand Dr. Hormes, you're making the presentation, the floor is yours.

MR. HORMES: For the record Josef Hormes. Bonjour Madame et Monsieur.

Good afternoon, Mr. President, members of the Commission, staff members of the Canadian Nuclear Safety Commission colleagues.

Let me start my presentation by introducing my colleagues that are here to help me answer difficult questions.

First of all there's Dr. Mark de Jong, the Director Of Accelerators who will give part of the

presentation.

It's Dr. Mo Benmerrouche our Manager for Health Safety And Environment. It's Dr. Tom Ellis our Director of Research, and it's Mr. Aziz Ahamd our manager health safety -- oh, sorry, our manager for quality assurance.

Before coming to the Isotope project presentation that is directly connected to one of the two amendments that we are asking for and that will be presented by Dr. Mark de Jong who was in charge of that project.

I would like to highlight in my presentation three issues. One is the safety culture, safety record of the Canadian Light Source. Our QA program that has been established over the last two years and I would end my presentation with some remarks about the potential radiation exposure of CLSI nuclear energy workers.

My first statement when I meet people from the general public is the Canadian Light Source is a safe facility with a strong safety record.

Just as a reminder the Canadian Light Source is not a nuclear power plant though we are regulated as a Class 1 nuclear facility by the same regulation as power plants.

We are a safe facility because in our case it doesn't matter who is switching off the power. If it is the operator or if it is an earthquake, it doesn't matter.

As soon as the power is switched off we are a safe facility. There is no prompt radiation, there's nothing left, we don't need any cooling; if we refer to what happened in Japan.

In this case we are a safe facility because it really doesn't matter who is switching off the power. It means no requirements for cooling or so when the machine's not operational.

It's also important to mention that we are an open facility in the sense that we are a user research facility.

The Canadian Light Source was built and is operated as user facility for researches from a academia industry and government, and they are the people that actually using the light source and doing most of the science at the light source and just a number, we have more than 1,000 user visits last year, people coming to the facility.

Okay. This slide should highlight our safety performance. The facility has now been in routine operation for nearly seven years and during this time we

had zero major injuries as defined by the Canadian OHS Regulation and we had also zero incidents on radiation dosimeters exceeding the Canadian Nuclear Safety Commission and your dose limits for the general public.

It's important to emphasize that this zero is not just for our users and visitors, that zero is also true for all our employees, also for the nuclear energy workers that are working there.

I think it's a remarkable safety performance and I would like to congratulate Dr. Benmerrouche and his team for their hard work to implement that safety program.

I strongly believe that this is not just good luck. It's the consequence of hard work, a well developed safety culture, and I want to emphasize that this culture is continuously nurtured by the staff members of the Canadian Nuclear Safety Commission in their interaction with our facility.

As I already mentioned we are requesting to have our Class 1B operation license amended by two issues: One, to incorporate a new QA manual, and the second point is to modify the 250 MeV access control interlock system which would allow us to use an area of the old Saskatchewan accelerator left for medical isotope production and medical isotope project that will be

introduced by Dr. de Jong later on.

This slide and the next two ones highlighting the QA program that we implemented and that was strengthened significantly by hiring Aziz Ahamd as a full-time QA manager for the CLS.

In close collaboration with all directors and managers Aziz developed a new QA manual. The previous manual, we had always a QA manual, but the previous manual was optimized for the construction and the commissioning phase of the light source. It's a slightly different way of handling the machine.

Now we are in our second phase and that is what I call "user operation". And therefore we had to change and modify a few things in that QA manual. And in addition to that QA manual there were also other issues of the QA program.

For example we implemented a management review process. We implemented a taproot investigation tool for investigating events. We improved and reorganized our internal audit program, and we implemented and improved nonconformance process, and especially the follow-up process for non-conformances.

Based on the new QA manual several documents describing high level safety relevant processes has also been rewritten. These processes are: document

control, training, work management and configuration management and non-conformance management.

I suppose it's really important to emphasize that most of these revisions were carried out in extremely close collaboration with Canadian Nuclear Safety Commission staff.

I think it's important to mention that our QA activities over the last two years were also influenced by a reportable event what we call the Potential Radiation Exposure of CLSI Nuclear Energy Workers.

This incident was called by a very unusual steering of our electron beam in a part of our system the limit to boost the transfer line.

However also in this event the radiation exposure of the workers involved was below the detection limit of dosimeters.

Based on our own taproot investigation it was actually the first taproot investigation carried out by CLSI staff in collaboration with TRIUMF (inaudible). Based on that taproot and based on the recommendation from CNSC staff we established several measures to mitigate risk also for the future.

For example we improved the local shielding. We established an independent verification process for the corresponding Dipole wiring, and we

improved significantly our visual and audible radiation alarms and response system.

I would like now to hand over to Mark de Jong to tell about the medical isotope project.

DR. DEJONG: Thank you, Josef. Okay. Now I'll talk about the second part of the CLS amendment request. The modification of the CLS access control and interlock system to permit access to release Room 13 also known as the Experiment Area 2 or EA2 at CLS from a lockup.

This slide shows a portion of the sub-basement of the Canadian Light Source facility. The electron beams come from the -- the electron beam line is shown in red going first coming in from the left and then going down to the bottom. This is part of the 250 MEV electron Linac transfer line to transfer electrons from the linear accelerator to the booster.

The Zone 3 which is shown shaded has been a part of the -- is a present part of the lock up system when we operate the electron Linac.

It was an old experimental area from the previous facility. It’s currently designated as a radiological storage area and no access permitted during operation of the 250 MeV Linac.

The next slide shows the plant new

configuration where Zone 3 of the lockup has been reduced to a short corridor and a new access gate has been installed. Additional concrete and lead shielding will be installed to reduce the possible radiation exposures to persons in the EA2 area while the 250 MeV electron Linac is operating.

This shielding will also block off access from the EA2 to the electron beam switchyard that’s in Room 3 which is where the current electron beam lines are.

Access to the EA2 area will now be through a service area room located above the electron switchyard and down a spiral staircase just shown in the drawing there.

After these changes, EA2 will be designated as a radiological controlled area and access can be independent of the operation of the 250 MeV Linac.

Nevertheless, there will continue to be restricted access similar to other such areas within CLS.

With these changes, we then plan to use the EA2 area for the medical isotope project that I will now describe.

The CLS medical isotope project is one of four such projects funded by Natural Resource Canada’s non-reactor-based isotope supply programs. All four projects are developed in accelerator-based techniques for

the production of either Molybdenum-99 or Technetium-99m.

In our project, the Canadian Light Source is the project lead with collaborators from the National Research Council, the University of Ottawa Heart Institute, the University Health Network, which is associated with the University of Toronto, and NorthStar Medical Isotopes, an American company that has developed an isotope separation unit optimized for the separation of Technetium-99 from low specific activity solution of Molybdenum-99.

Our project will examine the use of high-power electron linear accelerators for the production of Molybdenum-99 by a photo neutron reaction on Molybdenum-100.

In this reaction a high energy, approximately 15 MEV photon, knocks one neutron out of Molybdenum-100 to form Molybdenum-99. The high-energy photons are produced by Bremsstrahlung radiation when high-energy electrons hit a target.

The scope of the CLS isotope project includes the procurement, installation and commissioning of a 35 MeV electron Linac with a beam power up to 40 kilowatts. This is essentially a little bit over 1 milliamp average current for those that are more familiar with currents for accelerators.

We will also be designing a converter target, which is the target used by the electron -- the target the electrons will hit to produce the Bremsstrahlung radiation and a separate holder for Molybdenum targets.

The project’s goals include designing these components to handle the electron being powered greater than 20 kilowatts. Some modest development of remote handling of the Molybdenum targets will also be necessary.

In parallel, we are also using the NRC 35 MeV electron Linac to validate the production yield computations as well as some of the Molybdenum target processing requirements.

The processing includes dissolving the Molybdenum targets, separation of the Technetium from the Molybdenum solution and recovering and reforming new Molybdenum targets from the solution.

This slide shows a tentative layout of the planned isotope production facility in EA2. The smaller region shown on the left is where the 35 MeV electron Linac and target assembly will be located.

A new shielding wall will be installed to separate the isotope Linac from a new nuclear substance laboratory with two hot cells to be installed on the larger region on the right.

In addition, a new emergency exit to the surface will be required to meet building code requirements.

The next slide gives the overall strategy for installation of the isotope production facility. First, the present lockup system needs to be modified to release EA2 from the lockup and add additional shielding to protect against beam losses from the 250 MeV Linac. This requires an amendment to the present CLS Class I licence.

Then, following the standard CSNC licensing process and criteria for Class II facilities, we will construct the isotope production facility with CLS holding a separate Class II licence for this facility.

The EA2 will be split into two areas, one forming a bunker containing the 35 MeV isotope Linac and the other area renovated to become a containment level nuclear substance laboratory.

The isotope facility will meet the Class II requirements for a research and development facility.

I'll now hand the presentation back to Josef.

Thank you.

MR. HORMES: Thank you very much, Mark.

We come to our summary conclusion. We

believe that our application in support of the amendment of our Class IB operating licence is complete and has addressed all comments and questions raised by the Canadian Nuclear Safety Commission staff.

We would like a revision of the Quality Manual for the Class 1B nuclear facility. That's administrative in nature. And we would like the modification of the 250 MeV Linac ACIS and release of the AE2 area for use by the medical isotope project that has been assessed for radiological hazards.

The CLS safety report has been revised and accepted by the CNSC staff.

Last but not least, some concluding remarks about our interaction with Canadian Nuclear Safety Commission staff.

I think that the collaboration with CNSC staff is intense and constructive, and it is guided -- and that's the most important point -- by openness and trust, and I'm very grateful for that.

However, I mentioned already a year ago or so in my mid-term presentation to the Commission there's always room for improvement. And I still see a little bit of danger that we might be, I call it, over-regulated.

I think the focus of CNSC should be safety-related issues. I'm well aware of the problems because we

are regulated by the same rules and regulations than nuclear power plants. And it's sometimes not obvious to see what the impact on safety is by some of the regulations that are required.

My typical example is that connection between security and safety. It's a little bit difficult in our case because we have hardly any radioactive material, and when the facility is switched off, we have no problem with radiation.

It means the question is what is a security issue? Stealing my laptop, for example.

But let's not stop with that negative remark. What is really important is the collaboration, transparent collaboration between CNSC staff and CLSI, and I'm convinced that this constructive interaction and the continued support of CNSC staff was, in the past, perhaps the most crucial building block for the Canadian Light Source and it will be a crucial building block also in the future for the safe operation of the old Light Source and also the new medical isotope project.

Thank you very much for your attention.

THE CHAIRMAN: Thank you.

Before opening the floor for questioning, I'd like to hear now from CNSC. Monsieur Régimbald, the floor is yours.

11-H5
Oral presentation by
CNSC staff

M. RÉGIMBALD: Bonjour, monsieur le président, membres de la Commission. Mon nom est André Régimbald. Je suis le directeur général de la Direction de la réglementation des substances nucléaires.

Je suis en compagnie de madame Kavita Murthy, qui est la directrice de la Division des installations de catégorie II et des accélérateurs, et de madame Jacinthe Plante, agent principal de projet dans la même division.

Also with us today are Ms. Kuen Sia and Mr. Lawrence Colligan who are both management system specialists, and Dr. Felicity Harrison from the human and organizational factor. She’s a -- I’m sorry -- she’s a human and organizational factors specialist who are from the Directorate of Safety Management.

Also, Mr. Michael Beaudet, Director of the Nuclear Security Division, Mr. Raphael Duguay, conseiller en sécurité également de la Division de la sécurité nucléaire.

Je cède maintenant la parole à Madame

Murthy qui va commencer la présentation.

MS. MURTHY: Good afternoon, Mr. Chair, members of the Commission. For the record, my name is Kavita Murthy. Dr. Jacinthe Plante will walk you through the details of the request today. In the interests of time, we have omitted a lot of the information that has already been presented by the licensee.

This presentation consists of three different parts. We'll begin with the short introduction of the licensee. Next, we will provide you with information about the medical isotope projects and finally, we will discuss the two licence amendment requests that are in front of you today.

For the record, CLS stands for Canadian Light Source, the Class 1B nuclear facility. CLSI stands for Canadian Light Source Incorporated, the operator of the facility.

In our spoken presentation, CNSC staff will use the acronym CLS to refer to both the facility and the operator.

CNSC staff have assessed the CLS application and concluded that the application meets CNSC expectations; therefore, CNSC staff will provide a positive recommendation of the two amendment requests to the Commission today.

Dr. Plante will now continue with the presentation.

DR. PLANTE: Bonjour, monsieur le président, membres de la Commission. Let me introduce you to the CLS facility.

CLS is a particle accelerator which accelerates electron close to the speed of light to produce synchrotron radiation. The facility comprises a linear accelerator represented by number 1 on the top of the figure.

This accelerator brings the electrons to an energy of 250 mega electron volts. When the electrons reach that energy, they are transferring to the booster accelerator, represented by number 2.

The electrons are then accelerated to 2.9 giga electron volts. At this point, they are transferred into the storage ring, represented by number 3.

Electrons circulating in the ring emit synchrotron radiation tangentially to the storage ring. Synchrotron radiation is directed into beamlines which are used to conduct experiments. Number 4 on the figure is an example of a beamline.

CLS is a Class 1 particle accelerator since the electron beam energy is above 50 meV. It's received its first CNSC licence in 2000 for construction followed

by a CNSC operating licence in 2004. The licence was renewed in 2006 and will be expiring in May 2012.

The current licence has been amended three times by the Commission in 2008, 2009 and 2010.

This picture is a top view of the experiential hall which contains the storage ring and the booster ring. The hall dimensions are equivalent to two football fields.

During operation, the greatest radiation hazard at CLS is prompt radiation. It is called prompt radiation because it's only present when the beam is on. In other words, when the accelerator is turned off, the radiation is also turned off. Protection from prompt radiation is achieved with thick shielding and safety interlocks. In the event of a natural disaster such as an earthquake, the accelerator will shut off.

Following the earthquake in Japan in March, upon CNSC request, CLS reviewed its safety case and concluded that it still valid and new additional measures are required.

CNSC staff are satisfied with CLS' conclusion. CNSC staff are also satisfied that radiological hazards at CLS are adequately controlled.

The principal radiological hazards at shutdown are some activated component inside the

shielding. The radiation are variable levels and short-lived. Local shielding as shown in the picture by the red arrow is sufficient to adequately protect against these hazards. There is no need to cool down or contain the activated components.

In addition, environmental emissions from CLS are nil and the risk to public is minimal. To conclude, radiological hazards at CLS are very low.

This slide shows the dose received by staff annually at CLS since the last renewal in 2006. Over 1,000 persons, including 125 nuclear energy workers, are monitored at CLS. The exposure to nuclear energy workers are well below the regulatory limit of 50 millisieverts per year.

On the zoom-in of the graph, the maximum dose received by any monitored individual is also well below the public dose limit of one millisievert per year. The highest dose received by an individual in 2010 was .5 millisievert which is still a very low dose. The majority of monitored people received no dose.

Over the next few slides, we will present, for information only, the medical isotope project. There is no decision requested from the Commission on the medical isotope project.

In October 2010, Natural Resources Canada

or NRCan committed $35 million over two years to invest in research and development on Technetium 99 through the non-radioactive base isotope supply contribution program or the NISP.

CLS was one of the recipients of funding under this program. The funding will end in March 2012. This past February, CNSC and CLS signed an administrative regulatory protocol. This protocol establishes milestones and service standards for licensing activity related to the medical isotope project.

Technetium 99 is the radio isotope daughter of Molybdenum 99. CLS proposes to produce Molybdenum 99 by irradiating a 95 per cent enriched Molybdenum 100 target with a gamma beam generated using a 35 mEv electron accelerator. The Molybdenum 99 decays into Technetium 99 with a half-life of 2.75 days.

CLS proposes to install the medical isotope project within existing Class 1B facility in the area known as Experimental Area 2 or EA2. This area is adjacent to the existing 250 MeV linear accelerator which is represented by the yellow section on the left of the slide.

In the blue area to the right of the slide, the hot cells to process the medical isotope will be built. The hot cells will also be in EA2.

The entire project is defined as a Class 2 nuclear facility. It includes a 35 mEv accelerator which is defined as a Class 2 prescribed equipment. Further, less than one peta Becquerel of Molybdenum 99 will be processed annually at this facility. CMD-08M10 authorizes designated officers to issue Class 2 nuclear facility licences.

CLS will apply for a Class 2 nuclear facility licence for the medical isotope project.

The picture at the top of this slide shows an example of a Class 2 nuclear facility. A cyclotron used to produce Positron Emission Tomography or PET isotopes. Similarly, cyclotrons are also used to produce Technetium 99.

The Accelerators in Class 2 Facility Division regulates around 300 Class 2 nuclear facilities. All Class 2 licences are issued by designated officers.

In conclusion, CLS medical isotope project is similar to facility already regulated by CNSC under designated officer authority. Understanding that this area is of high interest to the Commission and the public, we have presented this project for your information only.

This concludes the first part of the presentation.

We will now move on the first of two

amendment requests. This request is to revise the safety report listed on the licence to allow occupancy in the Experimental Area 2 or EA2, during the operation of the 250 MeV linear accelerator.

The Experimental Area 2 or EA2, on the right of the slide where the medical isotope project will be installed is adjacent to the 250 MeV linear accelerator. At present, area EA2 is an exclusion area during operation of the 250 MeV accelerator. In other words, no one is allowed in the area when the accelerator is operating.

In order to allow access to area EA2 two major modification to the area are proposed. I will discuss a proposed modification in the next slides.

The first modification is to add shielding to reduce doses to an acceptable level in area EA2. CLS submitted details of the shielding and dose estimate to work in this area.

CNSC staff have performed independent analytical shielding calculation to verify if doses are acceptable during operation of the 250 MeV linear accelerator.

In our calculation we use two occasions, which are the source of the greatest radiation hazards shown by the green and orange circle on the figure. CNSC

staff have evaluated the following two scenarios: first, the worst case scenario where all the electrons beam is lost at one single point.

And second, for normal operation where there will be some losses of electron. For normal operation we have used five percent of beam power loss. There is note of CNSC staff calculation are presented in this slide. For the worst case a complete loss of electrons beam, the dose rate in area EA2 would be 15 microsievert per hour. It should be noted that this type of event is rare and lasts only a few minutes. If CLS staff were exposed in such an event the dose received would be negligible.

For normal losses during operation the dose rate in EA2 was .75 microsievert per hour. This would present 1.5 millisievert per year for a full occupancy of 2,000 hours per year, which is much higher than the expected occupancy of this area.

In reality the occupancy of the area would be less than four months during construction and will result a dose -- in a dose less than .5 millisievert.

In conclusion, the proposed additional shielding would reduce the dose to CLS staff to an acceptable level.

The second modification to area EA2 is a

change to the access control system. At present there are three entrances to area EA2 indicated by P1, P2 and P3. Of these only two will remain functional. P1 will be completely blocked with concrete. P2 will be controlled by the access control interlock system. Entrance P3 will remain the only safe access to area EA2 during operation of the 250 MeV accelerator.

Effectively with the additional shielding in place area EA2 will no longer be an exclusion area and can be safely removed from the lockup zone. CNSC staff have reviewed the lockup process in the lockup zone and the proposed changes are acceptable.

The second amendment request is the revision of the quality assurance manual listed on the current operating license. CLS revised its quality assurance, or QA manual listed in its license. The proposed revision corrects deficiencies identified during a CNSC audit in 2008, and following an investigation of an event in 2009.

CNSC staff identifies some deficiencies in QA processes and in the implementation of the program. Of the item listed on this slide Configuration Management Control and Independent Verification processes were identified as weaknesses contributing to the event in 2009.

Please note that this is the same event that was referred to in CLS presentation as potential radiation exposure to CLS nuclear energy workers. CNSC referred to it as the Dipole Incident for reason which will be obvious as briefly outlined in the next slides. In October 2009 CLS reported that due to a polarity error on the dipole magnet a 250 MeV electron beam was misdirected towards the shielding wall. In the figure the orange circle represent the dipole. The green arrow represent the normal direction of the beam and the red arrow represents the direction of the misdirected beam. At the time of the incident on the other side of the wall three CLS workesr were present. Following this incident the radiation badges for the workers were red. No dose was received by any of the worker present in the area during the event.

Following a review of the investigation report submitted by CLS and after an inspection that followed, CNSC staff identified several deficiencies that contributed to the event. CNSC required CLS to implement a number of corrective action, which are as follows: Revision of the QA manual, improvement of visible and audible alarm. The picture on the slide show the improved radiation alarm installed at CLS facility this year. The radiation alarm now include a set of three lights and a

loud speaker as seen on the top of the figure.

CNSC staff also requested retraining of staff on how to respond to alarm and to assess if similar event could occur at any other locations.

The diagram in the photograph show the area of the Dipole Incident. CLS safely reproduced the Dipole Incident in 2010. And has installed additional shielding in areas that show high radiation dose rate. This additional shielding is shown in yellow in the photograph taken by CNSC staff during an inspection in April of this year. CLS did not find any other location that could be affected with high radiation field.

This slide summarizes CNSC staff oversight of the QA program. Another program in 2008 highlighted deficiency in the QA program which were corrected in June, 2009. In October, 2009 the Dipole Incident event show further deficiency in the QA program. Since then CNSC staff inspection follow up on the implementation of corrective actions.

In March 2011 CLS applied to amend its QA manual. CNSC staff has reviewed the revised manual and found it acceptable. Before renewal in 2012 CNSC will perform a QA audit to verify the implementation of the program.

To summarize the medical isotope project is

presented to the Commission for information only. No decision is requested. CLS has requested two amendment to its license. The first amendment is regarding the revision of the safety report to all our staff to occupy area EA2. To prepare the area for the medical isotope project.

And the second amendment is regarding the revision of the quality assurance manual. CNSC staff reviewed CLS application and concluded that the application meets CNSC expectation and that the licensee is qualified to carry on the activity and will make adequate provision toward the protection of the environment, the health and safety of person.

For this application CNSC staff recommend that the Commission amend the license by updating Appendix A to include the latest revision of CLS safety report and that the Commission amend the license by updating Appendix B to include the latest revision of CLS quality assurance manual.

Thank you for your attention. CNSC staff is available for questions.

THE CHAIRMAN: Thank you. So let's jump into the question period and we'll start with Mr. Tolgyesi.

MEMBER TOLGYESI: Merci, Mr. Président.

Could you precise this Dipole Incident event which happened, which is in your slide 22, the one you compared to your slide 3. What happened? Where's the location?

It's to staff.

DR. PLANTE: The incident, this is compared to slide number 3 if I can.

MEMBER TOLGYESI: You have a full circle there from linear accelerator to booster and storage ring and beam lines.

DR. PLANTE: It's in between of the entrance of the linear accelerator to the booster and I can put it on the slide if you bring me to the slide. That will have happened here. Can you see that arrow? It's right here.

MR. REGIMBALD: It is right, Andre Regimbald for the record, it's right at the entrance from where the linear accelerator injects electrons into the booster as shown in the little -- can you point Jacinthe again the arrow? Can you see that Mr. Tolgyesi?

MEMBER TOLGYESI: Yes.

THE CHAIRMAN: So what's the doomsday scenario here if somebody was right in the middle -- I mean nobody got any dosage, et cetera, but what could have happened if somebody was in the line of sight?

MR. HORMES: Josef Hormes for the record.

There is shielding and that shielding was also tested during the commission of the whole system there.

It means we are not sure if the workers were not in the line of sight of the electron beam, but the shielding was obviously sufficient because there was no reading on the dosimeters in this case.

There is shielding of course what you have seen in the drawings. There was accidental shielding because there is a huge magnet sitting in between but there's also a wall that's an intentional shielding that was actually also calculated during the commission of the linear to booster transfer system. The reaction of our people was not what we would expect.

Well I'm looking for slide number 7 about doses, maximum dosage to workers. It's quite obvious that you are well below the public dose limit of millisievert for here.

But still it's quite increased compared to previous year's performance as well it was less than .2. Now you're at about a .5 or .6. This increase is due to what?

MR. BENMERROUCHE: Mo Benmerrouche for the record. The increase in that dose was actually me in fault in those measurement to produce the dipole event.

So I received that dose because I was doing measurement to produce the dipole event, and that dose is for myself as an nuclear energy worker, this is just for myself, .5 millisieverts I received.

But in general nuclear energy worker and users and staff do not exceed levels about .2 millisieverts. So that's why just for that specific time when we did radiation measurement to produce a dipole event.

MR. HORMES: Josef Hormes for the record.

That slide might be misleading. It's one exposure, it's not averaging over 1,000 users. And that one person received .5, is Dr. Benmerrouche in this case.

That is the highest dose that was recorded for anyone working at the CLS. And that means the highest dose in 2009 was, .01 and the highest dose recorded in 2010 was .5 because it was Dr. Benmerrouche repeating the dipole wiring event and doing a lot of measurements to verify that the shielding and everything was adequate.

MEMBER TOLGYESI: So he was testing on himself. You have any consequences, no?

DR. BENMERROUCHE: Still alive.

MEMBER TOLGYESI: And then I have one last question, it's a little bit more technical. When you go to the slide 11 of staff. What I understand that -- slide

11. That the photon beam produced by 25 MeV linear accelerator will hit the (inaudible) located in a target area I suppose. And there will be some hot cells which will be used to dissolve the moly targets to produce moly 99 and eventually Tc-99 moly.

Now this moly targets, moly target is consist of what, it's a solid, it's a liquid, it's a vapor, it's what?

DR. DEJONG: For the record Mark de Jong, Canadian Light Source. The targets are planned to be molybdenum metal discs 1 millimeter thick, 15 millimeters in diameter and there'll be a stack of them and the photon beam will be passing through them.

And then the processing afterwards will be just processing the small discs that are essentially about the size of a quarter.

MEMBER TOLGYESI: Okay. Now this moly targets will be processed in hot cells?

DR. DEJONG: Correct.

MEMBER TOLGYESI: Okay. So how will you move them because it's a shielding all around, how will you move these targets from where they are, where they are produced to the cells and ensure that, you know, what's the safety?

DR. DEJONG: The details we're still

working on. To make things nice and simple we are basically going to look at dropping those discs into a led pig and basically then carry them around and put them into the hot cells and carry on doing the processing in the hot cells.

MEMBER TOLGYESI: Okay. So they will be in a led pig.

DR. DEJONG: Yeah.

MEMBER TOLGYESI: It's no danger, no exposure for those who will manipulate them?

DR. DEJONG: That's correct.

MEMBER TOLGYESI: That's it Mr. President, merci.

THE CHAIRMAN: Thank you. Who's next? Dr. McDill.

MEMBER MCDILL: Thank you. First question to staff, is the oversight appropriate and suitable and matching to all other facilities, Class 1B facilities of this type? I mean, is this facility over-regulated compared to other facilities of the same type?

MS. MURTHY: Kavita Murthy for the record. To the extent that the hazards posed by this facility are comparable to other Class 2 nuclear facilities, we believe that CLS can be effectively regulated as a Class 2 nuclear facility.

However given that the definitions that are in our regulations place them in the Class 1 realm if they are, they have to follow the process associated with that.

MEMBER MCDILL: And what is the most I guess onerous aspect of that for them? They can tell me themselves, but from staff's perspective.

MR. REGIMBALD: Well Andre Regimbald here. The process for licensing is a bit more administrative, that there are more administrative processes. For example in coming to the Commission, compared to being the designated officer who would consider an application or a licensing decision.

However I would like to point out it's very important that the rigor in the technical assessment is the same whether the license is issued by an officer or whether it's presented to the Commission for a decision.

MEMBER MCDILL: Is there a fiscal burden associated? Fiscal or financial burden associated with this?

MS. MURTHY: CLS is exempt as a research facility at the present time, so short answer's no.

THE CHAIRMAN: But I know that university Professor (inaudible) is not being charged there but he's presumably some cost associated with this, right? To them.

MR. REGIMBALD: Yes, absolutely. The licensee has to come to the meeting here in Ottawa, but they are exempt from the CNSC Cost Recovery Regulations.

THE CHAIRMAN: Just to follow-up, so these are our regulations, right? So if you believe that they are misclassified by our regulation. What does it take to change it?

MR. REGIMBALD: Well, I suppose that CLS could present a request for us to consider an exemption by the Commission under the Act, on the regulations from the Class I regulations and have them classified as a Class II nuclear facility. And in the long-run we would introduce proposed changes to the Class I regulations to remove the designation and put that in the Class II nuclear facility regulations.

THE CHAIRMAN: Mr. Jammal.

MR. JAMMAL: Thank you, Mr. President. For the record, Ramzi Jammal. There are a couple things, to Dr. McDill’s very valid question.

When we were amending the Class II regulations way back then I want to go on the record and state, we told CLS, actually, we asked them and we were amending the regulation for them to fit into the Class II regulation. At the time CLS did not want to be in a Class II and they wanted to -- wished to remain as a Class I,

that's one aspect.

The other aspect the President asked question is what does it take to make the change to regulations. Of course through the process and we will be working on different classes with respect to the Class I regulation and the (inaudible). But we are, since we are before the Commission then the approval process with respect to this Class I facility, and all LSU colleagues can correct me if I'm offline here, that the delegation of authority can be granted to the DO, designated officer, so that the approval process can be done at the DO level and reported back to the Commission on the approval process.

But in conclusion when we amended the Class II regulations the intent was to include CLS, add CLS on their own motion, which we have documented exchanges with them; they wanted to stay as a Class I facility.

THE CHAIRMAN: CLS, why?

MR. HORMES: Yes, Josef Hormes. It was long before I came to Canada. It is for me history. And there were good reasons at that time to consider at least staying in Class I and (inaudible).

DR. DEJONG: I guess I have to claim responsibility for that decision.

The reason for the decision came when we had actually finally got our operating license as a Class

I facility. And then there was the request to come as a Class II, but the classification as Class II was as an electron synchrotron solely for the purpose of generating synchrotron radiation.

So that a variety of other experiments, say if we wanted to do an experiment even with the 250 MeV (inaudible) into a fixed target would be require us to be Class I again.

Also there were a variety of fairly detailed specifications on the character of the safety and lockup systems that were very prescriptive in the Class II. We had ones that we felt were completely equivalent and acceptable to the Commission, but they did not in detail comply with the Class II requirements and we would have to go back and reengineer it to meet the Class II requirements.

We felt with those changes that had no value and the possible future limitations on some potential experiments that may come in the future on a research facility given that we were already a Class I facility we chose to remain one.

THE CHAIRMAN: Well, we heard that there's flexibility here. I think there's room to negotiate in the future if so you wish. Dr. McDill.

DR. MCDILL: I have a couple more

questions, but why didn't you do this by teleconference for example? Why did all of you come?

MR. HORMES: Josef Hormes. We like the direct interaction and coming to a real city.

DR. MCDILL: Fair enough. We like to see you too.

My next question is with respect to the -- trying to recreate the incident. Did you present the experiment you wanted to run to staff, or were you required to before you deliberately exposed yourself even as a new (phonetic)?

MR. BENMERROUCHE: Mo Benmerrouche for the record. We did discuss the test that we wanted to do to reproduce the dipole event with a CNSC project officer. And the reason we wanted to do, redo or try to understand what happened because most people thought that the event was due to the reverse polarity of the dipole downstream. I think if we can put

UNIDENTIFIED SPEAKER: Slide 23.

MR. BENMERROUCHE: Slide 20 --

UNIDENTIFIED SPEAKER: Or slide 3.

DR. MCDILL: You can put slide 24 on CNSC staff.

UNIDENTIFIED SPEAKER: Slide 23. Try slide 22 I think, right? You want this one?

MR. BENMERROUCHE: So the one before that.

UNIDENTIFIED SPEAKER: Yeah. It's slide 22.

MR. BENMERROUCHE: Yeah. The -- when we had that event -- yeah. So you can see from the diagram there are two dipole. There's the B1300.02 and the B1300.03. When we had the event most people thought that it was due to the reverse polarity in the dipole B1300.03.

When you look at that configuration we did think that could have led to the high dose. The reason for that is if the beam is directed like in that red arrow it's well-shielded in the beam direction by that -- see, there's the booster dipole DP, it's a lot of steel there in the direction of the beam. And we did think that was the issue with the elevated radiation level that we measured. That's one point.

When we had the event we had the radiation alarm. We had the area radiation monitors, just between wall two and wall one, just in that crack there. And the levels measured by the radiation monitors were a little over 15 microSv per hour. And given the shield that is in place we thought that it cannot be possible, but it is due to the reverse polarity in that dipole.

So we wanted to understand what's going on. And when we talked to the accelerator physicist and we

tried to understand what was going on at that time. And at that time typically for the accelerator physicist they want to get the beam from B1300.02 to the green arrow on the other side of B1300.03.

And when you do that there's a fair amount of missteering between B1300.02 and B1300.03.

MEMBER McDILL: Miss --

MR. BENMERROUCHE: Missteering the beam.

MEMBER McDILL: Missteering.

MR. BENMERROUCHE: Yeah. And what happened is, because that dipole was in the reverse polarity they could not see the beam beyond B1300.03. So because of that they tried to missteer the beam so they can see whether they can have the beam on the other side of B1300.03.

Typically in most situation when you set up that line the missteering is very small. You don't have to do a lot of missteering before you can see the beam on the other side of B1300.03.

But because they could not see the beam because of the reverse polarity because the beam was not making it into the, you know, its nominal path, so they had to do some extreme missteering. When I say extreme we're talking about you know, slightly like 95 percent or so of the nominal path.

So by looking at the whole thing we said we need to try to reproduce the event by doing that missteering and see if we can reproduce that event. That's why we discussed with the CNSC staff about the whole issue. And then doing that testing we also -- we used the proper precaution to make sure that you know, there's nobody in that area except nuclear energy workers and the radiation staff.

And what happened is the elevated radiation level is not actually at beam height. The radiation -- the high radiation level was actually above beam height.

MR. BENMERROUCHE: The higher radiation that was actually above beam height. It was a little over, what, 1.7 meters or so.

So we wanted to do that just to have a better understanding of what’s going on with that situation so we can evaluate the losses and also design the proper shielding for that area.

So that was the main reason, if we didn’t do those radiation measurements, it’s going to be really hard for us to properly design the shielding like we show in the other slides and reduce the dose rates.

And also, I just emphasize that the dose rates were above beam height. So even if people were there, the likelihood of them being exposed to those

radiation level is very small because the radiation levels were above, you know, beam height.

Does that answer your question? I know it's a lot of details.

THE CHAIRMAN: Okay, forgive me, but I didn't get the punch line.

So what happened? So you did the test ---

MR. BENMERROUCHE: And then ---

THE CHAIRMAN: --- it's the miss-steering that's causing this?

MR. BENMERROUCHE: All right, we've figured out what happened.

THE CHAIRMAN: What happened?

MR. BENMERROUCHE: Miss-steering.

THE CHAIRMAN: So it's miss-steering and then it went off?

MR. BENMERROUCHE: Yes, the miss-steering was happening between B1300-02 to a B1300-03. Right?

THE CHAIRMAN: And, therefore, then, where did the beam go to then?

MR. BENMERROUCHE: So what happened is, when you miss-steer the beam, the beam will hit the big pipe at a very small angle and, when you do that, you shower, you produce a lot of radiation. Most of the radiation is well-shielded at beam height because of the

shielding and -- that we have in place.

THE CHAIRMAN: Okay.

MR. BENMERROUCHE: But, above, you will see slightly elevated radiation levels.

That also allow us to have a better understanding of what we need for shielding. And to really come up with the proper design of the shielding, there is many ways how to do that too and, then, we discuss that with the engineers and the best solutions that you come up with is to have a local shielding around the pipe.

So even if you have mistake, even at larger angles, it will still be captured by the local shielding.

MR. HORMES: Josef Hormes, for the record.

The alternatives would have been to rely on simulations; and we did that. We also simulated the event.

On the other side, we discussed it with the Canadian Nuclear Safety Commission staff: simulation is one side, but the real measurements are the truth.

And, therefore, with all those measurements, it would not have been really possible to determine also those showers that were above 1.70 metre or so. It would not be possible. I mean, the measurements were a crucial element for designing the

proper shielding that will prevent in the future any of those events.

THE CHAIRMAN: Dr. McDill?

MEMBER McDILL: I have no problem with running experiments, what I have a problem with is unnecessarily exposing -- even a new -- to this and that's why I asked -- and I am going to go back to the staff in a minute -- if this was approved.

I don't know, for example, why you didn't put a whole pile of dosimeters hanging on polymer dummies from the ceiling to the floor and the entire length of the wall.

So maybe you can ask and, then, staff, I know, wants to answer something.

MR. BENMERROUCHE: Mo Benmerrouche, for the record.

I still believe that the exposure was not -- we still practice a lot to make sure that we minimize the exposure to the staff, but ---

MEMBER McDILL: Forgive me, but as low as reasonably -- is not deliberately exposing yourself, that's not ---

MR. BENMERROUCHE: No, but what we've done is we tried to characterized the losses but, once we established that, we actually use dosimeters on the wall

to actually record the radiation levels that we indicate in our reports.

So it was just to get an idea of what's going on. But, once we established that we actually deploy dosimeters and we expose those dosimeters for whatever period of time to get adequate levels of radiations -- and that's what we've done actually, we've exposed shielding on various experiments for the situations.

MS. MURTHY: Just a point of clarification: The area that Dr. Benmerrouche is talking about is in a shielded area. It isn't -- he was never in direct line of the full beam. It is beyond a shielding wall.

Had he been in the beam, he would not be here today.

Number two, they did perform simulations before asking him or before undertaking the actual measurements.

MEMBER McDILL: So when we go to Section 5, page 2 of 6 and you are talking about:

> "… upon completion of shielding installation, radiation measurements will be performed to validate the shielding design. Additional shielding will be

added as required …"

This is going to be more of the same?

MR. RÉGIMBALD: I'm sorry, Dr. McDill, could you please repeat again your reference?

MEMBER McDILL: It's a supplementary report, section 5, Safety Report, page 2 of 6.

This is to go to the next stage. Are we going to have more testing of this kind?

MS. MURTHY: I believe the evaluation is complete and I believe that no other areas have shown the start of elevated dose levels; but I will let Dr. Plante answer.

DR. PLANTE: Jacinthe Plante, for the record.

We were on an inspection in April 2011. We have seen shielding in place, we received the result and the result are confirming a reduce of dose rates behind the shielding wall.

So we are satisfied with the dose and the shielding in place and there are no other additional areas where they found high exposure.

MEMBER McDILL: And the simulations don't show any other areas as well?

DR. PLANTE: Correct.

MEMBER McDILL: And will the simulations be

-- has the simulation software been refined to pick up this kind of change that wasn't picked up the first time?

Maybe CLS should answer that one.

MR. BENMERROUCHE: Mo Benmerrouche, for the record.

When we talk about the simulation, it's a Monte Carlo simulation. It's a code and -- I don't know if any ---

MEMBER McDILL: Yes, "Monte Carlo" says it all. Thank you.

MR. BENMERROUCHE: Okay.

THE CHAIRMAN: Monsieur Jammal?

MR. JAMMAL: Thank you, Mr. President.

Dr. McDill, you're asking very good questions and let's not -- I have known Dr. Benmerrouche for a while, let's not make him the hero that's he's been exposing himself to radiation.

There is a simulation that takes place based on Monte Carlo on determining the shielding aspect. The testing that he has done is a normal testing that we do during commissioning.

So you do the modeling, you establish the shielding design ascertains dose and, at times, when you are evaluating if there is a void in your shield, you're taking measurements.

You’re correct, usually, you start with the model itself, determine the efficiency of the shielding and, then, you go into the physical layout itself and you take other measurements or you put dummies or you put TLDs on the wall.

So before -- for me not reviewing, but the practice and the policy of the CNSC would never allow an individual to expose themselves, let it be voluntarily or not, without ascertaining the dose and potential worst case scenario.

And in that case, when we looked into the CMD, when I was dealing with the CMD, I asked the same questions. The dose was based -- the potential dose, was based on Monte Carlo simulation, adequacies of the shielding and, then, he was allowed to go on to the air to do the measurements.

MEMBER McDILL: So it was approved ahead of time, which was my first question.

MR. JAMMAL: Correct.

MEMBER McDILL: Thank you. Thanks, Mr. Chair.

THE CHAIRMAN: Thank you.

Monsieur Harvey?

MEMBER HARVEY: Merci, monsieur le president.

Just to follow, what was the reason, the main reason, to report the incident?

Would the incident have been reported to CNSC if there hadn't been people there?

MR. RÉGIMBALD: André Régimbald, here.

Yes, that's correct, Mr. Harvey, because in this instance there was no dose incurred by anyone or the dose was very low.

So because the people were standing behind that shielded area and no one was inside and they are not allowed to go inside the area.

But if the dose had exceeded an action level or a limit specified in the regulation, yes of course, we would have reported the incident to the Commission.

MEMBER HARVEY: What I mean is the reporting from the -- not from the Commission but from the licensee.

I mean, if there hasn't been people there, could the incident occur and no obligation to report to the CNSC staff.

MR. RÉGIMBALD: No, the incident would have been required by the regulations to be reported by CLS to the Commission as per the regulation.

MEMBER HARVEY: Okay.

How was it detected? Is this something that you detect instantly when that occurs?

How long could last such incident? And, have you ever to your knowledge such incident did occur in the past?

DR. DEJONG: For the record Mark de Jong, Director Of Accelerators. I'll give you a little background on that one. We had been coming out of an outage where we had been commissioning new power supplies for those magnets which was the end of not being commissioned and the error on the wiring occurred when retrofitting went back to the old power supply.

At the time we were trying to set up the beam going all the way through. So I think if we go to that diagram shown on slide 24, the normal set up procedure is to run the beam straight through along the bottom, there's a screen there to monitor it, and then the operator switches it into the bend to take a look.

The next position there you can see the beam would be after the second dipole which happened to be reversed. The operator was just trying to understand why he could see beam at the first position and couldn't see beam at the second position and steered it back and forth trying to see whether it was just some misadjustment on the first dipole.

When he was doing that the first time on the larger slide I guess it's 22. You see where it says RF, that's a radio frequency cavity there. The RF system was required for the booster to operator, but RF system tripped off.

The control for that RF system is just on the other side of the shielding wall so two of the people went over there to restart the RF system.

They no sooner got it restarted while the first operator was going and it tripped off a second time.

We've inferred afterwards that it was when he was steering the beam back and forth at some time the beam briefly went through that RF system, caused an arc in it and that's why it tripped off.

It's also why some of the other technicians who were just on the other side of the wall, while they were there they saw the radiation monitor going off indicating over 50 microsieverts per hour.

And they got out -- first they called the operator and said turn it off, the beam, and then got out there and reported it to the HSC saying that radiation monitor had gone off.

So that was the scenario through the -- by the time the second incident the operator had already concluded there was something wrong with those magnets

down there and immediately went down to investigate and found that the dipole polarity was reversed.

So the inference of the group at the time was that they got the radiation through the wall because of the reverse dipole. It was the subsequent reproduction of the event we realized that just by steering you could actually see that if the beam is not bent by the full amount but a little bit less you have a direct path going right into that wall causing a much larger shower. And that shower was going above the existing shielding that was in there.

So I think it highlighted for us, you know, several little problems on the operation. One is, in general the operators had known that there was a shielding against the inside of that concrete wall had assumed that it was sufficient so they didn't worry too much about any missteering of the beam when they were working there. So I highlighted that those assumptions were not correct and so I think that's where we had the whole investigation and said, okay we need more shielding around there and started responding to it.

But I think it was -- it created enough concern that we reported to Health and Safety, we left it up to Health and Safety to decide whether that was a reportable incident.

MEMBER HARVEY: Merci.

THE CHAIRMAN: Merci. Thank you. Mr. Barriault?

MEMBER BARRIAULT: Merci, Messieur le Président. I guess just a few business case questions if you want to on medical isotopes. Have you crunched out the figures whether you'll be cost effective of producing radioisotopes for medical purposes compared to the NRU costs?

DR. DEJONG: I guess I have two parts to my response. One is to try to determine what NRU costs are. That's the byproduct of the reactor.

In our analysis we'd be -- based on the measurements that we've actually done at the NRC on terms of the yield, the 40 kilowatt machine that we're building would provide approximately 100 curies per week which would be enough for Province of Manitoba, Saskatchewan and still have probably about 30, 40 curies left over. That two 100 kilowatt electron accelerators with this capability would have sufficient capabilities of supplying molybdenum 99 for the country.

When we try to go through all of the costs we believe you would actually make money at $400 per curie for the moly 99.

Now whether it really makes sense as a

private business it's still to be determined, but we certainly believe it could be quite competitive.

MEMBER BARRIAULT: So you'll be able to supply, you assume you'll be able to supply Saskatchewan, Manitoba I would imagine the east side Alberta, also?

DR. DEJONG: That's potential. For now we're talking about just, you know, this is a demonstration to see that we can get the yield. There will be certainly much more certification and regulatory approvals required from both the CNSC as well as Health Canada before we went on any sort of production.

MEMBER BARRIAULT: Thank you. Thank you, Mr. Chairman.

THE CHAIRMAN: I like to follow-up on this. So what is it that you actually have to deliver by 2012? You know, and are you going to be ready? 2012 is around the corner, are you going to do all this between now and then?

And is the chemistry and the hot cells and everything, you know, you don't have to do all this, it's not new discovery. You know the chemistry, you know the protocol, you know all the thing that needs to be done to actually produce this and you got to supply for molybdenum 100, all of the above.

DR. DEJONG: We certainly got a very

challenging timeline for trying to achieve something because all of the expenditures for this project must be completed by March 2012.

So it's a race to get things committed and spent and that results in scoping sometimes a little elastic.

We are most intently focused on being able to demonstrate that we can at least run 20 kilowatts into the target and demonstrate the yield of something like about 20 curies per day.

If we can demonstrate 20 curies per day and some molybdenum metal, I think that'd be a lot more interest and we'll look for funding to carry on during the processing afterwards.

We're going to take a look at trying to put in as much of that processing infrastructure as we can, feasibly within the project time, but it would be tight. I think when we compare -- we certainly know that the Health Sciences Center in Winnipeg has a separation technique for low specific activity molybdenum 99, activity from low molybdenum 99.

They have the capability of processing radiated molybdenum metal for extraction of the technetium. So we're also taking a look at some possible collaborations with them.

I think a lot of the elements are in place, we'll take a look at what we have time to actually do and then start taking a look at whatever we need to supplement afterwards.

THE CHAIRMAN: I met yesterday at the CNS a very interested party in the proof of concept and commission, it's your minister, Minister Norris who suggested that we be nice to you here today.

The point is that everybody is looking for the commercial proof of concept here. Are you keeping track of the other three experiments?

DR. DEJONG: We're certainly in, effectively in close communication with the other three components. Most closely but the Manitoba proponents that are also looking at the similar electron process. I've also worked closely with the TRIUMF people for just a lot of basic advice on hot cells and a lot of the handling and some of the issues.

The University of Saskatchewan is also pursuing a PET cyclotron and by that having close collaboration with the University of Alberta which is one of the fourth participants.

So it's a fairly small community and we're trying to stay in close collaboration and communication with everyone.

THE CHAIRMAN: The bottom line is you guys are convinced at least by 2016 there will be an alternative to the NRU?

DR. DEJONG: Certainly, yes.

THE CHAIRMAN: Anybody else, Mr. Harvey?

MEMBER HARVEY: Small question. In page 4 of your document about the target assembly which has coating for the targets will become somewhat more direct over your radiations. But with the careful selection of materials the assembly should useable for many radiations but would happen after that?

Careful on selection of material, DSN black should be usable for many irradiations but what happened after that? What, this will be irradiated that would be wasted, nuclear waste after that, I suppose and you will have to manage that.

DR. DEJONG: That’s correct, the current design for the converter target would be for one millimetre thick, tantalum falls approximately a centimetre, a couple centimetres in diameter.

We know of similar designs that it was used in Oakridge for production of neutrons for many years that was run up to about 40 or 50 kilowatts average power for years, so we expect that converter target to last a long time, but it will certainly get active.

The choice of tantalum over tungsten, which was the alternative, is to try to come up with, reduce the residual activity as much as possible or have materials that will decay reasonably fast and try to reduce the radiation level.

But it’s still, you know, a few cubic centimetres of all material at this time.

MEMBER HARVEY: Merci.

THE CHAIRMAN: Just one last quick question to staff. If post-March the government wants to allow commercial facility to become operational, what licensing, what further licensing process is required?

MS. MURTHY: As a Class 2 nuclear facility, they would become medical, an isotope production facility. So they would have an isotope production accelerator; they would be designed as a Class 2 nuclear facility with the processing integrated into the Class 2 nuclear facility licence as long as the activity did not exceed the limit that would make it a class one processing facility.

So it would be good to handle it as a Class 2 nuclear facility.

THE CHAIRMAN: So it would be a separate unit within the CLS, let’s say?

MS. MURTHY: Depending on -- yes, it would be a separately issued licence and separately maintained.

THE CHAIRMAN: And they have to come in with the new application to us? Is that ---

MS. MURTHY: Yes, yes.

THE CHAIRMAN: To a deal?

MS. MURTHY: That’s right.

THE CHAIRMAN: Right. Okay.

Well thank you very much. Good luck to you.

Okay. We’ll reconvene at 4:05.

--- Upon recessing at 3:57 p.m.