

**Canadian Nuclear
Safety Commission**

**Commission canadienne de
sûreté nucléaire**

Public hearing

Audience publique

July 5th, 2010

Le 5 juillet 2010

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

Salle d'audiences publiques
14^e étage
280, rue Slater
Ottawa (Ontario)

Commission Members present

Commissaires présents

Mr. Michael Binder
Dr. Moyra McDill
Mr. Dan Tolgyesi
Mr. Alan Graham
Dr. Ronald Barriault

M. Michael Binder
Mme Moyra McDill
M. Dan Tolgyesi
M. Alan Graham
M. Ronald Barriault

Secretary:

Secrétaire

Mr. Marc Leblanc

M. Marc Leblanc

Senior Counsel :

Conseiller principal:

Ms. Lisa Thiele

Mme Lisa Thiele

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Ottawa, Ontario

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--- Upon commencing at 2:32 p.m. /

L'audience débute à 14h32

Opening Remarks

M. LEBLANC: Bonjour, mesdames et messieurs.

Bienvenue aux audiences publiques de la Commission canadienne de sûreté nucléaire.

Mon nom est Marc Leblanc. Je suis le secrétaire de la Commission et j'aimerais aborder certains aspects touchant le déroulement des audiences.

The Canadian Nuclear Safety Commission is about to start a series of two public hearings this afternoon, starting with AECL's request to restart the NRU in Chalk River, to be followed later today with an opportunity to be heard on an order issued by a CNSC Designated Officer to the Saskatchewan Research Council regarding the Gunnar facility in Northern Saskatchewan.

During today's business, we have simultaneous translation. Des appareils de traduction sont disponibles à la réception. La version française est au poste 8 and the English version is on channel 7.

Please keep the pace of speech relatively

1 slow so that the translators have a chance of keeping up.

2 Les audiences sont enregistrées et
3 transcrites textuellement. The transcripts will be
4 available on the website of the Commission early next
5 week.

6 To make the transcripts as meaningful as
7 possible, we would ask everyone to identify themselves
8 before speaking.

9 I would also like to note that this
10 proceeding is being video webcasted live and that the
11 proceeding is also archived on our website for a three-
12 month period after the closure of the hearing.

13 As a courtesy to others in the room, please
14 silence your cell phones and other electronic devices.

15 Monsieur Binder, président et premier
16 dirigeant de la CCSN, présidera les audiences publiques
17 d'aujourd'hui.

18 Mr. Binder.

19 **THE CHAIRMAN:** Merci, Marc, and good
20 afternoon to everybody and welcome to the hearing of the
21 Canadian Nuclear Safety Commission.

22 Mon nom est Michael Binder. Je suis le
23 président de la Commission canadienne de sûreté nucléaire
24 et je vous souhaite la bienvenue, and welcome to all of
25 you who are joining us through webcasting.

1 I'd like to begin by introducing the
2 Members of the Commission that are here with us today. On
3 my right are Dr. Moyra McDill and Mr. Dan Tolgyesi. On my
4 left are Mr. Alan Graham and Dr. Ronald Barriault.

5 You heard from Marc Leblanc and we also
6 have with us Lisa Thiele, General Counsel to the
7 Commission.

8 So, Marc?

9 **MR. LEBLANC:** Yes. Before adopting the
10 agenda, please note that three supplementary Commission
11 Member Documents or CMDs were added to the agenda after
12 publication on June 28, 2010, as listed on the updated
13 agenda.

14 We have on the agenda a public hearing of
15 the application by Atomic Energy of Canada Limited for the
16 restart of the National Research Universal or NRU reactor
17 located at the Chalk River Laboratories, CRL, site in
18 Chalk River.

19 This will be followed by a hearing
20 providing an opportunity to be heard to Saskatchewan
21 Research Council on an order issued by a DO regarding the
22 Gunnar site in Northern Saskatchewan.

23

24 **10-H13 / 10-H13.A / 10-H13.B**

25 **Adoption of Agenda**

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THE CHAIRMAN: Okay. With this information, I would like now to call for the adoption of the agenda by the Commission. Do we have concurrence?

For the record, the agenda is adopted.

So let's now begin the hearing on the restart of the NRU reactor and you can see there's great interest in this story that we're going to hear. I assume it's not only a domestic interest; it's in fact an international interest.

Marc?

ONE DAY PUBLIC HEARING

Atomic Energy of Canada

Limited (AECL):

Application for the restart of the

National Research Universal

(NRU) Reactor located at the

Chalk River Laboratories (CRL)

site in Chalk River, Ontario

MR. LEBLANC: This is a one-day public hearing. The Notice of Public Hearing 2010-H-07 was published on June 11 to inform the public of this upcoming public hearing and the availability of the Commission

1 Member Documents.

2 A revised notice was published on June 16th
3 to announce the date of the hearing and the deadline for
4 filing interventions. A second revision was posted on
5 June 25th to change the date of the hearing to today.

6 The public was invited to participate
7 either by oral presentation or written submission. June
8 23rd was the deadline set for filing by intervenors. The
9 Commission received four interventions from the public.

10 I note that supplementary information has
11 been filed by AECL, as listed on the updated agenda.

12 **THE CHAIRMAN:** Okay. So I'd like to start
13 the hearing by calling on a presentation from AECL as
14 outlined in our CMD 10-H12.1, 12.1A and 12.1B.

15 I understand that Mr. MacDiarmid, you're
16 going to make the presentation. The floor is yours.

17

18 **10-H12.1 / 10-H12.1A / 10-H12.1B**

19 **Oral presentation by**

20 **Atomic Energy of Canada Limited**

21

22 **MR. MacDIARMID:** Thank you very much, Mr.
23 President. Good afternoon and thank you, ladies and
24 gentlemen.

25 For the record, my name is Hugh MacDiarmid,

1 President and CEO of Atomic Energy of Canada Limited.

2 Je voudrais vous présenter monsieur Bill
3 Pilkington, agent principal du nucléaire pour EACL, et
4 monsieur Hank Drumhiller, vice-président et directeur
5 général Opérations, et aussi plusieurs membres de notre
6 équipe de gestion qui sont ici aujourd'hui.

7 My colleagues and I are here today to
8 report that we have successfully repaired and leak-tested
9 the NRU vessel. We are seeking approval to refuel past
10 the guaranteed sub-critical condition.

11 I want to thank Commissioners for
12 accommodating our request to reschedule this hearing. I
13 do appreciate that the extensive demands on your time
14 caused a lot of you to move your schedules around.

15 Completing the repairs to the NRU is a
16 testament to more than a year of dedicated around-the-
17 clock effort by hundreds of AECL employees and contract
18 staff.

19 I want to take this opportunity to
20 recognize the efforts and achievements of our team at
21 Chalk River, as well as the contributions and support from
22 the Canadian nuclear industry.

23 We have engaged some of Canada's leading
24 companies as supplier partners to support us in our
25 efforts. The demonstrated thoroughness and creativity in

1 taking on the challenges that have never been experienced
2 before confirms the world-class status of the Canadian
3 nuclear industry.

4 We have also engaged some of the world's
5 leading experts to ensure the effectiveness of the repair
6 techniques that we have deployed.

7 I want to acknowledge also the timely and
8 capable support of CNSC staff. They have displayed a high
9 level of professionalism throughout.

10 As I have said on a number of occasions
11 before Parliament, AECL takes its responsibilities very
12 seriously to provide a reliable supply of medical isotopes
13 to Canada and the world. It has been our foremost
14 operational priority.

15 In order to ensure this reliable supply of
16 isotopes, we have taken every reasonable action throughout
17 the outage to improve NRU's ongoing safety and reliability
18 and this will continue.

19 We, at AECL, are confident NRU is now ready
20 to resume safe operation.

21 Let me now turn over the proceedings to
22 AECL's Chief Nuclear Officer, Bill Pilkington, in order
23 that he can provide a more comprehensive presentation.

24 Thank you.

25 **MR. PILKINGTON:** Good afternoon, Doctor

1 Binder and Members of the Commission.

2 For the record, my name is Bill Pilkington,
3 Senior Vice-President and Chief Nuclear Officer.

4 As Mr. MacDiarmid mentioned, we are here to
5 provide you with an update on our progress on repairing
6 the NRU reactor vessel and on our preparations to return
7 the NRU to service.

8 My remarks today will follow the outline on
9 the slide you see before you with emphasis on the repairs
10 conducted, future activities and why we are confident that
11 the react can be safely returned to service.

12 On May 15th, 2009, a heavy water leak was
13 detected from the NRU reactor. The leak was traced to the
14 gas-filled annulus between the heavy water filled reactor
15 vessel and the light water reflector.

16 The picture in the upper left shows the
17 water that was seen to be seeping through corrosion on the
18 outside surface of the vessel. No corresponding hole
19 could be seen on the inside of the vessel until the
20 surface was prepared for repair as shown in the lower
21 right picture.

22 The consequences of the heavy water leak
23 were minimal as the water was collected and stored. Some
24 tritium from evaporation was exhausted through the NRU
25 ventilation system but the amount remained well below

1 regulatory limits.

2 This slide shows a picture of the NRU
3 reactor and a schematic illustrating the location of the
4 leak in relation to the nearest access point on the upper
5 deck, nine metres above the bottom of the vessel. Access
6 to the interior of the vessel is through apertures that
7 are 12 centimetres in diameter, roughly the size of my
8 hand.

9 In addition, the reactor deck is only 3.7
10 meters in diameter, limiting the area for staging and
11 executing the in-vessel work. And the pointer right now
12 on the presentation is pointing to roughly the centre of
13 the deck.

14 One way to appreciate the difficulties of
15 examining and repairing the vessel is to think of
16 repairing the basement wall of a two-storey house by
17 working from the roof through a length of drain pipe.

18 In the case of the NRU vessel, the work was
19 made more challenging by high radiation fields that pose a
20 risk for staff and can damage electronic equipment. This
21 is a detailed schematic of the base of the NRU vessel
22 showing the annulus, light water reflector, and the
23 location of the leak at the bottom of the annulus shown by
24 the red arrow.

25 The black arrow below indicates the

1 circumferential weld at the base of the vessel that is
2 used as a reference elevation. Note that the vessel wall
3 thickens below the circumferential weld.

4 The actual condition of the inside surface
5 of the vessel was relatively clean with about one
6 millimetre coating of gibbsite. Gibbsite is a corrosion
7 product of aluminum that is formed in water.

8 Outside the vessel there was corrosion
9 product build-up on the lower vessel wall, the floor of
10 the light water gutter, and the wall of the reflector.
11 Also, the heavy water gutter was filled with corrosion
12 products and the lip was corroded away in some areas.

13 The first step in assessing the vessel
14 condition was a visual inspection of the full
15 circumference of the NRU vessel. The pictures on this
16 slide show a team of AECL staff using a remote camera to
17 examine the vessel. The visual inspection was followed by
18 a comprehensive non-destructive or NDE campaign undertaken
19 over five months to determine the thickness of the vessel
20 wall.

21 Progressively more sophisticated probes and
22 delivery systems were used to expand the area of
23 inspection and the quality of data. This represents one
24 of the largest NDE campaigns carried out in the nuclear
25 industry on a single reactor component with over two

1 million data points collected.

2 This is a composite of the NDE data into
3 one image of a band of the vessel wall from just below the
4 circumferential weld to a height of about 250 millimetres
5 above the weld. The original wall thickness was 8
6 millimetres as indicated by dark brown and darkens further
7 as the vessel wall thickens below the circumferential
8 weld.

9 Lighter shading indicates the degree of
10 wall loss. The remaining wall over most of the vessel is
11 more than seven millimetres. Patches of regional wall
12 reduction were found at the base of the vessel extending
13 upward from the level of the floor of the J-rod annulus
14 about 50 millimetres above the circumferential weld.

15 These show up as light coloured areas in
16 the figure, with some pockets of highly localized
17 corrosion below the areas of regional corrosion. The
18 areas to note are J-rod 13 to 18 as the largest area of
19 corrosion; the corrosion sites between J-rod 21 and J-rod
20 30; and the leak site at J-rod 41.

21 With the challenges posed by the high
22 radiation environment and limited access, proven remote
23 welding technology was chosen as the preferred method of
24 repair. All activities had to occur within a 12-
25 centimetre hole, 9 metres away.

1 The picture shows the congestion at the top
2 of the NRU reactor in carrying out in-vessel work.
3 Parallel development was carried out on mechanical repair,
4 welded structural plates, and weld build-up. All have
5 proven valuable.

6 In November 2009 localized weld build-up
7 was selected as the primary repair strategy. Extensive
8 qualification and practice were undertaken before going to
9 the reactor, using bench tests and integrated tests in
10 full scale mock-ups.

11 Hundreds of AECL and contractor staff
12 worked around the clock for more than a year. Through the
13 course of the inspection, tooling development and repair,
14 more than 350 contractor staff have provided tooling and
15 services.

16 A number of mock-ups were built to develop
17 and test tooling and procedures. The photo is a full-
18 height mock-up in the NRX reactor hall. Another full-
19 height partial mock-up was built in the mechanical
20 equipment design building specifically to test tooling
21 developed at Chalk River. And three full-height welding
22 stations were set up at the supplier of the welding
23 technology, Liburdi Automation.

24 They did this by cutting a hole in their
25 roof and erecting a tent to house the weld control

1 stations and accommodate the full height of the tools. In
2 addition, three full-height mock-ups were built adjacent
3 to the NRU vessel to carry out final weld development and
4 training with in-vessel tools.

5 A full wall section coupon was required to
6 determine the corrosion mechanism that caused deep
7 penetrations like the one that led to the leak. In the
8 picture on the left, the hole saw for cutting the coupon
9 is seen being tested in a mock-up. The actual cutter is
10 indicated by the blue box.

11 The tooling was designed to fold up to fit
12 through the 12-centimetre aperture and then unfold to
13 deploy in the vessel. The radiation of the NRU vessel has
14 modified the original material properties through
15 transmutation and alteration of the microstructure.
16 Tooling was developed to remove thin scoop samples about
17 the size of a Canadian quarter from the vessel wall.

18 In the picture on the right the scoop
19 cutting wheel is highlighted by the green circle and the
20 scoop sites by the blue box. Each scoop is large enough
21 to study material properties without requiring repair of
22 the vessel. Scoops were used to confirm that there was no
23 material sensitization or intergranular corrosion and to
24 determine mechanical properties of the wall material for
25 structural analysis and welding.

1 In addition, a sample weld was carried out
2 on a scoop which was sectioned to examine the properties
3 of the weld and its heat affected zone.

4 On the left is a picture of the site where
5 the vessel wall scoops were removed from typical vessel
6 wall material from the weld, and from the heat-affected
7 zone at one of the vertical seam welds. One of the
8 removed scoops is shown in a metal sample holder.

9 On the upper right is a picture of the
10 coupon hole next to the leak site taken from inside the
11 vessel. You can see the corrosion in the J-rod annulus
12 beyond.

13 The bottom right picture is the coupon in
14 the cutting tool and you can see the corrosion on the
15 surface of the coupon.

16 Specialized tooling was required to clean
17 the vessel in preparation for welding and to vacuum the
18 vessel after repairs had been completed. The picture on
19 the left shows staff manipulating tooling through a 12-
20 centimetre hole with the indexing portion of the cleaning
21 tool on the left, it's the aluminium structure.

22 The picture on the right is the head of a
23 cleaning tool being tested in a mock-up.

24 A number of different tools were developed
25 to carry out the repair steps including, from left to

1 right, grinding, plate placement and a vertical weld tool.

2 The right-hand schematic illustrates how
3 the tools were designed to pass through the 12-centimetre
4 aperture, work around in-vessel obstructions and deploy
5 accurately and reliably to the vessel wall.

6 The tools also had to meet stringent AECL
7 standards for use in a reactor, undergo foreign material
8 exclusion inspections and retract reliably to be able to
9 exit the vessel after completing a task.

10 Mock-ups were used extensively to ensure
11 high quality welding operations could be performed
12 reliably. For the final repair site, over 100 test plates
13 were welded in the mock-ups before executing the repair in
14 the vessel.

15 A preliminary fitness for service
16 assessment was used to determine the sites on the vessel
17 wall that required repair to re-establish leak tightness,
18 structural integrity and corrosion allowance. This slide
19 shows the locations of the 10 repair sites and the
20 location of the test weld. These areas are outlined in
21 red.

22 Each repair site required a complex
23 sequence of weld development, welder qualification and
24 reliability testing, integration testing, the actual
25 repair work, NDE and certification of the repair.

1 Before any repairs were undertaken, in-
2 vessel welding was proven with a test weld carried out
3 December 3rd, 2009. Full NDE of the test weld confirmed
4 the in-vessel weld process was acceptable.

5 In addition, a scoop sample was removed to
6 examine the condition of both the weld material and the
7 heat affected zone adjacent to the weld.

8 Metallography results were reviewed by AECL
9 and external materials and welding experts to confirm the
10 material condition was acceptable and the repairs could
11 proceed. The basic repair technology used weld overlay to
12 build up the wall thickness and re-establish the
13 mechanical strength. The overlay could be vertical or
14 horizontal depending on the desired feature and in-vessel
15 constraints.

16 In the month of December, five sites were
17 welded and NDE completed to confirm quality repairs. The
18 expectation was that, as the welders gained experience,
19 their skill and confidence would improve to offset the
20 challenges posed by the increasing size of later repair
21 sites.

22 However, application of a prudent and
23 rigorous approach to the larger more complex sites
24 required a unique repair design for each site.

25 J-rod 41 was the original leak site and the

1 location where the through-wall coupon was removed to
2 identify the corrosion mechanism causing deep corrosion
3 pockets. A 1.5-millimetre thick backing strip was used to
4 cover the hole and the leak location and the adjacent
5 coupon removal site.

6 The upper left shows tacking the backing
7 strip in place. The lower left shows additional tacks and
8 fillet welds to secure the backing strip. The picture on
9 the right shows the weld build-up applied to complete the
10 repair.

11 In addition to repairing the holes at J-rod
12 41, backing strips were used to support weld build-up in
13 regions of very thin vessel wall. At J-rod 23, this
14 repair technology reached its limit of application. With
15 the thin vessel wall achieving a quality repair was very
16 challenging.

17 A new concept was developed to provide a
18 repeatable repair. This concept was based on putting a
19 window frame of weld build-up around the plates as shown
20 in the centre photo, followed by a weld overlay of the
21 plates and window frame to complete the repair as shown on
22 the right.

23 **(SHORT PAUSE/COURTE PAUSE)**

24 **MR. PILKINGTON:** Okay. Do I need to repeat
25 anything? Excuse the delay. I'll pick up on the J-rod 23

1 repair.

2 So in addition to repairing the holes at J-
3 rod 41, backing strips were used to repair regions of very
4 thin vessel wall. And so on J-rod 23, with the thin
5 vessel wall, achieving a quality repair was very
6 challenging.

7 A new concept was developed to provide a
8 repeatable repair and this concept was based on putting a
9 window frame of weld build-ups around the plates and
10 that's shown in the centre picture, followed by weld
11 overlay of the plates and the window frame to give the
12 completed repair as shown on the bottom right.

13 J-rod 23 was the last site that could use
14 full weld overlay as the stresses for the larger weld
15 areas approached the allowable limits to avoid disturbing
16 the lower vessel seal.

17 For the larger repairs, structural plates
18 were welded to the vessel to reduce the extent of weld
19 overlay and the resulting stresses. In this approach, the
20 plates were thicker and designed to re-establish
21 mechanical strength of the vessel wall without the
22 covering of weld overlay.

23 The first application was the J-rod 25/27
24 repair site using four plates 3 millimetres thick. The
25 tooling used to install the plates had to be modified to

1 tack structural plates in place as shown in the lower
2 right picture taken in the vessel following plate
3 installation.

4 New weld and NDE techniques also had to be
5 developed to ensure qualified structural welds at the
6 plate edges and between plates.

7 The completed test plate, number 24, which
8 is the one shown in the picture on the left, was produced
9 in a mock-up and it's shown in that upper picture. In
10 all, more than 30 test plates were produced prior to
11 completing the J-rod 25/27 repair in the vessel.

12 J-rod 13/17 was the last and most
13 complicated repair covering an area of more than twice the
14 size of the next largest repair.

15 To understand the discussion that follows,
16 you have to know that the plates were numbered in order of
17 installation, in vertical rows starting at the top left.

18 So the mouse is now over plate number 1,
19 and then 2, 3; then the next row is 4, 5, 6 and then 7, 8,
20 and not yet installed 9.

21 A three-by-three array of 4-millimetre
22 thick structural plates was used to reduce the weld stress
23 on the vessel lower seal. This was an evolution of
24 previous repairs but still required development of nine
25 specific weld processes plus NDE procedures for the unique

1 groove welds between the plates.

2 The top left picture shows 8 of 9 plates
3 installed. The tack on the sixth plate, which the mouse
4 is showing, melted through the thinned vessel wall
5 requiring a modification to the placement of the ninth
6 plate.

7 The bottom left picture shows the complete
8 installation of the plates and the horizontal and vertical
9 window frame of 4-millimetre weld build-up in the vessel.

10 The bottom right picture shows the addition
11 of a large area of horizontal 3-millimetre build-up on the
12 left side of the completed repair.

13 J-rod 13/17 is the only repair site that
14 required significant rework after the initial welding was
15 complete. Post-weld eddy current testing indicated a
16 surface breaking flaw between plates 8 and 9 extending
17 across into the groove between plates 5 and 6 and down
18 between plates 6 and 9. These are all located in the
19 lower right corner of the repair.

20 Follow-up visual inspection showed a crack
21 in the groove wells. The crack is believed to have
22 occurred as the large weld build-up was being carried out
23 on the left-side of J-Rod 13 to 17 repair.

24 Displacement during the large area of weld
25 build-up, as shown on the finite element model, combined

1 with lack of fusion is believed to have caused the crack.

2 Note that the deflection shown in the
3 finite element model have been exaggerated to make them
4 visible in this picture or in this figure.

5 The two horizontal and one vertical crack
6 tip were ground out and welded. The length of the crack
7 was then excavated to a depth of 2 millimetres and
8 rewelded. Two attempts were required to achieve an
9 acceptable weld. Portions of the rework weld were then
10 ground to improve NDE capability.

11 Visual inspection was repeated for the
12 whole J-Rod 13/17 repair area. Any current testing was
13 repeated over the repair area and for the groove weld
14 between Plates 7 and 8.

15 Prior to declaring repairs complete, given
16 the challenges and complexity of the J-Rod 13/17 repair, a
17 workshop was held, including internal and external experts
18 to consider if sufficient repair and inspection had been
19 carried out to assure a quality repair. Consensus
20 supported declaring the repair complete.

21 Post-weld inspection results have
22 demonstrated the success of the weld repair program.
23 Engineering has assessed the small areas of lack of fusion
24 and determined they do not affect the effectiveness of the
25 repair.

1 One reportable indication was identified in
2 the heat-affected zone of the J-Rod 23 repair and shown in
3 red and it will require follow-up monitoring.

4 Following declaration that the repairs were
5 complete the NRU vessel was refilled with water.

6 An in-service leak test witnessed by the
7 responsible authority did not find any evidence of water
8 leakage from the vessel.

9 Trace amounts of tritium were measured in
10 the J-Rod Annulus between the vessel and reflector during
11 the vessel fill but there were no signs of moisture.

12 Ongoing monitoring over several days with
13 the vessel full indicated tritium levels trending toward
14 background.

15 Additional visual inspections were
16 undertaken of the inside of the vessel in the region where
17 tritium was detected. No flaws or imperfections were
18 found.

19 Tritium readings remained close to
20 background levels when the vessel was refilled following
21 the visual inspection.

22 So, Mr. Chairman, if it would be of help, I
23 have brought samples of weld plates that I could use to
24 help show the actual size of these repairs.

25 **THE CHAIRMAN:** By all means. I know you

1 can get really excited about the engineering of welding
2 but I really would like to see it and feel it.

3 **MR. PILKINGTON:** Okay. So these are the
4 test plates that were used for the repair sites and so I'm
5 going in sequence, really, on the last four repairs.

6 And the first one is of interest because as
7 you can see it was where the coupon was removed and so we
8 have that hole and we also have right next to it the
9 origin of the leak. This is the J-Rod 41 coupon.

10 So this shows the area of corrosion and
11 this shows the repair that was used to -- to return to
12 structural strength and leak tightness. So we have a
13 structural plate that was welded in place and then that
14 was overlaid with horizontal weld to complete the repair.

15 Okay, so that is J-Rod 41.

16 The next one is the J-Rod 23 repair and I
17 don't know if you can see the difference but -- but the
18 corrosion, although over a small area, was quite
19 extensive. The vessel wall was quite thin at this
20 location.

21 And by the way, I would just point out that
22 these are actually accurate reproductions of the profile
23 of the vessel wall. They were machined using the NDE data
24 from all of the inspections that were done. So they very
25 accurately represent the condition of the vessel wall,

1 except of course they're not covered with corrosion
2 products.

3 **THE CHAIRMAN:** Including the thickness?

4 **MR. PILKINGTON:** Yes.

5 So the -- yes, and this represents the
6 original 8 millimetre thickness of the vessel wall.

7 This repair was the one that resulted in
8 the most welding stress, J-Rod 23, and required us to move
9 to a different strategy for larger sites.

10 And you can see on this plate that this is
11 -- this is deformation from the welding, this is not the
12 normal shape of the plate.

13 Now, the vessel would not have seen this
14 much stress because it's a much better heat sink but this
15 does give you an indication of the kinds of stresses that
16 the welding creates.

17 And so in this one we had two backing
18 plates and then the window frame around and then an
19 overlay of weld build-up over that.

20 So then we go to J-Rod 25/27, we see a
21 broader area of corrosion and the repair, this time the
22 first application of structural plates and so we have four
23 3 millimetre thick structural plates and then we've
24 created this window frame of weld build-up between and
25 around the plates to complete the repair.

1 And finally -- just testing the strength of
2 my assistant here.

3 Finally, you'll recognize the 3 x 3 of the
4 J-Rod 13/17 repair. Now, this is only representative
5 because in fact this was an early test model for this
6 repair and it does not actually represent the spacing of
7 the plates in their final configuration but it does give
8 you an idea on the plated area. And if you remember, not
9 only is there the plated area but there's a fairly large
10 area above, below, and mainly on this side, a very build-
11 up, this was the build-up that caused the deformation of
12 the vessel and created the problem.

13 So the point to make here is really the
14 size of the area of corrosion and so that final repair
15 essentially covered from one side of this plate almost to
16 the other.

17 And it's also clear that -- well, actually,
18 you cannot really see the general scalloping, you can feel
19 it in this area but you can't see it from looking at the
20 plate, but the wall is thinner all the way across.

21 But what is visible is the deep
22 penetrations or deep pockets that have been formed and
23 it's not too hard to see that they essentially are formed
24 along a waterline; okay?

25 So that is perhaps the important thing to

1 note from this repair, as well as the fact that on this
2 repair they are very deep over a large area.

3 In fact, on this repair, when we did the
4 vessel cleaning prior to welding there were actually a
5 couple of areas that went through a wall.

6 So looking at the corrosion on J-Rod 13 to
7 17 is then a good segue into talking about the corrosion
8 mechanism.

9 **THE CHAIRMAN:** Thank you for this
10 representation.

11 You realize that all of this material now
12 is formal record here. You've got to leave it with us
13 now. At least for a period of time so people can examine
14 it.

15 **MR. PILKINGTON:** Yes. To be honest, I
16 didn't realize that.

17 So moving on; based on the evidence from
18 the corrosion coupon and experience with the corrosion in
19 the annulus between the vessel and reflector -- sorry,
20 just a second. I'm on the wrong slide. Okay.

21 So we're now turning to the source of the
22 degradation of the NRU vessel and so there were two
23 related corrosion mechanisms that have been identified.

24 First, there's a regional wall loss that
25 results in a scalloped reduction -- which is being shown

1 by the mouse -- in the wall thickness illustrated with NDE
2 results on the left picture at the J-Rod 41 leap site.

3 Second, as shown in the cross-section of
4 the coupon removed from J-Rod 41, localized corrosion
5 pockets can form below the regional wall loss at a level
6 that would correspond to the water line in the annulus, as
7 I showed you on the J-Rod 13 to 17 plate.

8 Based on the evidence from the corrosion
9 coupon and experience with corrosion in the annulus
10 between the vessel and reflector, both the regional
11 corrosion and the localized corrosion pockets resulted
12 from nitric acid formed by irradiation of air in the
13 presence of light water from reflector leaks.

14 Carbon dioxide is distributed into the
15 annulus to displace air, but the delivery has not always
16 been effective. Regional corrosion shown here in NDE
17 results from J-rods 13 to 17 is due to contact of acidic
18 water with the vessel, for example, due to splashing or
19 spraying.

20 Corrosion pockets, shown in the magnified
21 view of NDE results from J-rod 41, result from an electro-
22 chemical cell where acidic water running down the vessel
23 wall contacts oxygen-rich water from the reflector leaks.
24 Analysis of the coupon from J-rod 41 confirmed that no
25 other contaminants were driving the electro-chemical

1 process.

2 The series of pictures from top left to
3 bottom right show the condition of the J-rod annulus,
4 first when the vessel was installed, then an area of
5 typical corrosion; next, increased corrosion at the leak
6 site and finally the improvement achieved through
7 vacuuming in the annulus.

8 The strategy to reduce and arrest corrosion
9 is based on reducing air and water ingress. Immediate
10 action has been taken to address water leaks and clear
11 drains to eliminate pooling and splashing on the vessel
12 wall.

13 Action has also been taken to reduce air
14 leaks and improve the delivery of CO₂. Going forward, CO₂
15 purity and the pH of water drained from the annulus will
16 be closely monitored. Further reductions of water and air
17 ingress will be achieved through physical improvements
18 during regular planned maintenance outages.

19 Additional mitigation measures are under
20 consideration including the application of a cold spray
21 sacrificial aluminum coating, repair of the reflector
22 leaks, and changes to the reflector water chemistry.

23 Recognizing that corrosion was not
24 anticipated in the vessel condition assessment performed
25 in 2004 and 2005, AECL undertook actions to ensure that

1 there were no concerns with the assessments of other NRU
2 systems.

3 First, the condition assessment process was
4 reviewed to ensure there was no generic problem with the
5 process and none was found.

6 Second, an independent process of review
7 was carried out by an expert panel to validate the results
8 of the condition assessments. And no gaps of safety
9 significance were found.

10 Going forward, the integrated safety review
11 that is currently underway to support licence renewal will
12 address gaps to modern codes and standards. The isotope
13 supply reliability program is improving plant life
14 management including the maintenance program and system
15 health monitoring.

16 In assessing the NRU's fitness for service,
17 regional corrosion compromised the vessel's ability to
18 withstand specified loads. The top graphic on the slide
19 shows the results of finite element analysis used to
20 determine site requiring repair. The lower graphic shows
21 acceptable mechanical performance following repair.

22 Continued fitness for service will be
23 verified through in-service inspections conducted during
24 planned maintenance outages. In future, the reliability
25 of NRU operation will be enhanced through longer planned

1 maintenance outages.

2 These longer outages will start with the
3 first within nine months of return to service and then
4 will occur annually thereafter subject to review based on
5 NRU performance and outage experience.

6 The duration of annual maintenance outages
7 will be set by the critical path activities and are
8 expected to be about four weeks in duration.

9 In-service inspection will monitor wall
10 thickness and thereby assure ongoing structural integrity.
11 The inspection program and ongoing mitigation reduces but
12 does not eliminate the potential for highly localized
13 corrosion pockets.

14 Such corrosion pockets do not impact the
15 structural integrity but could lead to a heavy water leak.
16 Tooling is being developed to effect a mechanical repair
17 of a small leak without defueling or draining the reactor.

18 Causes for the NRU leak event have been
19 assessed and found to be consistent with opportunities for
20 improvement identified in a 2008 and 2009 safety culture
21 survey. Corrective actions have been rolled into AECL's
22 improvement program called Voyageur Phase II.

23 Broad elements of the program are:

24 1. To improve equipment reliability to
25 ensure a low tolerance for equipment issues, eliminate

1 work-arounds, improve maintenance programs, spares and
2 system health monitoring;

3 2. To reinforce desired organizational
4 behaviours such as a questioning attitude and the use of
5 event-free tools;

6 3. To improve problem identification and
7 corrective action to consistently identify and address
8 problems with a very low significance level;

9 4. To improve the use of operating
10 experience to learn from internal and external events;

11 5. To improve standards for operation;
12 for example, through improved procedural adherence, outage
13 planning and the WANO peer review process; and finally

14 6. To improve leadership and oversight
15 through the strengthening of our leadership academy,
16 change management, and observation and coaching.

17 Measures of improvement will include site
18 and departmental level event free-day resets, interim
19 safety culture surveys, equipment reliability indicators,
20 and a health index for the corrective action program.

21 Human resources, equipment upgrades to
22 address obsolescence and equivalency, spare parts, and
23 program improvements are all funded through the isotope
24 supply reliability program.

25 The NRU outage provided an opportunity to

1 carry out maintenance and inspection activities that
2 cannot be completed within the normal operating cycle.
3 Safety and reliability improvements were made to the heavy
4 water system, to the processed water system, the fuel rod
5 flask, and control rod systems. All outstanding
6 maintenance activities requiring the reactor drained and
7 defueled were completed.

8 To address CNSC staff inspection findings,
9 comprehensive system walk-downs were completed on the
10 seven NRU safety upgrades during the outage and all
11 findings have been reviewed and dispositioned.

12 As we proceed with the NRU Return to
13 Service Program, the safety upgrades will be confirmed
14 fully operational, fully tested, and fully capable of
15 performing their safety functions.

16 As part of the NRU Return to Service
17 Program, the NRU readiness for service process will assure
18 all systems are fully operational and fully tested. A
19 detailed integrated plan has been produced for all
20 maintenance, testing, system configuration, and training
21 activities and is being executed as shown by the work-down
22 curve.

23 A dedicated team was assembled in September
24 2009 to put together the step-by-step procedures supported
25 by checklists needed to safely and efficiently return

1 systems to service. Operating experience from the restart
2 in 1991 was reviewed and included in the development of
3 procedures and checklists.

4 More than 2000 activities have been
5 identified and scheduled. The return to service is
6 supported by a dedicated outage control centre and fix-it
7 now teams to address emergent issues on equipment that has
8 been laid up for a year.

9 Training associated with the NRU return to
10 service includes both update training on new procedures
11 that have been developed and associated with restart
12 activities, and refresher training on activities that have
13 not been routinely performed during the outage.

14 Training is being delivered close to the
15 time it is required for maximum benefit. This chart shows
16 the over 400 training activities leading up to refilling
17 the reactor vessel. Similar programs are being delivered
18 prerequisite to starting to refuelling activities and
19 prior to restarting the reactor to low power operation.

20 In the months prior to the May 14th, 2009
21 shutdown, it was suspected that there was one or more
22 defects in the NRU driver fuel. The current driver fuel
23 design has had excellent performance since it was
24 introduced in NRU in the early 1990s. Until coolant
25 activities rose in late 2008, there has been no record of

1 defects.

2 Suspect fuel was removed from the reactor
3 in January through March of 2009 and fission product
4 activity in the coolant was decreasing consistent with the
5 defects having been removed from core. Subsequent
6 examination of the suspect fuel removed has confirmed
7 there were defects.

8 A total of four defects have been found and
9 all are similar to the one shown on the slide. They occur
10 at the ends of the fuel elements as a split in the
11 aluminium fuel sheath in an area where the sheath has
12 bulged.

13 The defect mechanism appears to occur early
14 in the service interval of the fuel. Defects are limited
15 to batches of fuel manufactured before February 2008.
16 Based on the location and nature of the defects, the most
17 likely cause is organic contamination introduced during
18 the manufacturing process.

19 No fuel from the batches with known defects
20 will be reloaded in the NRU for start-up. Steps have been
21 taken to ensure the likelihood of fuel failure following
22 restart is acceptably low. The majority of fuel to be
23 reloaded was in the NRU when the shutdown occurred and was
24 demonstrating good performance.

25 As a further contingency measure, the

1 procedure for responding to rising coolant activity
2 levels, which may indicate a new defect, has been enhanced
3 to assure appropriate measures are taken in the unlikely
4 event of future fuel defects.

5 The June 23rd earthquake was a magnitude 5
6 centred north of Ottawa. A Government of Canada seismic
7 monitoring station is located on the Chalk River site.
8 The peak ground acceleration at Chalk River was 0.006g,
9 where g is the acceleration due to gravity. This would
10 equate to an earthquake with a magnitude between 3 and 4
11 centred at Chalk River.

12 NRU's safety functions have been qualified
13 for an earthquake of magnitude 6 and in addition NRU has a
14 seismic trip set at 0.06g.

15 Nuclear facilities and buildings were
16 walked down by operations following the earthquake and
17 assessed by engineering to confirm no damage had occurred.

18 At the time of the earthquake, the in-
19 service leak test was in progress on the reactor vessel.
20 To provide assurance of vessel integrity, those areas that
21 had been completed were re-inspected. Also, the vessel
22 was drained and an additional visual inspection was
23 performed that included the larger repair sites with no
24 anomalies found.

25 On communications, regular updates have

1 been provided to the public and stakeholders generally on
2 a weekly basis to ensure they were kept informed of
3 progress. Update number 63 was issued June 30.

4 AECL has set up the www.NRUCanada.ca
5 website in July of 2009 with frequent updates to provide a
6 wealth of information to all stakeholders. Weekly
7 briefings have been held with senior government officials
8 to report progress on the repair and return to service.

9 Phone-in meetings have been arranged with
10 healthcare stakeholders and local officials when
11 significant developments have occurred which may impact
12 their constituents; for example, extensions to the repair
13 schedule or major milestones such as the completion of
14 repairs.

15 AECL is in regular communication with the
16 other major isotope producers on projections for the NRU
17 return to isotope production through the Association of
18 Imaging Producers and Equipment Suppliers, or AIPES, in
19 Brussels.

20 In summary, the NRU vessel has been
21 successfully repaired and is fit for service. AECL is
22 confident that all requirements for safely restarting the
23 NRU have been met. We respectfully request approval to
24 reload fuel past the guaranteed sub-critical condition
25 thereby allowing full return to service and resumption of

1 NRU operation and medical isotope production.

2 Thank you, Mr. Chair.

3 **THE CHAIRMAN:** Thank you.

4 I'd like to move now to a presentation from
5 CNSC Staff, as outlined in CMD 10-H12.

6 Mr. Jammal, the floor is yours.

7

8 **10-H12**

9 **Oral presentation by**

10 **CNSC Staff**

11

12 **MR. JAMMAL:** Bonjour, monsieur le président
13 et membres de la Commission.

14 For the record, my name is Ramzi Jammal,
15 Executive Vice-President and Chief Regulatory Operations
16 of the Canadian Nuclear Safety Commission.

17 Avec moi aujourd'hui l'équipe de la
18 Commission canadienne de sûreté nucléaire. I start with
19 Mr. Peter Elder, Director General of the Directorate of
20 Nuclear Safety and Facilities Regulation; Mr. Miguel
21 Santini, Director of the Chalk River Laboratories'
22 Compliance and Licensing Division; Dr. Etienne Langlois,
23 Project Officer responsible of regulatory oversight for
24 the NRU Operations.

25 With me also, our specialists, licensing

1 compliance team, and through video our Nuclear Site
2 Inspectors office to including Mr. Reuben Marini.

3 Mr. President, Members of the Commission,
4 the NRU shutdown has impacted multiple directorates at the
5 CNSC. Over the last 13 months, CNSC staff performed
6 various regulatory activities other than those specified
7 in the NRU restart protocol.

8 CNSC staff executed licence amendments as
9 requested without delays and without compromise to safety.
10 In specific, the Directorate of Nuclear Substance
11 Regulations amended no later than 24 hours requests from
12 hospitals and clinics to increase their possessions,
13 possession limits, to change their inventories in order to
14 have alternate isotopes.

15 Mr. President, the spent resources for
16 regulatory efforts were above the planned regulatory
17 activity and CNSC staff provided 24/7 services and in
18 specific Doctor Langlois and our site office at Chalk
19 River.

20 I'd like to give you a brief background.

21 In May 2009, a small leak was discovered in
22 the vessel of the NRU reactor at Chalk River Laboratory.
23 The reactor was placed in a safe shutdown condition and
24 AECL subsequently decided to de-fuel and drain the reactor
25 to complete inspection and repair activities.

1 While most aspects of such repair are
2 covered by the existing conditions of the current Chalk
3 River Laboratories licence, this repair and restart
4 required unique considerations that are beyond CNSC staff
5 approval.

6 Hence, we're before you requesting an
7 approval to re-fuel the reactor and put it into beyond the
8 defined temporary guaranteed sub-critical condition.

9 As part of CNSC clarity of requirements and
10 transparency, AECL-CNSC established an NRU restart
11 protocol and this protocol was signed by both presidents
12 of the Commission and AECL.

13 The protocol is an administrative tool that
14 clearly documented the regulatory requirements so the
15 repair and the restart or return to service is done in
16 accordance with applicable codes and standards.

17 Mr. President, among other things in the
18 protocol was the conflict resolution that was frequently
19 invoked and this was done at my level and Mr. Pilkington's
20 level.

21 In this slide, I show you the map with
22 respect to the NRU restart protocol and sections in the
23 CNSC CMD in order to indicate how the protocol has been
24 executed during the course of the vessel repair and the
25 NRU return-to-service projects.

1 The protocol is now closed and CNSC staff
2 confirm that all the necessary information to make a
3 recommendation to the Commission for this approval has
4 been received and that the protocol has met its intent by
5 enhancing communication between the two organizations and
6 very close management oversight.

7 Today's presentation will provide details
8 on CNSC staff's assessment of the information provided by
9 AECL to support the NRU reactor's return to service. But
10 before I hand the presentation over to Mr. Elder, I wish
11 to make the following statements.

12 Has the NRU been repaired safely? The
13 answer is yes. Has the repair re-established the
14 structural integrity? The answer is yes.

15 However, the rest of the presentations will
16 discuss the operational reliability and the need for
17 operational experience and cultural changes at the AECL.

18 I will now pass the presentation on to Mr.
19 Elder.

20 **MR. ELDER:** Thank you, Mr. Jammal.

21 Today's presentation consists of seven
22 parts. First, I will provide an update on the vessel leak
23 repair and CNSC staff's overall conclusion on the repair.
24 Then Mr. Santini will go through the other four areas
25 assessed by CNSC staff during this extended outage

1 associated with the decision to allow restart and
2 continued refuelling.

3 Afterwards, we will provide information on
4 additional activities not directly linked to the restart
5 of NRU but that would be of interest to the Commission.

6 Finally, we will provide CNSC staff's
7 conclusions and recommendations.

8 As listed in the restart protocol, CNSC
9 staff required AECL to complete the following activities
10 during the vessel leak repair project: conduct a root
11 cause investigation into the leak.
12 This was divided into two parts: a technical
13 investigation focussed on the vessel and the cause of the
14 corrosion, and a wider organizational investigation onto
15 why the vessel was allowed to get into such a condition.

16 The results of the second part will be
17 discussed later in the presentation.

18 Then AECL was required to perform an
19 extensive assessment of the vessel to determine its
20 complete condition, define a repair strategy and a
21 detailed repair plan based on the condition assessment and
22 the technical root cause, implement a mitigation strategy
23 again based on the cause of the leak, demonstrate that
24 acceptable repair had been done in accordance with
25 applicable codes and standards, and finally to produce a

1 fitness-for-service safety case for the vessel showing
2 structural integrity will be maintained with an acceptable
3 safety margin.

4 To achieve a high level of confidence in
5 the reactor vessel repair initiative, CNSC staff required
6 a comprehensive conditional assessment to evaluate the
7 state of the vessel, the extent of corrosion damage, the
8 general fitness for service of the vessel and the repair
9 options.

10 As has been stated by AECL, the original
11 leak occurred at location JR-41 but there was also heavy
12 local corrosion at other locations at the same elevation
13 near the floor of annulus. And at two locations, JR-41
14 and JR-13/17, there were through-wall penetrations. That
15 is to say there was no metal left in these locations in
16 small areas.

17 It should be noted however that very little
18 general corrosion was identified in the rest of the
19 vessel. This was also true for other structures
20 associated with the vessels and the walls of the light
21 water reflector tank.

22 Given the extent of corrosion in the
23 annulus at this floor level, it was evident that repair
24 was required to re-establish the structural integrity of
25 the vessel and to re-establish the design criteria.

1 The state of the NRU vessel revealed by the
2 non-destructive testing inspection showed the vessel had
3 been subject to a degradation mechanism that was more
4 active than previously believed. AECL submitted a
5 corrosion report which identified the main cause of leak -
6 - vessel leak was nitric acid attack in the J-rod annulus
7 on the outside of the vessel wall attributed to nitric
8 acid production from ingress of both air and water into
9 the J-rod annulus.

10 The presence of air results in the
11 radiolysis production of oxides of nitrogen that dissolve
12 in water to form nitric acid. The source of the water in
13 the J-rod annulus is a leakage from the light water
14 reflector.

15 After reviewing the submissions and the
16 data provided by AECL, CNSC staff has accepted AECL's
17 conclusion that corrosion by nitric acid is the main cause
18 of the observed degradation of the NRU vessel wall.

19 However, the studies to date have not
20 conclusively dismissed other possible secondary mechanisms
21 and there is limited data on the corrosion rates for
22 nitric acid.

23 Therefore, ongoing inspections are required
24 to reduce the uncertainty in the corrosion rates and to
25 continue to eliminate other potential sources. These

1 inspections will be detailed on later slides in this
2 presentation.

3 To address the corrosion -- vessel
4 condition degradation, AECL has developed short-term and
5 long or medium-term mitigation strategy which I'll discuss
6 on the next slide.

7 As I mentioned earlier, the cause of the
8 corrosion is nitric acid production in the annulus. To
9 mitigate this mechanism, AECL has developed a
10 comprehensive J-rod annulus mitigation strategy.

11 To date, AECL has implemented six elements
12 of the strategy, including installation of a new CO₂
13 injection system to displace the air in the annulus and
14 improve the sampling of the CO₂ that is injected,
15 installation of new upper seals and lower J-rod seals
16 again to reduce air ingress, and the cleaning of annulus
17 drains to provide better drainage of water and prevent
18 standing water formation.

19 However, these elements do not stop the
20 corrosion but should slow it down. The effectiveness of
21 the elements can only be proven through routine
22 inspections after restart since the reflector has been
23 emptied and air ingress conditions change during
24 operation.

25 Post the restart, AECL will need to

1 continue to reduce the air leakage and reflector leaks in
2 the annulus at future extended outages and continue to
3 develop the strategy and implement a contingency plan if
4 there is further corrosion.

5 One aspect they are discussing is
6 investigating the application of a sacrificial aluminium
7 coating that would act as a barrier to arrest vessel
8 corrosion. And as a contingency, AECL is developing a
9 mechanical repair tool for small leaks that can repair
10 without de-fuelling the reactor.

11 I will now shift the focus of the
12 presentation to the repair strategy.

13 As has been noted by Mr. Jammal, many
14 aspects of the NRU vessel repair are covered by existing
15 conditions in the Chalk River Laboratory site licence and
16 these conditions remain enforced for the current repairs.

17 The key requirements stem from the CSA
18 Standard N285 series on pressure retaining systems and the
19 associated American Standard of Mechanical Engineering's
20 *Boiler and Pressure Vessel Code*.

21 Through the NDE's, AECL identified 10 sites
22 requiring repair around the base of the vessel. These
23 range from small areas of a few millimetres to extended
24 regions as has been presented by AECL.

25 The selection of the repair sites is

1 consistent with the requirement that structural integrity
2 in vessel be re-established while minimizing the risk of
3 damaging the bottom seal during welding.

4 CNSC staff accepted the approach proposed
5 by AECL to use ASME Code Section 11 in defining the repair
6 requirements for the NRU vessel. Use of this section of
7 the Code requires regulatory approval for the repair plan
8 for the vessel and inspection and test plans for each
9 repair site.

10 These inspections and test plans included a
11 detailed description of the post-repair non-destructive
12 testing and examination, including the techniques that
13 will be used and the limitations of those techniques for
14 each site.

15 CNSC staff approved the repair plan and the
16 test procedures for each repair site prior to the start of
17 welding that included a description of the repair
18 procedure, the repair areas, the tooling required and the
19 staff training required.

20 I will now present more details on the
21 post-repair inspections.

22 After all the repairs and the post-repair
23 inspections are complete, and prior to restart of the
24 reactor vessel, AECL was required to submit a repair
25 report. The repair report, including all the supporting

1 documents for each repair site, must demonstrate that
2 established codes, standards and processes for the vessel
3 repairs have been followed and the detailed results of the
4 post-repair inspections confirm the vessel fitness for
5 service.

6 Given the tight timeline for the return to
7 service and the complexity of the information to be
8 collected in support of the repair report, AECL submitted
9 the supporting documentation for the first nine of the 10
10 repair sites and prior to the final repair report.

11 However, AECL cannot bring the reactor
12 critical until CNSC staff has approved this final report.

13 AECL has now submitted the final report and
14 I'll discuss the results of the last repair on the next
15 slide.

16 CNSC staff can confirm that repairs and the
17 post-repair inspections completed to date were all done in
18 accordance with the repair plan and demonstrate the re-
19 establishment of structural integrity of the vessel.

20 We will provide in writing to the
21 Commission an update when the final repair report has been
22 fully reviewed and accepted.

23 I will now turn to the final last repair.
24 As stated by AECL this final repair is complete and this
25 was the largest and most complex repair site compared --

1 in comparison with the previous nine ones.

2 As AECL has stated, the initial NDE
3 confirmed a crack in the welding and AECL then went back
4 and developed a weld repair strategy to repair the crack
5 and this weld repair was completed on June 14th, 2010 and
6 the NDE on the day afterwards. So this was after the
7 publication of our CMD.

8 Since then CNSC staff has received the
9 final repair report, including the details of this repair.
10 While we are still doing our comprehensive review the
11 preliminary review has not identified any problems with
12 this repair and include that the vessel is fit to return
13 to service.

14 In order to monitor future reactor vessel
15 conditions on a continuing basis AECL has developed an in-
16 service inspection program, using non-destructive
17 examinations to identify and monitor any deterioration in
18 integrity of the vessel on a continual basis.

19 Inspections are mandatory under CSA
20 Standard N285.4 and the first inspection must be no later
21 than nine months after the NRU restart.

22 To support operation of NRU AECL is
23 required to submit a comprehensive safety case that
24 demonstrates the reactor vessel is repaired and fit for
25 service. AECL has done this in two stages; a preliminary

1 assessment was developed again to determine the areas that
2 needed to repair and this was accepted by CNSC staff.

3 The final assessment is to be completed
4 within 90 days after the return -- after returning the
5 vessel to service and this report integrates the results
6 of all the post-repair NDU results, as well as the final
7 corrosion reports and will define the ongoing inspection
8 requirements and frequency beyond the first inspection.

9 The final assessment will also analyse
10 uncertainties in the NDE results and tools and that will
11 be again developed into identifying focused areas for
12 future inspections.

13 As stated by AECL, there will be a planned
14 extended maintenance outages of NRU in the future of about
15 three to four weeks with the first one reoccurring within
16 nine months.

17 In these outages they will conduct not only
18 the inspections required but also additional vessel life-
19 management activities like continued corrosion mitigation
20 and other maintenance activities.

21 Thereafter, the NRU maintenance outage of
22 about four weeks duration is planned, at least annually,
23 to ensure continued and ongoing fitness or service of the
24 vessel.

25 The actual interval between maintenance

1 outages will depend on the results of the inspections of
2 the previous outage.

3 CNSC staff has concluded that the
4 maintenance of the vessel fitness for service case is an
5 ongoing activity that needs to be accounted for, and
6 account for new inspection information and we believe
7 that, again, the fitness for service case needs to be
8 updated to include new supporting information to support
9 licence renewal in 2011.

10 This slide presents information since CNSC
11 staff CMD was issued on June 11th. After the completion
12 of the final repair AECL did perform the leak test, as
13 required by the repair plan. The leak test was witnessed
14 by the appropriate authority and it verified that the
15 annulus region was dry during the leak test which took
16 about two days to do.

17 As noted, AECL did measure small
18 concentrations of gaseous tritium above baseline levels
19 prior -- after refilling the vessel and specifically in
20 the area between J-Rod annulus 13 and 23.

21 There are several potential sources of
22 tritium in the annulus but obvious potential source was
23 the vessel repairs.

24 However, at no time was water observed in
25 the annulus, meaning that any potential leak from the

1 vessel would be extremely small.

2 AECL did decide to empty the vessel to
3 further investigate the source of this tritium, detailed
4 visual inspections to the repair sites were made from the
5 inside and outside and no visible cracks were identified
6 nor was any moisture.

7 This met the Code requirements and CNSC
8 staff has no concerns with the safety case for the vessel.

9 As the Commission is aware, there was an
10 earthquake on June 23rd, centred near Ottawa. The
11 earthquake was felt at Chalk River and as stated at the
12 June 28th Commission meeting the vessel was full at the
13 time of the earthquake. The leak test verifications were
14 repeated after the earthquake and again, no signs of a
15 leak were identified.

16 The visual inspections were also -- I just
17 discussed above, about looking for source of tritium were
18 also done after the earthquake and they serve -- so they
19 service part of the post-earthquake verification and that
20 again no damage was identified.

21 Just to note, in addition to the vessel the
22 NRU building and as well as all buildings and structures
23 and facilities, including the ground -- underground and
24 aboveground waste storage tanks were verified post-
25 earthquake and no damage was identified.

1 CNSC staff remain satisfied the NRU has the
2 required seismic protection in place.

3 So CNSC staff concludes that AECL has
4 conducted a thorough examination of the vessel that
5 allowed them to identify they needed repairs, CNSC staff
6 has verified that the vessel was repaired in accordance
7 with applicable nuclear standards and noting of course
8 that we are still doing our detailed confirmatory review
9 of the final report.

10 The repaired vessel is fit for service,
11 provided the initial period of operation for the NRU is
12 limited to no more than nine months. This will ensure the
13 first in-service inspection is conducted while there are
14 still margin to the corrosion allowance to cover the worst
15 possible scenario, i.e. the highest potential corrosion
16 rate.

17 Second, in the long-term ongoing
18 inspections will require NRU to be operated in a different
19 fashion than previously. Planned extended outages will be
20 needed as part of the operating regime. AECL has
21 indicated its intention to plan yearly extended outages,
22 exact timing and periodicity of the subsequent inspections
23 will be determined once the final fitness for service
24 report is submitted.

25 The leak test has been performed and CNSC

1 staff have reviewed the preliminary results of the last
2 area and is satisfied that the vessel's structural
3 integrity is acceptable.

4 While AECL has had a process in place to
5 monitor and measure tritium presence in the annulus as a
6 possible source of leak congestion, CNSC staff has
7 required AECL to enhance this process to make sure that
8 there is a determined leak detection limit and the
9 prescribed actions, if a leak is detected, are documented
10 and the operators are appropriately trained.

11 So we're again looking for extra mitigation
12 in case of a potential leak.

13 I will now pass the presentation over to
14 Mr. Santini who will discuss the other issues around the
15 extended outage.

16 **MR. SANTINI:** Thank you, Mr. Elder.

17 The NRU return to service project includes
18 all of the activities other than the vessel repair that
19 must be completed prior to the NRU restart.

20 The RTS plan is divided into three groups
21 of activities; field work, procedures and supporting
22 activities.

23 The last time the NRU Reactor underwent an
24 approach to critical after an extended shutdown of more
25 than six months was 1991. Hence, many activities related

1 to these RTS are considered non-routine.

2 As such, the CNSC required AECL to submit
3 all of the documentation to demonstrate the systematic
4 approach to the return to service and carried out several
5 onsite verifications in relation to this project.

6 CNSC staff is satisfied that the plans, the
7 procedures and the training developed by AECL adequately
8 support a safe start of the NRU reactor and that the
9 number of certified staff is sufficient to support restart
10 activities.

11 At this time, the RTS activities are still
12 in progress. Before approach to critical for restart,
13 AECL needs to declare the reactor ready for service. CNSC
14 staff will continue to closely monitor the remaining RTS
15 activities through compliance inspections. CNSC staff's
16 assessment of RTS activity further concludes that the core
17 can be reloaded and the reactor will operate within the
18 safety -- safe envelope established in the current licence
19 and CNSC staff is satisfied that the RTS activities on the
20 training of the NRU personnel are adequate in supporting a
21 savoury start of the NRU reactor.

22 Next I would provide information on the
23 organization of human factor issues that contributed to
24 the NRU vessel leak event. Several organizations on human
25 factor issues contributed to the NRU vessel leak event

1 over many years of operation and management and
2 structures.

3 These casual factors point to
4 organizational weaknesses that are consistent with the
5 results of the safety culture of self-assessment that AECL
6 performed in 2008. AECL and CNSC staff agreed that the
7 corrective action plan should therefore address both the
8 root cause for this event and the 2008 safety culture
9 self-assessment.

10 CNSC staff concludes that the corrective
11 action plan has identified essential elements required to
12 correct the organizational weaknesses that led to the
13 vessel leak. The plan is ambitious and it covers a broad
14 range of activities from the development of human
15 performance to new policies and implementation of best
16 industry practices.

17 For some causal factors, the CAP relies
18 heavily on the isotope supply reliability program, to
19 support some assurances of a stability, funding our
20 resources. However, the ability of these programs to
21 effectively provide the required stability and resources
22 in the long term will not be verified since it depends on
23 continued funding from the federal government.

24 As a result of this, CNSC staff recommends
25 the Commission request AECL to provide updates of the

1 details of the corrective action plan implementation every
2 six months for at least the next two years.

3 This slide provides information on the gaps
4 in the 2004 and 2005 vessel condition assessment that were
5 uncovered with the event which were initially performed by
6 AECL for the NRU re-licensing in 2005. These gaps raised
7 doubts about the validity of the other condition
8 assessments performed by AECL for this year's licence
9 renewal. For that reason, CNSC staff required AECL to
10 review all of the previous condition assessments, to
11 identify of any potential gaps that may have an impact on
12 safety.

13 AECL carried out a high level assessment
14 using the Phenomena Identification and Ranking Table,
15 PIRT, process which is based on a systematic top-down
16 approach in assessing importance of the phenomena on the
17 system and then the component -- on the component levels -
18 - and then at the likely phenomenon level. AECL's PIRT
19 looked at the risk to safety and reliable operation of NRU
20 to the year 2021.

21 CNSC staff concurs with the conclusion of
22 the PIRT process and the overall conclusion that there is
23 little impact to safety as a consequence of the gaps
24 identified in the process. However, the remaining issues
25 with respect to the shortcoming of identifies in the 2004-

1 5 assessment may have an impact on operating reliability.

2 Some of the gaps have been addressed
3 through AECL's extended activity project within the
4 current outage but AECL has committed that any remaining
5 items will be addressed in the integrated safety review
6 for licence renewal and the Isotope Supply Reliability
7 Program.

8 CNSC staff is currently performing a
9 thorough review of AECL's condition assessment under the
10 integrated safety review in preparation for the CRL
11 licence renewal next year as is considered an important
12 component for the continued operation of the NRU reactor.

13 Prior to the shutdown of the vessel leak,
14 AECL has reported high activity of fission products in the
15 heavy water and it was later found out that this was due
16 to the presence of defective fuel in the reactor. Given
17 that this is a rare event and it appeared that it was more
18 than one defective fuel element, CNSC staff required AECL
19 to demonstrate that there was not a generic problem with
20 NRU fuel and provided its assurances that the fuel loaded
21 in the reactor, irradiated or fresh, is not likely to
22 fail.

23 At this time, AECL's investigation is not -
24 - into the defective fuel is not complete and therefore
25 CNSC staff believes that AECL cannot give assurances that

1 the fuel loaded in the reactor is unlikely to fail.
2 Therefore, CNSC staff required AECL to put in place
3 additional mitigating measures.

4 In response, AECL developed the NRU heavy
5 water system high radiation identification and response
6 procedure to mitigate any impact of any future fuel
7 failures which can lead up to the reactor shutdown if the
8 failed fuel is not promptly localized.

9 CNSC staff concluded that this is an
10 important extra barrier. This procedure will reduce the
11 risk of prolonged operation of the reactor with defective
12 failed fuel precluding contamination of the primary system
13 with fission products and provides risk mitigation.
14 Ultimately this procedure will enhance workers' protection
15 and be consistent with the ALARA principle.

16 With this extra mitigation, CNSC staff
17 concurs with AECL that the risk to the health and safety
18 of workers, the public and the environment due to fuel
19 failure are acceptable. However, the risk to fuel failure
20 has not been properly addressed yet so the risk to
21 operational reliability has not been adequately mitigated.

22 In June 2010, CNSC staff performed an
23 inspection of AECL fuel manufacturing quality assurance
24 and its relation to the fuel effect investigation. The
25 results of this inspection are still being analyzed but

1 some weaknesses in the QA, quality assurance, were found
2 and AECL will need to address those to improve the fuel
3 manufacturing process.

4 The following three slides will present
5 information on the additional outage activities performed
6 by AECL that were not required for restart and are
7 presented today for information only.

8 The extended shutdown of NRU was a unique
9 opportunity to perform maintenance and other activities on
10 the reactor and its systems that are normally limited by
11 time constraints, excessive radiation fields and other
12 obstacles. The Extended Activity Project, EAP, was
13 developed by AECL to take advantage of this extended
14 outage.

15 The scope of the EAP work included a large
16 number of jobs selected by an AECL expert panel using a
17 risk-based approach applied to a list of tasks based on
18 such items like the plant life management recommendations,
19 longstanding maintenance and repair work, preventive
20 maintenance backlogs, NRU safety upgrade walk downs and
21 work identified as part of the protocol for the NRU
22 licensing activities.

23 In the time allowed, AECL completed more
24 than 75 percent of the activities initially identified in
25 the EAP.

1 On March 19th, 2010, AECL declared this
2 project closed. The remaining activities initially
3 planned under the EAP were deferred to future extended
4 shutdowns. AECL's declaration included safety and impact
5 assessment, as justification for these deferrals for
6 future outages.

7 CNSC staff concurs with AECL's assessment
8 and will be monitoring to make sure that the outstanding
9 activities are included in the future outage work.

10 Another additional outage activity
11 performed by AECL is the NRU safety upgrades walkdowns.
12 In 2006 QA audit on the upgrades, CNSC staff found that
13 some of the construction activities were not carried out
14 in accordance with the requirement of CSA 286.3.

15 One major part of the EAP project was the
16 completion of the comprehensive walkdowns of the seven NRU
17 upgrades to verify that the field installation conforms to
18 the requirements of the standard.

19 The walkdowns of all NRU upgrades were
20 completed by AECL during this extended outage and resulted
21 in numerous findings following AECL's accepted corrective
22 action program.

23 The significance of these findings were
24 classified in accordance to safety impact; again,
25 following AECL's accepted corrective action program.

1 About 150 findings were classified by AECL
2 as "must-do's" before reactors restart since they had a
3 potential impact on safety.

4 The most significant findings were missing
5 seismic analysis documentation for the new emergency core
6 cooling and the qualified emergency water supply systems.

7 AECL had to re-design the supports --
8 seismic reports. CNSC staff will verify that the seismic
9 reports are replaced before restart.

10 Two inspections based on random sampling
11 were carried out to verify completion of the work related
12 to the walkdown findings when declared completed by AECL.
13 In a few cases, CNSC staff has requested original
14 documentation to AECL to support the completion
15 declaration.

16 CNSC staff is planning a 100 percent
17 verification of all significant walkdown findings and will
18 update the Commission on future -- on the results in the
19 future.

20 At this time, CNSC staff is of the opinion
21 that AECL is on track to resolve all safety significant
22 findings prior to restart. To date, all safety upgrades
23 are installed and operational.

24 Based on the review of AECL's submissions,
25 inspections of AECL projects and discussions of technical

1 items, CNSC staff concludes that the NRU Reactor vessel
2 has been repaired as to be fit for service noting that
3 AECL has made an acceptable safety case for continued
4 operation and the vessel leak test has been performed and
5 accepted by TSSA.

6 Therefore, CNSC staff recommends that the
7 Commission approve the return to service of the NRU noting
8 that the acceptance of the final repair report by CNSC
9 staff is pending and the in-service inspections of the
10 vessel are mandatory and the first inspection must be no
11 later than nine months after the NRU restart.

12 CNSC staff also recommends the Commission
13 to request AECL to provide updates on the progress on
14 effectiveness of the organizational corrective action plan
15 every six months after the restart of the reactor.

16 This concludes CNSC staff's presentation.
17 We are now ready to answer any questions the Commission
18 may have.

19 **THE CHAIRMAN:** Thank you.

20 First of all, what I would like to do is --
21 we're going to do one round of questions then listen to
22 the interventions that were filed with us and then -- and
23 then go for another round of questions.

24 Before we start, I'd like to recognize that
25 we have some representatives from the Emergency Management

1 of Ontario, should people want to question their views
2 about the seismic event or anything else associated with
3 the emergency planning.

4 So with that introduction let me start with
5 Mr. Graham.

6 **MEMBER GRAHAM:** Thank you, Mr. Chair.

7 I'd just like to start off on a -- first,
8 on a positive note saying that I believe that AECL have
9 assembled perhaps the largest group of engineers and
10 scientists and so on to get this repair fixed and you're
11 to be congratulated for getting that done.

12 However -- and I'll say "however" -- the
13 rest of my questions are perhaps not going to be quite
14 that complimentary but I'll start off by that we heard
15 today that the vessel has been leak-tested and is ready
16 for restart.

17 We've heard from CNSC staff that the
18 repairs report by CNSC staff is still pending. My
19 question first of all to AECL is: When do you foresee
20 meeting the CNSC requirements and being able to restart
21 the reactor?

22 **MR. PILKINGTON:** This is Bill Pilkington,
23 for the record.

24 AECL has submitted the information for the
25 final repair report. I believe that was done last

1 Tuesday.

2 However, there will be time required --
3 it's quite an extensive package of documentation and there
4 will be time required for the CNSC to review that.

5 **MEMBER GRAHAM:** To CNSC staff then: When
6 do you foresee the final approval for the reactor to be
7 restarted?

8 **MR. ELDER:** So I'd just explain what we
9 mean by in terms of "pending".

10 Again, this is -- this is the written
11 documentation that everything has been done. So what we
12 do is we compare it against what was supposed to be done
13 to all their evidence that it has been done.

14 So it's a final confirmation step.

15 All the requirements are already laid out
16 in the original repair plan. The repair report just
17 demonstrates that it was done appropriately.

18 We are currently reviewing that. As Mr.
19 Pilkington said, it was sent on Tuesday, we didn't
20 actually receive the whole memory stick that it came on
21 until we actually got it in our offices on Friday. So
22 we're doing -- reviewing that right now. We figure it's
23 about a week.

24 So by the end of this week or maybe at the
25 latest early next week, we would be -- have done that

1 confirmatory review.

2 Again, it's to make sure that they've
3 dotted the t's and crossed the i's on that final repair.

4 We've seen the preliminary data. There is
5 nothing in the preliminary data that indicates a problem
6 but we are going to do a comprehensive walk-through of it
7 to make sure that everything was done that was supposed to
8 be done.

9 **MEMBER GRAHAM:** So back to AECL, you're
10 looking at probably by the end of July you would be -- the
11 reactor would be in full operation?

12 **MR. PILKINGTON:** So our current schedule
13 would have the reactor operating at high power by the end
14 of July and first delivery of isotopes.

15 **MEMBER GRAHAM:** Then, after that, you're
16 down, what? Generally, on a 30-day basis, down three to
17 four days on general maintenance; that's been the routine
18 of operating of the NRU?

19 **MR. PILKINGTON:** Bill Pilkington, for the
20 record.

21 Currently, the NRU is operating on a 28-day
22 cycle of which 23 days would be operation and five days
23 would be maintenance and testing.

24 And as said in the presentations, that will
25 now be augmented by an annual extended maintenance

1 shutdown.

2 **MEMBER GRAHAM:** And that annual extended
3 maintenance shutdown would be at about nine months or at
4 six months?

5 **MR. PILKINGTON:** So the first planned
6 shutdown will be within nine months.

7 So we would expect it will occur sometime
8 in the first calendar quarter of 2011.

9 Following that, planned outages will occur
10 on an annual basis.

11 **MEMBER GRAHAM:** Thank you.

12 And the next line of questioning is with
13 regard to -- you were before us about three years ago for
14 licence renewal, had -- did all this corrosion that we're
15 hearing about today and have heard about for the last 14
16 months, did that occur -- all occur after you came before
17 us, three years ago?

18 **MR. PILKINGTON:** Bill Pilkington, for the
19 record.

20 No, that corrosion has been progressing for
21 a number of years.

22 **MEMBER GRAHAM:** I keep a bit of a library
23 on CNSC -- on AECL appearing before us and it's quite
24 large, for different reasons: for licence renewals, for
25 other significant development reports, for other things.

1 And when you came before us with regard to
2 -- in reading back -- you came before us in renewing that
3 50 year-old reactor and so on and the robustness for
4 service.

5 I'm wondering why you hadn't done the type
6 of inspections that now occurred and caused a 14-month
7 shutdown. Why was that overlooked?

8 **MR. PILKINGTON:** Bill Pilkington, for the
9 record.

10 My review of the information and of the
11 findings of the root cause assessment that was done for
12 both the technical root cause and organizational root
13 cause would indicate that the corrosion that was occurring
14 in the vessel was not identified in the condition
15 assessment that was done for licence renewal in 2006.

16 And a part of that was that, at the time,
17 the technology did not provide for non-destructive
18 examination at the base of the vessel where the build up
19 of gibbsite -- that's the oxide of aluminum in water --
20 where the build-up of gibbsite was heavier.

21 And there was an assumption made in the
22 condition assessment that because carbon dioxide is
23 heavier than air, that the carbon dioxide concentrations
24 should be higher, lower in the vessel and, therefore,
25 there should not be a concern since measurements higher up

1 had indicated very very little corrosion of the wall.

2 So with the limitations of the inspection
3 and assumptions that proved not to be true, we ended up
4 with this corrosion going unnoticed.

5 **MEMBER GRAHAM:** Well, that's correct. Your
6 assumptions were wrong and by that -- but prior to your
7 application for renewal of the licence three years ago,
8 you did do coupon analysis, I believe, in various parts of
9 the vessel and to my knowledge, some of those coupons were
10 never examined. Is that correct?

11 **MR. PILKINGTON:** Bill Pilkington, for the
12 record.

13 So I did not bring with me experts on
14 corrosion coupons to today's hearing. And so I believe
15 that coupons were not examined at that time because they
16 were felt not to represent the conditions in the vessel.

17 **MEMBER GRAHAM:** Well, yes. But then you
18 were wrong again.

19 I'd like CNSC to comment on the fact that
20 three years ago, we issued a licence for five years on the
21 information that was provided to this Commission, on the
22 information that the reactor was fit for service for the
23 next five years, and less than two years into that
24 licence, the reactor had to be shut down.

25 Did you not get sufficient information from

1 AECL or was there some oversight on behalf of both
2 parties?

3 **MR. ELDER:** First, we did, in terms of
4 coming up to that licence renewal, ask AECL to do a
5 condition assessment of all the systems and they
6 identified 21 systems that were done. And we looked at
7 overall what they were done and the importance to the
8 safety functions in the reactor.

9 So we looked at those things in terms of
10 what risk were in gaps in those assessments -- going to
11 cause in terms of looking at the importance of this one.
12 And when you looked -- they did do an assessment of the
13 condition, as Mr. Pilkington said.

14 They did do a condition assessment of the
15 vessel. It obviously missed something, but you have to
16 look at it in terms of what the safety consequences of
17 that was, given that they detected the leak well before it
18 became a safety issue and then it had a very limited
19 safety impact because they shut down and had to fix it.
20 It had a very large operational impact on them but a very
21 minimal safety impact.

22 So again, when we're looking at it
23 from a safety point, it didn't -- and the work
24 they've done since then has not identified any major
25 gaps in their safety case.

1 **MEMBER GRAHAM:** AECL is before us today
2 giving us an update on restart. We've heard of over --
3 missed information and so other things that have led to
4 this which -- and I could ask what this last 14 months has
5 cost AECL at repairing the NRU and I will ask that.

6 But my other -- my first question is, are
7 there anything else that is being overlooked today that
8 you can assure this Commission that when you start up that
9 you will be able to get the next nine months, then a large
10 shut down, then back for the balance of the licensing
11 period?

12 Are you confident -- because I've read the
13 organizational improvements and read what your improved
14 standards, improved leadership and oversight. And, you
15 know, CNSC [sic] has been before us before with those
16 exact same words. They've been before us back in 1998-99.
17 They were back before us in 2003-2004. And they were
18 always going to do better, always going to put together a
19 better organization, always going to put together a better
20 leadership.

21 And what I want to know today is, as a
22 Commissioner and as a Commission, are we in the position
23 to be assured that these words are not just words?
24 They've got to be meaningfully put together to establish
25 credibility within AECL.

1 **MR. PILKINGTON:** Bill Pilkington, for the
2 record.

3 We've put a lot of effort in this
4 presentation this afternoon to talk about the improvements
5 that have been made and the improvements that are
6 underway.

7 In terms of the equipment, we have taken
8 advantage of this period of outage to do much more than
9 simply repair our reactor vessel.

10 We have undertaken maintenance that
11 requires the reactor defueled and drained with this
12 opportunity. In fact, we've done all outstanding
13 maintenance that requires that condition. We've done much
14 more in terms of inspections.

15 We've done walkdowns of systems to verify
16 their installation exactly meets the design. We've taken
17 the opportunity to undertake further inspections. We've
18 reviewed condition assessments. We've returned to
19 condition assessments using the PIRT process from a
20 different approach to get a second view that, in fact,
21 nothing has been overlooked.

22 And going forward, we will start up with a
23 reactor in a much better condition than it was when we
24 shut down. We will always operate the NRU safely. We
25 will not operate it in an unsafe condition, but we have

1 done more work in this outage to improve the reliability
2 going forward than simply repairing the vessel.

3 And if I just might add that we continue to
4 invest in improvement in the NRU through the isotope
5 supply reliability program. We have funding available and
6 we have a program in place whose sole purpose is to
7 improve the reliability of NRU operation, and that program
8 continues.

9 I am confident that we will operate safely
10 and reliably through the next operating interval.

11 **MEMBER GRAHAM:** Mr. Chair, I have a lot of
12 other questions, but I want to pass it on to my
13 colleagues.

14 But just one question I had -- what have
15 you -- what has this whole episode cost since last May?

16 **MR. MacDIARMID:** Hugh MacDiarmid, for the
17 record.

18 I did make a comment when I appeared before
19 the House of Commons Standing Committee just a couple of
20 months ago that still holds, which is that the total cost
21 will be in the neighbourhood of \$115 million.

22 **THE CHAIRMAN:** That's including all the
23 repair plus the extra?

24 **MR. MacDIARMID:** That's correct. I'm
25 sorry, I should clarify that.

1 That does include -- in a sense that's our
2 cash requirement, which includes foregone revenues from
3 isotope production.

4 **THE CHAIRMAN:** But ---

5 **MR. MacDIARMID:** So direct costs are about
6 80 -- about 90 million of that total.

7 **THE CHAIRMAN:** Any of these costs are also
8 towards getting the licence renewed into 2011? I thought
9 you've done a lot of additional work.

10 **MR. MacDIARMID:** That would include the
11 extended activities program component of that, which does
12 contribute to the readiness for the licence renewal.

13 **THE CHAIRMAN:** Okay. Thank you.

14 Dr. McDill?

15 **MEMBER McDILL:** Thank you, Mr. Chair.

16 I'd like to begin by acknowledging the
17 technical complexity and challenge of what's been done
18 over the shutdown period.

19 My questions, Mr. Chair, are principally
20 technical in nature and for the purposes of providing some
21 transparency to the public reviewing this document.

22 In your presentation, AECL, on page 5, you
23 show the schematic of the vessel.

24 Could you point out or tell me where the
25 lower vessel seal is with respect to that schematic so

1 that I understand the residual stress comments later in
2 the document?

3 **MR. PILKINGTON:** Bill Pilkington, for the
4 record.

5 I believe the lower vessel seal would not
6 be visible -- or actually, I guess it is.

7 If you look at the lowest point ---

8 **MEMBER MCDILL:** Maybe we could have the --
9 could we have it up?

10 **MR. PILKINGTON:** Could we put it on the
11 screen?

12 (SHORT PAUSE)

13 **MEMBER MCDILL:** It's Slide 5 -- 4 and 5.

14 **MR. PILKINGTON:** There we go.

15 Okay, we'll just leave it in that format.

16 But I think if you can put the mouse over the -- or we'll
17 get help.

18 Thank you for the help.

19 I think if you just put the mouse over the
20 -- this is the mechanical seal at the base of the vessel.
21 So you're only seeing the top portion of it, it's a
22 double-knife edge aluminium seal and there is a helium
23 interspace.

24 **MEMBER MCDILL:** And where are the bolts
25 that are referred to for that seal, roughly? I know

1 they're not on the image but can you talk to them?

2 **MR. PILKINGTON:** So I believe the bolt
3 circle actually passes through the seal but let me -- let
4 me pass that question to Randy Lesco, our Chief Nuclear
5 Engineer.

6 **MR. LESCO:** So for the record, my name is
7 Randy Lesco. I'm the General Manager of Engineering and
8 the Chief Nuclear Engineer for the site.

9 The actual bolts actually pass between the
10 two knife edges of the seal.

11 **MEMBER McDILL:** Thank you. That's helpful.

12 My next question, it relates to your Slide
13 21, but any of the ones with plates would be okay.

14 What is the material of the plates that
15 have been applied, for example, in JR13 to 17? You
16 haven't discussed the material.

17 I know what the material of the vessel is,
18 it's an irradiation hardened 5052, I believe, but what are
19 the plates?

20 **MR. PILKINGTON:** Again, I'll direct that
21 question to Randy Lesco.

22 **MR. LESCO:** Randy Lesco, for the record.
23 It's made out of 5052 aluminium.

24 **MEMBER McDILL:** So it's Virgin 5052?

25 **MR. LESCO:** That is correct.

1 **MEMBER McDILL:** Okay.

2 And the filler weld, what alloy was that?

3 **MR. LESCO:** Randy Lesco, for the record.

4 It was 4047 aluminium.

5 **MEMBER McDILL:** Is there any -- is there
6 any long-term issue with chemical corrosion or galvanic
7 corrosion between any of those materials and, if there is,
8 how would you detect it in medium to long-term?

9 And maybe staff can comment on the answer.

10 **MR. LESCO:** Randy Lesco, for the record.

11 So that assessment was done ---

12 **MEMBER McDILL:** Sorry, I can barely hear
13 you.

14 **MR. LESCO:** Randy Lesco, for the record.

15 So that assessment was done to ensure that
16 we did not have galvanic corrosion between the well fill
17 material 4047 and the 5052 aluminium.

18 **MEMBER McDILL:** And staff concurs?

19 **MR. ELDER:** Sorry, I'll ask Raoul Awad, our
20 technical lead on this one, to answer.

21 **MR. AWAD:** Raoul Awad, for the record.

22 We believe that 4047 and 5052 will behave
23 in the same manner regarding the corrosion.

24 **MEMBER McDILL:** I'm more concerned about
25 the risk of galvanic corrosion or some inter-material

1 corrosion.

2 **MR. AWAD:** We don't have any indication
3 that can confirm there could be galvanic corrosion between
4 them.

5 **MEMBER McDILL:** Thank you.

6 My next question is with respect to the
7 finite element analysis and you presented a deformation
8 map on Slide 22.

9 You removed a coupon from the vessel to
10 determine material properties but, in your finite element
11 analysis, were you able to use that coupon to develop a
12 constitutive model or to predict the high temperature
13 behaviour of the material during welding or were you able
14 to use a constitutive model and material properties from
15 other -- some other sources?

16 **MR. LESCO:** Randy Lesco, for the record.

17 So we did use some of the data associated
18 with that material properties that we measured from the
19 coupon, as well as the scoop samples.

20 **MEMBER McDILL:** So you did high temperature
21 tests on the sample to determine its yield strength at
22 welding temperatures?

23 **MR. LESCO:** So let me just step back one.
24 Randy Lesco, for the record.

25 What we did in terms of developing this

1 finite element metals or the techniques for analysing the
2 deformations, we actually did sample coupons in terms of
3 measuring the heat input prior to actually welding
4 demonstration coupons.

5 **MEMBER McDILL:** Did staff look at the
6 source of the constitutive model for these predictive
7 measurements?

8 Is an industry code used? Where did the
9 high temperature properties come from?

10 I can understand the heat input and
11 velocity coming from the test welds but the behaviour is a
12 bit more challenging?

13 **MR. AWAD:** Actually, we looked at it from
14 two perspectives: the first one is the qualification of
15 the weld itself and the second one is the final fitness
16 for service assessment will model all the stress generated
17 in the -- in the vessel.

18 But for this particular one, we didn't look
19 at it.

20 **MEMBER McDILL:** So this prediction map of
21 deflection from welding, this is one use of the finite
22 element analysis and the other one, the fitness for
23 service on Slide 29, I'll come to, this image on Slide 22,
24 you've exaggerated the deformations by 1000 times, 100
25 times, 10,000 times? It's not in the picture.

1 And what is the red spot on the left that's
2 at the opposite end of the deformation?

3 This is -- you're using this to talk about
4 the crack so it's very unclear in this map what things
5 are. Perhaps you could explain.

6 **MR. PILKINGTON:** Okay, Bill Pilkington, for
7 the record.

8 I'm just going to generally go back over
9 what this picture is describing.

10 We were aware before we completed the
11 repair at J-Rod 1317 that the welding on the left-hand
12 side, which is a large area of 3 millimetre weld build-up,
13 would result in significant deformation of the vessel.

14 And so, prior to doing the welding, we did
15 look at the expected deformation and I believe it was in
16 the order of 5 to 6 millimetres, maximum, which I think is
17 your red spot.

18 And so we made sure that our tooling would
19 be able to complete the repair with that amount of
20 deformation occurring during the repair process.

21 The significance is that there was also
22 deformation that occurred on the right-hand side of the
23 repair due to the work occurring on the left.

24 And so that deformation was, we believe,
25 the source of the cracking that occurred as that cracking

1 was not there when the repair was completed on the right-
2 hand side but was there after the complete build-up was
3 done on the left-hand side.

4 Or excuse me -- excuse me -- and the other
5 point is that I believe that the amount of deformation on
6 the right-hand side was between 2 and 3 millimetres.

7 **MEMBER MCDILL:** Thank you.

8 Does staff want to follow-up on that?

9 **MR. AWAD:** Raoul Awad, for the record.

10 I will ask Mr. Blair Carroll to comment
11 this one.

12 **MR. CARROLL:** Blair Carroll, for the
13 record. I'm a Technical Specialist with Operational
14 Engineering Assessment Division.

15 With regards to deflections of the vessel
16 wall, the licensee used laser profilometry after -- after
17 welding to measure the deflections and compare that back
18 to the behaviour predicted in the numerical models.

19 And with regards to your previous question
20 regarding the post-weld behaviour of the material, one of
21 the tests that was done beforehand was with one of the
22 scoop samples taken from the vessel to actually weld a
23 bead of -- weld a bead over top of that coupon as it was
24 contained within a larger plate of aluminium and the
25 licensee went back in after the coupon was welded and

1 looked at the metallurgy and the mechanical properties of
2 that post-welded coupon to help them predict how the
3 numerical model would behave compared to the actual welds
4 on the vessel.

5 **MEMBER McDILL:** Okay. So it would appear
6 there was some back and forth iterative development
7 between the experiments and the FEA model to get a
8 harmonized model then; is that correct?

9 Okay. Thank you.

10 My next question is with respect to Slide
11 23 which I think is the next slide actually. Thank you.

12 With respect to the red "R" in JR-23 and
13 the -- that was a flaw in the heat affected zone and
14 there's a follow-up coming.

15 What is the nature of the reportable flaw?
16 Is it a -- it's obviously not a lack of fusion, but what
17 is it? What was it?

18 **MR. LESCO:** Randy Lesco, for the record.

19 So basically it was a flaw that was
20 detected on the left-hand side, top corner of the weld
21 which was picked up by ultrasonic examination and it was
22 slightly a sub-inner surface defect roughly in the order
23 of 60 millimetres long -- or makeup of 60 millimetres
24 long.

25 **MEMBER McDILL:** How will that be

1 dispositioned in over time? What's -- it's been cleared,
2 like you're tracking it?

3 **MR. LESCO:** Randy Lesco, for the records.

4 That's correct. So it will be part of our
5 ongoing in-service inspection to monitor that indication.

6 **MEMBER MCDILL:** And staff, can you comment
7 on that please?

8 **MR. ELDER:** In terms of the disposition it
9 comes up to making sure that this becomes part of their
10 in-service inspection to go back and revisit that
11 indication on a routine basis.

12 So it may not be annually, but, you know,
13 to see if there's any growth in that crack. It doesn't
14 pose an issue right now, but it certainly is part of the
15 -- it will become part of their in-service inspection to
16 continually monitor that.

17 **MEMBER MCDILL:** And it's oriented in some
18 manner in which it won't experience any kind of crack
19 opening mode to the best of your knowledge?

20 **MR. LESCO:** Randy Lesco, for the record.

21 That is correct.

22 **MEMBER MCDILL:** Thank you. And similar
23 comments then, please, with respect to the 4-5 lack of
24 fusion. I realize again that the technical authority has
25 cleared these but how will AECL and staff monitor the lack

1 of fusion?

2 **MR. LESCO:** Randy Lesco, for the record.

3 So basically when we were designing the
4 repair we had taken into account some inefficiencies in
5 terms of the weld and so these have been demonstrated in
6 our structural assessment that some minor lack of fusion
7 is acceptable and will not increase in size during
8 operation of the vessel.

9 **MEMBER McDILL:** Staff?

10 **MR. ELDER:** Just a comment. When we're
11 looking at this one, we're making sure that none of them
12 had a potential impact on structural integrity so that
13 then they go into the ongoing monitoring program to make
14 sure that they do not get any bigger but we have no
15 evidence to support that they would get bigger than where
16 they are.

17 **MEMBER McDILL:** AECL showed us some models
18 of test welds and test combinations with considerable
19 deformation. Now I realize those are plates and they're
20 separate from the vessel and so we don't have the heat
21 sink and neither do you have the constraint that the
22 vessel applies.

23 So my concern is with all of these flaws
24 that there isn't some local bending going on. These are
25 very complex welds with multiple side-by-side passes with

1 one pass sort of heat treating the previous perhaps to
2 some extent but ultimately with large residual stresses.

3 Does AECL or does staff have a concern
4 about local bending that's happening?

5 I realize you've got a predictive FEA and
6 I'll come to the predictive FEA in a minute but I'm very
7 concerned about localized bending going on in this loaded
8 vessel. I realize the pressures are low, it's low
9 temperature, low pressure, but --- maybe AECL first?

10 **MR. LESCO:** Randy Lesco, for the record.

11 So basically to ensure that we don't have
12 an issue with respect to residual stresses or local
13 bending, part of our ultrasonic examination was to look
14 into the heat affected zone to ensure that we do not have
15 any indications associated with that issue.

16 **MEMBER McDILL:** My last question, or last
17 series of questions -- you want me to go to round 2?

18 **THE CHAIRMAN:** No, I still want somebody to
19 translate to me what this discussion was about. Somebody
20 better tell me what is the safety concern here that Dr.
21 McDill and AECL and stuff are talking about.

22 Is there any safety concern? I mean,
23 you're showing an "R" in red. It's reportable. To me
24 it's a red flag. So please explain to me in terms of
25 safety language.

1 **MR. PILKINGTON:** This is Bill Pilkington,
2 for the record.

3 And again, I won't challenge the discussion
4 that just went on but I would say that -- make the point
5 that for the areas of lack of fusion, as was stated, the
6 structural analysis of the repair took into account that
7 there would be some areas of lack of fusion and so
8 allowances were made in the structural analysis.

9 So our engineering has reviewed the lack of
10 fusion that was identified and determined that it is well
11 within the allowances in the structural analysis.

12 So our view would be that the lack of
13 fusion does not pose a safety issue. It's well within the
14 structural analysis that was done.

15 In the case of the reportable indication on
16 J-rod 23, we do not believe that that feature will grow in
17 service. The stresses in operation are essentially the
18 same as the stresses with the vessel at rest.

19 However, for that indication, we will go
20 back and re-do the NDE on it to confirm that it remains
21 the same as when it was found and so that confirmation
22 over successive inspections over successive years of
23 outage will confirm that it in fact is not growing and
24 does not present any safety hazard.

25 **THE CHAIRMAN:** Staff want to comment on

1 this?

2 **MR. AWAD:** For the record, Raoul Awad.

3 This is related to the code language.

4 There is three levels. One, what we call recordable,
5 reportable and effective flaw.

6 When you have effective flaws, we have to
7 shut down and repair. Recordable and reportable that just
8 monitor for the next inspection to see how the evolution
9 of this flaw but there is no safety significance of it.
10 It's almost safe.

11 **THE CHAIRMAN:** Thank you.

12 Dr. McDill?

13 **MEMBER MCDILL:** Thank you.

14 My last question relates to a comment made
15 in Section 4.4, the post-weld inspections, and the figure
16 on page 29, or Slide 29, which is the fitness for service
17 slide? Thank you, that's the one.

18 You have a comment in the report that says:

19 "The only area that could not be
20 inspected was the heat affected zone
21 below the wells."

22 You're developing a tool and then you

23 comment:

24 "The stress field in the vessel is
25 oriented in a circumferential

1 direction which is along the axis of
2 small cracks and the lower heat
3 affected zones so there's no driving
4 force."

5 I'm concerned again about local bending.
6 That given, looking at your before and after repair stress
7 field maps, there's no indication here of what these are.

8 Is this effective stress? Is this hoop
9 stress? Are these deformations? It says "stress fields";
10 so I'm presuming we have stresses here.

11 And in the one on the lower quadrant of the
12 image, does that finite element model take into account
13 the total new geometry of the vessel with the welded
14 plates or is it an optimized vessel geometry?

15 So there's a complex set of questions
16 there. Thank you.

17 **MR. LESCO:** Randy Lesco, for the record.

18 So what you see in the lower picture is an
19 actual model of the vessel at repair which includes where
20 we have indicated areas of wall loss from the original
21 vessel. So that is a representation of the vessel after
22 repair.

23 What you see there is basically a stress
24 field of the local membrane stresses after the repair.

25 **MEMBER McDILL:** Thank you.

1 So it includes the full geometry, all the
2 welded ---

3 **MR. LESCO:** Randy Lesco, for the record.

4 I just wonder if you could repeat your
5 question, Dr. McDill?

6 **MEMBER McDILL:** That's fine. I was waiting
7 for the discussion to -- so you've told me that includes
8 the geometry with the new plates, all the new welds
9 completely, every single one? There's no optimization
10 there?

11 **MR. LESCO:** Randy Lesco, for the record.

12 So that basically reflects the as-repaired
13 vessel.

14 **MEMBER McDILL:** Thank you.

15 And does staff want to comment on the use
16 of membrane stresses in this application? Effective
17 stress I would have thought was ---

18 **MR. CARROLL:** Blair Carroll, for the
19 record.

20 This is only one component of the vessel
21 stress analysis. We haven't received the final fitness
22 for service assessment yet but we do appreciate your
23 comments with regards to local bending stresses and we
24 expect that the laser profilometry measurements that have
25 been taken before and after welding at these locations

1 will help us determine what the bending stress components
2 are so that they can be incorporated in the fitness for
3 service assessment as well.

4 **MEMBER MCDILL:** Thank you, Mr. Chair. I
5 have only one last question and once again it's the fact
6 that we can't inspect this area and following up Mr.
7 Graham's comments, there's a certain nervousness up here
8 on the dais with respect to lack of inspection.

9 So perhaps you could comment on when will
10 the tool be developed so we can -- so there will be an
11 inspection of that area?

12 **MR. PILKINGTON:** Bill Pilkington, for the
13 record.

14 The tooling to do this inspection is
15 currently under development and we will have the tooling
16 available and the qualified procedures available to
17 complete this inspection in our first extended shutdown
18 within the first calendar quarter of 2011.

19 **MEMBER MCDILL:** Thank you.

20 And staff is satisfied that there is
21 sufficient conservatism that this lack of inspection is
22 not an issue at this time?

23 **MR. ELDER:** Yes, and that's one of the
24 factors when we came with the nine months is going back
25 and looking at all the information we had and looking for,

1 you know, obviously we are going to when we get the final
2 fitness for service reports within the three months.
3 We'll inform you if any of this changes our opinion but
4 right now we're fully satisfied with the nine months as
5 acceptable.

6 **MEMBER MCDILL:** Thank you, Mr. Chair.
7 That's all my questions for round one.

8 **THE CHAIRMAN:** Okay. Trying to get round
9 one finished before we take a break.

10 Mr. Tolgyesi?

11 **MEMBER TOLGYESI:** Merci, monsieur le
12 président.

13 When you are looking historically, leaks
14 are closely related today in NRU's history. The first
15 vessel started to leak in 1957 and then was established
16 that the cause is probably nitric acid.

17 Was this corrosion due to nitric acid the
18 main reason to replace the vessel in 1970-72?

19 **MR. PILKINGTON:** It's Bill Pilkington, for
20 the record.

21 And I believe the replacement took place
22 between 1972 and 1974 and the vessel was replaced because
23 of nitric acid corrosion.

24 There's a couple of things that could be
25 added. One is that the vessel material for the first

1 vessel was susceptible to intergranular corrosion and the
2 50-52 alloy of the current vessel is not, and in fact has
3 proven not to be.

4 And the second thing is that the inert gas
5 in the J-rod annulus CO₂ I believe was added with the
6 installation of the second vessel. So I believe the first
7 vessel had air in the space between the vessel and the
8 reflector.

9 **MEMBER TOLGYESI:** And after replacing the
10 vessel in the early seventies, leaks continued through
11 mechanical seal mainly, that's what you were saying?

12 **MR. PILKINGTON:** That is correct that leaks
13 in the reflector appeared even in the second vessel
14 within, I think, two years of it being put into service.
15 So there was a design issue with both vessels in that they
16 were susceptible to leaks developing in the reflector.
17 That would be light water leaks.

18 **MEMBER TOLGYESI:** Was the mechanical seal
19 part of this examination and what are the results?

20 **MR. PILKINGTON:** Bill Pilkington, for the
21 record.

22 Could you explain what you mean by the
23 mechanical seal?

24 **MEMBER TOLGYESI:** But you were saying that
25 there are some leaks through mechanical seal. Do you

1 still have some leaks through mechanical seal or not?

2 **MR. PILKINGTON:** Okay. Bill Pilkington,
3 for the record.

4 So the true mechanical seal, there's one at
5 the top of the vessel and one at the base of the vessel
6 and both of those have not had a history of leaks since
7 early in the installation.

8 However, the reflector has had a history of
9 leaks and these leaks have generally occurred at tubes
10 that run through the water box and into the J-rod annulus.
11 And so these tubes in the reflector have chronically
12 developed leaks and a number of actions have been taken
13 over the years to mitigate these leaks but they have not
14 eliminated them.

15 **MEMBER TOLGYESI:** You were saying that in
16 2004-2005 assessment, focus was on corrosion at the upper
17 part of the vessel where the first vessel failed. That
18 was the main reason. It was the upper part.

19 However, the leakage in the 2009
20 nondestructive examination is concentrated on the bottom
21 300 millimetres of 9,000 because it's nine metres height I
22 think.

23 How could you explain that this wide gap in
24 2004 assessment and what we find in 2009 because it's the
25 kind of what we were saying that's supposed to be? In

1 2004, we said it's supposed to be on the upper part the
2 corrosion and what we find that it's quite worse, much
3 worse and it's in the bottom part, which we did not expect
4 probably, or did you?

5 **MR. PILKINGTON:** So Bill Pilkington, for
6 the record.

7 From the best of what I have learned that
8 the original vessel failed I believe at the bellows. I
9 think there's a couple of expansion bellows partway up but
10 generally in the higher level or higher elevation of the
11 vessel. I believe those were the areas that were most
12 subject to corrosion on the first vessel and so in the
13 inspections done in 2004-2005, that area was the focus of
14 those inspections.

15 After the leak occurred in May 2009, we did
16 do a very thorough inspection at the base of the vessel
17 which before wasn't possible. So we have a very accurate
18 map of the lower portion of the vessel, the lower 300
19 millimetres.

20 We also did samplings of wells higher up in
21 the vessel and other areas higher up in the vessel
22 including these bellows. So we have done, on a sampling
23 basis, a broad examination of the vessel. However the
24 focus here has been on the area that has shown corrosion
25 and that was the cause of the vessel leak.

1 **MEMBER TOLGYESI:** What you are saying you
2 are mainly examining -- visual examination and non-
3 destructive examination of 300 millimetres, except of six
4 vertical welds which you scan from bottom to the top or
5 from top to the bottom.

6 **MR. PILKINGTON:** Yes, so I can confirm that
7 we did do further NDE inspections of the vertical welds in
8 the vessel, and we did do vertical strips over the length
9 of the vessel, but I cannot confirm how many we did.

10 **MEMBER TOLGYESI:** What you are saying on
11 page 35, "Phase 3, six vertical scans were conducted from
12 the top of the vessel to the bottom circumstantial weld
13 using phase RAUT." So there were six at least.

14 **MR. PILKINGTON:** Okay, the consensus of
15 recollection is six, but I don't have that as a fact.

16 **MEMBER TOLGYESI:** And do you have any
17 results of these scans?

18 **THE CHAIRMAN:** Mr. Elder?

19 **MR. ELDER:** I won't guess -- of the six.
20 My recollection is it was six as well, but one of the
21 things that was very important for us is they repeated
22 some of the scans they had done in 2004 and 2005, so we
23 could see that there was no degradation between those two
24 scans.

25 So again, that confirmed that there's not

1 something active happening in the rest of the vessel, only
2 at this corrosion at the bottom. Which was not because of
3 limitations to tools and the time they had to look at was
4 not identified in that 2004-2005 scan.

5 So it was very important that -- for us,
6 they did two things that were very important. They
7 repeated scans, so they have data from 2004-2005 and again
8 in 2009, and they looked at the welds. There are a number
9 of vertical welds in the vessel, and they looked at those
10 vertical welds as well, which were -- again, because they
11 were a weld, they could be potentially susceptible to a
12 different corrosion.

13 And again, there was no -- there was just a
14 very minimal -- I say very minimal corrosion -- within the
15 technique you'll get, it's greater than seven millimetres,
16 between seven and eight, eight being the -- within the
17 uncertainty and the technique there's full wall.

18 **MEMBER TOLGYESI:** So you were too fast for
19 me because I was asking for results. I couldn't find it.

20 You were saying that in Phase 4 that
21 examination -- you did examination on the walls behind the
22 baffle blocks in the Figure 2.2, but I cannot find; where
23 is this baffle blocks, what you call them?

24 **MR. PILKINGTON:** It's Bill Pilkington, for
25 the record.

1 It shows quite well on one of the early
2 slides, I think about the third or fourth slide in.

3 **MEMBER TOLGYESI:** Yes.

4 **MR. PILKINGTON:** So we're working on the
5 mouse, so that the structure that you see that is angled -
6 --

7 **MEMBER TOLGYESI:** Yes?

8 **MR. PILKINGTON:** --- is a baffle block.

9 **MEMBER TOLGYESI:** Okay.

10 **MR. PILKINGTON:** I believe it's a heat
11 shield in order to reduce radiation heating of the
12 material behind it.

13 Oh yes, so the Phase 4 inspection, we had
14 to design a probe that had a geometry low enough profile
15 to be able to scan behind the baffle block.

16 **MEMBER TOLGYESI:** And at page 3.7, you are
17 saying that, "these examinations..." -- you were enumerating
18 them -- "...did not reveal any abnormal thinning in the
19 vessel walls."

20 What's abnormal and what's normal?

21 **MR. PILKINGTON:** It's Bill Pilkington, for
22 the record.

23 I have a limited technical capability to
24 answer that question, but I am aware that on the Phase 4
25 scans, there was a significant amount of indication that

1 was due to the original welds in the vessels. And so in
2 the data that was taken, the analyst had to look, take
3 into account the -- what they were seeing from the
4 original welds in the vessel and look for abnormalities.

5 We were really looking for wall thickness
6 and for significant changes in wall thickness, and we
7 identified none at those lower elevations.

8 **MEMBER TOLGYESI:** And just one in this
9 round, you were talking about thickness of the scoops
10 which were from 0.36 to 3.43 millimetres; 3.43 over 8 is
11 about 42 percent. It's quite thick, scallop sample.

12 **MR. PILKINGTON:** It's Bill Pilkington, for
13 the record.

14 Yes, I believe those would be the depth of
15 the depressions that were produced when the scoops were
16 removed. So the scoops themselves, the samples were
17 thinner by the width of the blade that had to cut them.

18 Now those scoops were taken, there was
19 actually -- they were taken from areas of full wall of the
20 vessel. And so because of the benign shape of the scoop
21 and because of the wall thickness where they were taken,
22 there was adequate structural strength and corrosion
23 allowance remaining after the samples were taken.

24 **MEMBER TOLGYESI:** And you know when you are
25 looking -- I don't know what was the figure -- it's 4.1.

1 It was in a -- you know, you were showing the spots where
2 you were welding. These 10 -- here, Slide 15.

3 When you are looking at these colour codes,
4 you know, when you were showing these 10 places where you
5 were welding, there are some next to JR-30, which is close
6 to similar colour as the JR-30, if you consider was the
7 thickness. And why you didn't do any work there?

8 It's similar to the left on -- the JR-13/17
9 is a spot. Are some reasons why you didn't do welding
10 there or it's eventually a potential of leakage or
11 corrosion?

12 **MR. PILKINGTON:** So the strategy was to do
13 repairs in areas that, through the structural analysis,
14 would not meet structural requirements plus corrosion
15 allowance or that had a leak existing.

16 So in JR-41 where we had both, a leak and a
17 coupon removed, the repair was obvious.

18 But when you look at some of the other
19 areas, unfortunately, the strips are not blown up that
20 large, but you may see very small areas of very deep
21 penetrations.

22 As I showed in the samples that I had, the
23 general scalloping that occurred from the general
24 corrosion mechanism really was an issue in few sites. The
25 other issue of deep pockets or deep penetrations was, I

1 guess, the main reason for needing to do repairs.

2 So when you look at those sites, every area
3 that we did not repair has sufficient material for
4 structural -- to meet structural requirements and to have
5 an adequate corrosion allowance.

6 And so the mitigating strategies that we're
7 taking to arrest corrosion will prevent those from ever
8 reaching the point of requiring repair.

9 **MEMBER TOLGYESI:** My last is just -- tell
10 me in the future -- now, you have all these technologies
11 to measure the thickness -- what is the minimum thickness,
12 what you will reach, you will act to make sure that the
13 vessel is safe; six, four, three millimetres?

14 **MR. PILKINGTON:** Bill Pilkington, for the
15 record.

16 I believe that the minimum thickness is not
17 an absolute but is a function of the stress at every
18 location on the vessel.

19 So we will take measurements of the wall
20 thickness going forward, and we would put those into our
21 stress analysis to determine that we still have full
22 structural integrity and sufficient corrosion allowance
23 for whatever the next operating interval would be.

24 **MEMBER TOLGYESI:** Okay, thank you.

25 **THE CHAIRMAN:** Dr. Barriault?

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

2 First of all, I would like to comment also
3 really on the fact that it's been a very interesting,
4 fascinating engineering process for me to follow during
5 the repair of this vessel.

6 However, I often wonder really whatever
7 happened to the person that you had responsible for
8 corrosion management. Does that function still exist?

9 I understood from previous presentation
10 that you had a person responsible for monitoring the
11 corrosion in this vessel during its operation; is that
12 correct?

13 **MR. PILKINGTON:** Bill Pilkington, for the
14 record.

15 That would not be entirely correct, and one
16 of the challenges we faced as an organization is accepting
17 conditions, equipment conditions, that really should be
18 brought to the attention of the organization.

19 And so we have world-class corrosion
20 experts and we've in fact brought them into play in
21 dealing with this issue. However, the people that had the
22 corrosion knowledge and understood the consequences didn't
23 have the information to tell them that there was a
24 corrosion issue in the vessel.

25 **MEMBER BARRIAULT:** So -- I'm sorry.

1 **MR. PILKINGTON:** I would just say that the
2 staff who were working with the vessel didn't recognize
3 the risk that this corrosion presented.

4 **MEMBER BARRIAULT:** So were these people
5 involved before this problem, or after the problem
6 appeared?

7 **MR. PILKINGTON:** So our corrosion people
8 would have been involved in the condition assessment that
9 was done in 2004-2005. I believe they have not been
10 involved in general ongoing corrosion monitoring in the
11 vessel that contributed to the condition assessment that
12 was done.

13 **MEMBER BARRIAULT:** With the change in
14 management culture, do you see an involvement of these
15 people at the onset?

16 **MR. PILKINGTON:** So the organization that
17 we are moving to is one where our operating and
18 maintenance staff will not accept low standards of
19 equipment condition and where anything that appears to be
20 of a low standard will be raised to the attention of the
21 organization for disposition.

22 And that's the way that the people who
23 understand the science of the corrosion will be brought
24 into the loop as a part of the overall health monitoring
25 of the NRU systems.

1 **MEMBER BARRIAULT:** If I can -- I'm sorry.

2 If I can ask the same question of the CNSC
3 staff -- are you comfortable that all of the reactor
4 vessels out there do not have corrosion problems?

5 **MR. ELDER:** In terms of this type of
6 corrosion, you've got to understand this is a research
7 reactor. It's actually a unique research reactor in terms
8 of having aluminum vessel.

9 **MEMBER BARRIAULT:** I understand that.

10 **MR. ELDER:** Yeah.

11 **MEMBER BARRIAULT:** But there are other
12 vessels out there.

13 **MR. ELDER:** There are other vessels out
14 there and they -- I'm going back into the power reactor.
15 They're much more -- they've always had more defined
16 inspection programs based on the higher risk systems, the
17 high-pressure systems and high-pressure, high-temperature
18 systems.

19 And as I said there has been a structured
20 program. If there has been a -- from our perspective on
21 this one is how you translate those down into a low-
22 pressure system. We're looking at -- you know, certainly
23 we've figured out how NRU going forward has to have in-
24 service inspection.

25 What we're looking at what does this mean

1 for other systems. We have no other reactors. We have no
2 indication of a problem but in general how would you
3 approach it differently so you would not develop this
4 problem in another one. So we are looking at that.

5 **MEMBER BARRIAULT:** Okay. So what I'm
6 hearing then is that you're not completely comfortable at
7 this point but you're going to look into it.

8 **MR. ELDER:** We are comfortable where we are
9 but we want to make sure that we don't end up down this
10 road 10 to 15 years in the future with something else.

11 **MEMBER BARRIAULT:** Thank you.

12 My next issue to the CNSC staff is with
13 Slide 19. It's mentioned -- and you don't have to look it
14 up -- what it mentions in there is that there was no
15 safety issue to the public with this reactor and I would
16 like to beg to disagree with that.

17 And the reason why I disagree is because I
18 think that the shut down of isotope production created a
19 safety issue with the public in Canada and internationally
20 for that matter. But we won't belabour that one.

21 A few medical questions really -- during
22 the repair of the vessel, did you have any work-related
23 injuries or lost time injuries?

24 **MR. PILKINGTON:** It's Bill Pilkington, for
25 the record.

1 And we did have -- we have had lost time
2 accidents on site. I believe over the space of the outage
3 we have had a total of four. I'm not pleased with that as
4 our record of performance. However, I would point out
5 that as a site, our lost time accident rate actually
6 decreased in the past year over the prior year. But
7 again, we're continuing to focus on safety and improving
8 that record.

9 **MEMBER BARRIAULT:** So we did have some
10 safety issues to the public, I guess, or to the workers,
11 for that matter.

12 And the next point really is that you
13 mention that you're going to have isotope production in
14 early July. Do you have a date on that, or am I wrong in
15 assuming this?

16 **MR. PILKINGTON:** I'm sorry. We were saying
17 that we expect to ship isotopes by the end of July.

18 **MEMBER BARRIAULT:** By the end of July.
19 Okay.

20 On that same point, the cost to repair is
21 150 million, if I understand correctly a while ago. Will
22 that cost be passed on to the health, I guess, management
23 of this country with the increase in costs for isotopes or
24 will you just absorb that cost?

25 Or is that confidential information?

1 I don't want to get into ---

2 **MR. MACDIARMID:** Hugh MacDiarmid, for the
3 record.

4 Basically we're -- we have a combination
5 here of a commercial revenue stream from the sale of
6 isotopes ---

7 **MEMBER BARRIAULT:** Exactly.

8 **MR. MACDIARMID:** --- and we forego that --
9 we have foregone that for the past year and it will be
10 resumed.

11 But we simply bring those revenues in as
12 part of our normal commercial arrangements, commercial
13 contract, and then when it comes to unanticipated
14 expenditures such as this, we do need to seek additional
15 funding from the government which is done through the
16 annual cycle or supplements as necessary.

17 So it will -- the additional costs that
18 were not built into our original plans are indeed being
19 borne by the government.

20 **MEMBER BARRIAULT:** So I guess what I'm
21 hearing is that we're not operating on a cost-recovery
22 system. We're operating on a subsidized system to the
23 health industry, no? Am I correct?

24 **MR. MACDIARMID:** I think I'd -- rather than
25 judging it I'll simply say that we operate within our

1 contract and the contract does provide for the recovery of
2 some of our costs. But again we've been rather clear that
3 if you were to look at the full costs of producing
4 isotopes, they're substantially greater than the revenues
5 we generate.

6 **MEMBER BARRIAULT:** Okay. And I guess I'm
7 not going to ask if in the future you want to change that.
8 I'll leave that alone.

9 Next question really -- the repair to the
10 vessel. What do you think is the life expectancy of this
11 or do we know at this point? Or perhaps it's all unknown
12 at this point.

13 **MR. PILKINGTON:** It's Bill Pilkington, for
14 the record.

15 And so we have provided a repair that meets
16 the structural requirements and provides for some
17 corrosion allowance. And so our success at fully
18 arresting corrosion essentially will determine the life of
19 the vessel.

20 So we believe that through the mitigating
21 strategies that we have in place and the additional
22 strategies which we will be implementing, we will be able
23 to show the vessel fit for service through its expected
24 life.

25 **MEMBER BARRIAULT:** And what is the expected

1 life?

2 **MR. PILKINGTON:** So the target in the
3 repair program was to assure a vessel life beyond 2016,
4 likely out to beyond 2021.

5 **MEMBER BARRIAULT:** Okay, so we're looking
6 at about another 10 or 11 years, I guess. Yeah.

7 We mentioned earlier that you were going to
8 look at sacrificial aluminum coating to prevent, I guess,
9 galvanic action in the future or to prevent problems with
10 corrosion. Do you care to expand a little more on that?
11 How do you propose to do that? Is it a lining that's
12 going to be placed inside the vessel or is it just paint,
13 or what is it?

14 **MR. PILKINGTON:** Okay. It's Bill
15 Pilkington, for the record.

16 And so cold spray is a technique by which
17 essentially pure aluminum is sprayed in very fine
18 particles at very high velocities, I think using helium as
19 a carrier gas. And it actually mechanically welds to the
20 surface that it's sprayed on.

21 And so we actually just completed within
22 the last week a factory acceptance test of a process that
23 proved very very positive. It's able to apply coatings up
24 in the range of three to four millimetres onto a wall with
25 good adhesion and provide excellent coverage. So we see

1 this as a very likely -- a good candidate for part of our
2 mitigation program going forward.

3 **MEMBER BARRIAULT:** Thank you.

4 That's all for now, Mr. Chairman. Thank
5 you.

6 **THE CHAIRMAN:** Thank you.

7 Just a couple of observations. First of
8 all, the one thing that really surprised me that -- to
9 learn that there was not an extending shutdown since 19 --
10 a planned extended shutdown since 1991, if I got it right,
11 which the two organizations -- I cannot understand how
12 that was allowed to go on because I thought you do need
13 some relief from operational pressures to take like a very
14 good look, in a more fundamental way at the vessel.

15 And I'm happy to see that, from now on,
16 it'll become a general practice which I assume was a good
17 management practice to all nuclear kind of facilities
18 internationally.

19 Am I -- am I correct about that?

20 So you care to comment on this, AECL?

21 **MR. PILKINGTON:** It's Bill Pilkington, for
22 the record.

23 And so it is normal nuclear utility
24 practice to take shutdowns on some period and, in fact,
25 nuclear utilities are finding that they can extend their

1 operating intervals between shutdowns.

2 However, there does normally need to be a
3 maintenance shutdown and one that allows for the
4 implementation of improvements to the plant on some
5 frequency.

6 And so, operating the NRU on the cycle I
7 believe that was actually a shorter cycle than 28 days
8 some years ago but this allowed for only very short
9 intervals to carry out maintenance and inspection.

10 So certainly, as the NRU has aged, the
11 benefit from taking extended shutdowns on some frequency
12 has also increased and so we see that as the optimum path
13 for safety and reliability going forward.

14 **THE CHAIRMAN:** I understand you -- it's
15 just probably a situation where the isotope production,
16 pressures, may have driven -- I think, I'm guessing, may
17 have driven you guys to try to do everything within five
18 days but I'm surprised that the regulator, us, didn't
19 insist on a little bit more extended shutdown so you can
20 take a look at a more profound way at the systems and
21 what's wrong with them.

22 So I don't know if you care to comment on
23 that: do you?

24 **MR. JAMMAL:** If you want me, sir, I will
25 comment.

1 It's Ramzi Jammal, for the record.

2 The safety is our responsibility, the
3 operation is the responsibility of the operators. So as
4 long as there were no indications with respect to the
5 safety and the corrective action plan that was done with
6 respect to the self-assessment conducted by AECL and the
7 inspection that we've carried out ourselves with respect
8 to corrective action plan that highlighted exactly to what
9 you were saying, that the isotope production trumpeted any
10 of the operation's perspective.

11 But we lived through the safety components,
12 the verification of safety and were able to manage with
13 respect to the balance, the fact of the isotope production
14 and the safety.

15 **THE CHAIRMAN:** Thank you.

16 We've moving to a little bit more positive
17 thing. I'm still amazed at the technology that AECL
18 developed and, in fact, my question is now you have now
19 developed the capacity to fix this vessel forever and
20 ever.

21 What is the meaning of "end of life" here
22 if you can actually keep welding?

23 I'm sure Dr. McDill will have a point of
24 view on this. There must be a limit somewhere but, I
25 mean, what is the limit if you can actually keep on fixing

1 it?

2 And if you are able to actually do the
3 fixing from outside, you don't even have to drain this
4 machine, so what is the meaning of how long you can keep
5 the machine running?

6 **MR. PILKINGTON:** It's Bill Pilkington, for
7 the record.

8 And I might just go back because I didn't
9 mention when I spoke of cold spray that that would be
10 applied to the outside surface of the vessel from the J-
11 Rod Annulus.

12 I guess the challenge here is that it would
13 not be cost-effective to remove the fuel and the heavy
14 water from the vessel on a periodic basis to do more
15 extensive repairs. And, with the stresses induced in the
16 vessel, there certainly are limits to the amount of repair
17 that can be done.

18 So first of all, I don't believe the vessel
19 has an infinite life. I believe that we can show it fit
20 for service for many years into the future.

21 But the other thing is that -- that NRU is
22 now, I think a 53 year-old reactor and so there's more
23 maintenance required, there's more obsolescence issues to
24 be faced, there's more gaps between current standards that
25 need to be addressed.

1 And so, in licence renewal, we're investing
2 in assessing the improvements that will -- need to be made
3 in the next licence interval and there will be significant
4 cost involved in making those improvements.

5 So at some point in time, you know, the
6 investment required to continue to operate would exceed
7 that, that would be -- make good business sense, I guess.

8 **THE CHAIRMAN:** My last question then, it's
9 -- I think I asked you that question previously: So you
10 stand by your decision about not replacing the vessel but
11 rather keep on repairing it?

12 **MR. PILKINGTON:** So I have heard from some
13 quarters the question raised on whether it would have been
14 a better strategy to replace the NRU vessel with a new one
15 and the main driver for the strategy that was taken was to
16 minimize the duration that the NRU was unavailable for
17 isotope production.

18 So we will have been out of service for 13
19 to 14 months by the time we return to isotope production
20 and the time to acquire and install a new vessel would
21 have been in the order of 48 months or more.

22 So the real driver for that decision was to
23 minimize the time that NRU was unavailable as opposed to
24 looking for a solution that would allow for the longest
25 life extension.

1 **THE CHAIRMAN:** Thank you.

2 I think this is a good time to take a break
3 for about 10 minutes -- until 5:30.

4 Thank you.

5 --- Upon recessing at 5:17 p.m.

6 --- Upon resuming at 5:32 p.m.

7 **THE CHAIRMAN:** Okay, we are now moving to
8 the interventions.

9 We have one oral presentation and three
10 written submissions, so I would like to start with the
11 oral presentation by the Canadian Nuclear Workers' Council
12 as outlined in CMD 10-H12.2.

13 And I understand, Mr. Shier, you're going
14 to make the presentation. Please carry on.

15

16 **10-H12.2**

17 **Oral presentation by the**
18 **Canadian Nuclear Workers' Council**

19

20 **MR. SHIER:** Thank you.

21 For the record, my name is David Shier; I'm
22 the President of the Canadian Nuclear Worker Council and
23 with me today is Mr. Gabe Peplinski and Mr. Gordon Tapp.

24 Mr. Peplinski is a representative from the
25 Power Workers Union at AECL's Chalk River site and

1 represents the operators and Mr. Tapp is the President of
2 the Chalk River Technician and Technologists Union; and
3 both Mr. Tapp and Mr. Peplinski both actually worked on
4 the repairs at the NRU.

5 The Canadian Nuclear Workers' Council is a
6 council union to represent members working in the Canadian
7 nuclear industry and the majority of the union at AECL are
8 members of the council.

9 I should point out that the other unions at
10 Chalk River Laboratories have had input into our
11 submission and are in full support.

12 Our presentation will be non-technical but
13 we believe that is important that the Commission and the
14 public hear the views of the workers that were involved in
15 this endeavour over the past 14 months.

16 And we are here today to request support
17 for AECL's request to restart the NRU Reactor and our
18 presentation will be brief.

19 Workers at AECL/Chalk River have naturally
20 been fully engaged in the rehabilitation of the NRU.
21 During the past 14 months of work at this site, I've had
22 many challenges, changing work environments, et cetera
23 during this project.

24 Many workers were brought in from other
25 facilities on-site to assist the NRU work and this created

1 a need for training and safety orientation for many of
2 these workers. Many workers required many additional
3 hours to complete this work.

4 Fortunately, during this period, there were
5 -- or unfortunately, there were four lost time injuries
6 but only two of them would be related directly to the
7 actual NRU rehabilitation.

8 During maintenance and repair at nuclear
9 facilities, there is a tendency that worker radiation dose
10 increase. During the NRU work, no worker received a dose
11 above the regulatory limit.

12 It needs to be pointed out that workers at
13 Chalk River have been under an extreme pressure during
14 this period. There was the issue of concerns for their
15 livelihood as well as the fact that NRU and medical
16 isotopes have and are still big news. The public is now
17 aware of the location of the Chalk River Laboratories and
18 these workers have been required to answer many questions
19 from family, friends and the public.

20 Union leaders from Chalk River are
21 constantly being asked questions at labour events that
22 they attend, and their answers to these queries were
23 always optimistic that the NRU would be repaired and would
24 return to service.

25 The workers at Chalk River live with their

1 families in the vicinity of the facility, and you can be
2 assured that if there were any safety issues in regard to
3 the NRU, that the on-site unions would bring them to the
4 forefront.

5 The workers at the Chalk River site are
6 very proud of their work in the repairs of the NRU over
7 the last 14 months. The Canadian Nuclear Worker Council
8 is of the opinion that the repairs to the NRU are complete
9 and AECL meets all requirements for the reactor to be
10 operated safely.

11 We therefore urge the Commission to approve
12 the start-up of the NRU as requested. We will naturally
13 be happy to answer any questions you may have. Thank you.

14 **THE CHAIRMAN:** Thank you. The floor is
15 open. Questions? Mr. Graham?

16 **MEMBER GRAHAM:** We heard from AECL's
17 presentation that there have been improved standards of
18 operation in the last year. Would you mind giving us an
19 overview of what those improved standards have been in
20 operation at AECL?

21 **MR. SHIER:** I'll ask Mr. Tapp or Mr.
22 Peplinski to -- and they are right from the site to
23 comment on that.

24 **MR. PEPLINSKI:** For the record, Gabriel
25 Peplinski.

1 Training is ongoing. There's training to
2 re-introduce us to courses and jobs we haven't done since
3 we've been shut down. Ongoing new programs are trained
4 up. It seems like, not in a bad way, but we're always
5 shuffling our staff around in the training courses, so we
6 can get the training done as well as do the work; so it is
7 an ongoing process and it's very intense.

8 **MEMBER GRAHAM:** Can you give us a little
9 overview of those new programs that you refer to of what
10 new programs have been initiated and also what
11 improvements have also been done with regard to leadership
12 and oversight?

13 **MR. PEPLINSKI:** The event-free tools have
14 been introduced in the past couple of years and a
15 refresher periodically is a standard. Radiation
16 protection courses too for all the non-radiation workers,
17 so we can monitor situations ourselves a little more
18 closely. Just normal training and safety is part of the
19 regimen as well now.

20 **MEMBER GRAHAM:** Were radiation production
21 courses not in place before?

22 **MR. PEPLINSKI:** We were -- had Group 3
23 training but now there are certain parameters that we can
24 do on our own in a Group 2 course. So up to a certain
25 level, we can monitor ourselves, monitor the work station

1 and if it's above that, then we have to get radiation
2 protection support to help us.

3 But it streamlines the process a bit
4 because if there's certain jobs that past practice shows
5 that they're not rated really high contamination areas, we
6 can go ahead and do them without slowing the worker,
7 drawing people from other work areas.

8 **MEMBER GRAHAM:** Have you seen a change in
9 the resources with regard to program improvements?

10 **MR. PEPLINSKI:** The dose rate is down per
11 year. We have tritium masks for work in our rod bays, our
12 tritium dose intake is down. We're working on rod bay
13 improvement. We have meetings ongoing about that in order
14 to clean it up to make it -- that was one of the major
15 dose areas before.

16 There was very little dose actually taken
17 by anybody on top of the reactor because all of the
18 reactor was de-fuelled and if we were over on an open
19 position, there was a beam. But other than that, it was a
20 very, very clean area and periodically it was wiped up and
21 mopped by RP support.

22 **MEMBER GRAHAM:** In AECL's presentation they
23 talked about reinforcing strong organizational behaviours
24 that, e.g., questioning attitudes, et cetera. Had there
25 been a problem with regard to attitudes in the past?

1 **MR. PEPLINSKI:** Not so much a problem but
2 maybe more complacency by the workers somewhat. I don't
3 want to pick on us, but we just got a reinforcement that
4 we, you know, we have to -- continually upgrade ourselves
5 as well and be aware of what goes on around us a little
6 more.

7 **THE CHAIRMAN:** Just on that point, there is
8 no -- let me use maybe indelicate language -- there's no
9 fear about reporting something that workers feel should be
10 reported and fixed or taken up the line?

11 **MR. TAPP:** For the record, I'm Gordon Tapp.

12 Right now, we have a process in place
13 called the impact system where if somebody sees something
14 that's out of the ordinary, whether it's safety related or
15 not, they can immediately put this into the system and
16 it's brought to attention of the appropriate management,
17 and management reviews it and then it's brought up the
18 line.

19 If it's of safety concern, of course, the
20 Site Safety and Health Committee, which is run jointly by
21 management and union, is always there where these issues
22 can be brought up and there's been no retribution. I
23 don't think there's any fear of retribution to bring any
24 important item of significance up.

25 **THE CHAIRMAN:** Thank you. Dr. Barriault?

1 **MEMBER BARRIAULT:** Over the last year or
2 two, have you had any work stoppage for what's considered
3 an unsafe worksite?

4 **MR. TAPP:** For the record, Gordon Tapp.

5 No, I don't believe we have any records of
6 work stoppage or work refusals that have been brought
7 forward to the Site Safety and Health Committee.

8 **MEMBER BARRIAULT:** Would these four work
9 related injuries that you've had on shutdown, and I don't
10 want to get into personal medical history, but is there
11 anything that could have been done to prevent these
12 injuries?

13 **MR. TAPP:** For the record, Gordon Tapp.

14 For two of these injuries, I was actually
15 the Site Safety and Health Committee person that
16 investigated it for the Hazardous Occurrence and Injury
17 Report. For a lot of them it's attention to detail; you
18 know, you saw the pictures of how congested the top of the
19 reactor was. One of the injuries happened up there where
20 a person twisted her ankle. It's as simple as that. And
21 it's just because it's a little bit of a hazard. I know
22 when I went up to investigate it, you had to step-stone
23 around things.

24 And the other injury that I was aware of,
25 down the rod bays again, it was a moment of inattention

1 and people made assumptions. A minor injury occurred but
2 overall usually the level of awareness once these things
3 happen is raised and factors put in to mitigate future
4 incidents.

5 **MEMBER BARRIAULT:** Thank you, Mr. Chairman.
6 Thank you.

7 **THE CHAIRMAN:** Thank you very much.

8 The next intervention is a written
9 submission from Ms. Darlene Buckingham as outlined in CMD
10 10-H12.3.

11
12 **10-H12.3**

13 **Written submission from**
14 **Darlene Buckingham**

15
16 **THE CHAIRMAN:** Any questions? No question?
17 Okay, I'll have a little kind of observation.

18 On the second page, this is really
19 something that I'm sure maybe, Dr. Barriault, you'll have
20 a view on.

21 The second paragraph it starts,

22 "Now what about radioactive isotope
23 used for medical purposes? This has
24 been blown up and distorted by the
25 medical profession as saving lives."

1 You want to say something?

2 **MEMBER BARRIAULT:** I think you're asking me
3 a question; are you? Yes.

4 **THE CHAIRMAN:** What I'd like to hear is
5 AECL. Would you like to react to this?

6 **MR. PILKINGTON:** Bill Pilkington for the
7 record.

8 And no, Dr. Binder, we do not have a
9 comment on that.

10 **THE CHAIRMAN:** Anybody else has any other
11 observation or question?

12 Okay, thank you.

13 The next submission is a written submission
14 for Ms. Jennifer Tsun as outlined in CMD 10-H12.4.

15

16 **10-H12.4**

17 **Written submission by**

18 **Ms. Jennifer Tsun**

19

20 **THE CHAIRMAN:** Mr. Graham.

21 **MEMBER GRAHAM:** A couple of questions and I
22 know one of them was answered already today with regard to
23 after the earthquake inspection. And I guess the
24 intervenor on the top of page three brought up the subject
25 of spent fuel dry storage silos and dry casts. And you do

1 have a lot of tile holes with storage -- tile storage, I
2 believe -- on site.

3 Have those been inspected also after the
4 earthquake to see that there was no damage?

5 **MR. PILKINGTON:** It's Bill Pilkington, for
6 the record.

7 And our waste management areas were
8 inspected following the earthquake and no damage or
9 abnormality was identified.

10 **MEMBER GRAHAM:** So not only -- we're not
11 only talking about the reactor; we're talking about all of
12 the facilities on site whether it be storage tanks,
13 underground storage of waste, and so on. Those have all
14 been inspected?

15 **MR. PILKINGTON:** Bill Pilkington, for the
16 record.

17 And that is correct. There was a broad
18 inspection of all of the facilities at the Chalk River
19 site carried out.

20 **MEMBER GRAHAM:** The only other question I
21 had with regard to -- and it was with regard to
22 earthquakes and so on and you gave the observation
23 somewhere that -- and I had it somewhere here with regard
24 to the size of an earthquake and what the readings were on
25 site and so on.

1 And the largest it's been or the plant has
2 been designed for, I believe, .24 if I have that correct?
3 And the largest that's ever been in that vicinity was a
4 .25? Am I correct on that or I find my notes here
5 somewhere.

6 Would you like to comment on that with
7 regard to the size of a seismic event?

8 Yes, the plant was built to a seismic event
9 of .24 Gs. At Chalk River, the last one that we just had
10 the other day was a .006 G measurement at Chalk River, but
11 there has been no historic record in that area of more
12 than .07.

13 But they are -- the design is -- pardon me,
14 the earthquake at the epicentre was a .14, I believe, in
15 Quebec where the epicentre was, which is significantly
16 higher than Chalk River. But you go on to say that no
17 historic observations of an earthquake in the vicinity of
18 Chalk River of that magnitude -- but there have been up to
19 .25. And in it's 1 in 1000 years it would be a .25 -- I
20 believe that's what you're saying.

21 My question would be -- is 1 in 1000 is
22 significant. It's a long time away but as my colleague
23 always uses the comparison, the Ocean Ranger was 1 in 1000
24 also. And it happened. So I'm just wondering about -- if
25 the epicentre was right at Chalk River and it was a .25, I

1 know you have automatic shut downs, but what damage would
2 that cause to the reactor?

3 **MR. PILKINGTON:** It's Bill Pilkington for
4 the record.

5 And I do not have very strong knowledge on
6 either the seismic history in the Chalk River area or the
7 details around the seismic design. So I do know that
8 there has never been an earthquake in that area recorded
9 near the design basis of .25 G and that is the earthquake
10 that the plant was designed to.

11 And so under that condition I believe that
12 the plant would be safely shut down and that the fuel
13 would be cooled essentially indefinitely. I do not
14 believe that one could conclude that the structures would
15 remain operable as a reactor going forward. But the plant
16 would be in a safe state following a seismic event of that
17 magnitude.

18 By the way, I appreciate that you corrected
19 the fact that the seismic activity on the recent
20 earthquake was .006 G. When I was making my presentation
21 I left out a zero.

22 **MEMBER GRAHAM:** Correct -- 006 is what it
23 was but it was 014 -- 0.14 at the epicentre which was 100-
24 and-some kilometres away. But if the epicentre had been
25 closer, it would have been higher.

1 I understand we have Emergency Measures
2 Ontario, Mr. Chair. I just wonder if they have any
3 comments or anything to add with regard to their concerns
4 with regard to earthquake or seismic activities in the
5 vicinity of Chalk River in view of the fact that the last
6 one that was several weeks ago was a 0.14 which is
7 significantly high. It's up almost to what your design is
8 for the whole plant.

9 Emergency Measures Ontario here?

10 **MR. MORTON:** Thank you for the opportunity.
11 For the record, my name is Mike Morton. I'm a deputy
12 chief with Emergency Management of Ontario. I am joined
13 by Dave Nodwell who is our manager for planning and
14 exercises, and Kathy Blyer who is one of our senior
15 nuclear planners.

16 In terms of the impact of a seismic event,
17 we really plan overall for the effects of any event that
18 might cause offsite consequences so regardless of what the
19 cause is, we look really at what would be the worst
20 accident that could occur. And in terms of the Chalk
21 River facility, we're looking at the loss of coolant and
22 also a subsequent failure of the emergency cooling system
23 which would result potentially in some sort of offsite
24 release of radiological material.

25 And that would then, in accordance with the

1 provincial Nuclear Emergency Response Plan trigger a
2 protective measure depending on the offsite dose ranging
3 from sheltering, which is by far more likely than the
4 others which would be evacuation or KI administration.

5 **MEMBER GRAHAM:** Are you satisfied that AECL
6 have a sufficient plan in place for seismic activities or,
7 I should put, for all possible accidents? Are you -- is
8 the Emergency Response Plan filed with you and are you
9 satisfied that it's sufficient to meet all the needs at
10 Chalk River?

11 **MR. MORTON:** Our primary concern is with
12 plans that would be in place for the offsite response, so
13 primarily looking at the plans that would be filed by Deep
14 River, Laurentian Hills which should be the municipalities
15 potentially impacted.

16 Those plans were last exercised in 2007 and
17 are currently undergoing some upgrading and review. We
18 are confident that we can respond effectively to an
19 incident at the provincial level and over the next months
20 we'll be working very closely with the facility and the
21 municipalities to put forward an updated version based on
22 lessons of that exercise to ensure that we are indeed at
23 the best possible programmic level in terms of
24 international practice for emergency management.

25 **MEMBER GRAHAM:** Would CNSC or CNSC first or

1 AECL care to respond to first of all the revisions to the
2 2007 plan and how that -- the new plan that's under review
3 -- how that new plan will correspond with other emergency
4 response plans for other bordering communities at other
5 nuclear facilities?

6 So I guess what -- it should maybe be the
7 AECL first.

8 **MR. WHITE:** Andrew White, Chief Regulatory
9 Officer and General Manager.

10 We have our own emergency preparedness
11 program onsite and that program takes into account a broad
12 range of possible threats to the site, including things
13 like earthquakes or major failures of systems, and these
14 plans are exercised on a regular basis and I believe that
15 they interface with the communities and the EMO. So I
16 think that our plans are robust and would deal with any of
17 these types of circumstances.

18 **MEMBER GRAHAM:** The question was how are
19 you responding to the 2007 update that was referred to by
20 Emergency Preparedness? Are you preparing one and when
21 will it be available and when -- how much different will
22 it be and so on?

23 **MR. WHITE:** Andrew White for the record.

24 These updates are primarily with the
25 communities, so we would interface with the communities

1 and aid them in their updates. So our plan is really in
2 terms of how we interface with the communities in their
3 updates and so we are working with them as they work on
4 their updates right now.

5 **THE CHAIRMAN:** I can't resist. I got you
6 -- we've got you in front of us and I want to ask a little
7 bit a general question and that is the role of alerting
8 the citizens that there's an emergency. I'm talking about
9 sirens. Now, we used to have sirens -- you guys are too
10 young to remember World War II sirens.

11 We discontinued them but now I'm told that
12 -- I thought that was an agreement that in certain
13 communities in a certain situation, you should have
14 sirens. Now, is that true in all facilities; would it
15 apply to Chalk River, Deep River? What is your view about
16 sirens and do you enforce them or not?

17 **MR. MORTON:** Under the provincial nuclear
18 emergency response plan, which was recently upgraded and
19 then subsequently approved by the Ontario Cabinet in 2009,
20 we set standards for public alerting. So rather than
21 outlining the specific methodology for meeting those
22 standards, we stated in the current nuclear emergency
23 response plan that the communities must be able to alert
24 those both indoors and outdoors of an incident within 15
25 minutes.

1 For the area around Chalk River, and it's a
2 nine kilometre zone from the site, the indoor requirement,
3 we are indeed satisfied with; there's a phone dialing
4 system.

5 The outdoor system currently relies on
6 going through communities with vehicles that have PA
7 systems. One of the things that we are looking at
8 following the exercise of 2007 and the current revision to
9 the plan is whether the community can go further to
10 guarantee that that outdoor requirement can absolutely be
11 done within the 15-minute standard.

12 There's currently some question following
13 the exercise of whether it can be carried out in the exact
14 15-minute timeframe and, as a part of this planned review,
15 we want to make sure with complete satisfaction that the
16 people who may be outside at the time of incident would
17 not -- who would not potentially receive a phone call, can
18 be made aware.

19 Certainly, looking at sirens would be one
20 of the methodologies that I'd imagine they would want to
21 look at in reflecting on that standard.

22 **THE CHAIRMAN:** Just by way of information,
23 our little exercise, does the Can-seismic thing prove that
24 the so-called priority phone line did not work; they were
25 jammed? So the 15 minutes as standard to reach citizen is

1 a very high standard, and I'm not sure we figured out how
2 to do it properly yet.

3 **MR. MORTON:** From a -- from the perspective
4 of Ontario, we certainly want to make sure that without a
5 doubt, that standard can be met within 15 minutes and,
6 again, I think that's a very important line of discussion
7 for the reissuing of this plan over the next months.

8 **THE CHAIRMAN:** Thank you. Mr. Graham?
9 Anybody else? Dr. Barriault.

10 **MEMBER BARRIAULT:** My question is to AECL.
11 In this presentation, the comment was made that a rad-
12 waste incinerator is in operation at Bruce and one is
13 proposed for Chalk River. Now I don't know if that's
14 going to deal with the NRU Reactor at all, and that's what
15 we are dealing with.

16 But could you comment on what a Rad-waste
17 incinerator is? I would assume it's something that burns
18 contaminated clothing, radioactive material.

19 **MR. PILKINGTON:** Excuse me, but could you
20 clarify where that appears in our presentation?

21 **MEMBER BARRIAULT:** It's not in your
22 presentation; it's the presentation that was made by this
23 intervenor a few minutes ago ---

24 **MR. PILKINGTON:** Okay ---

25 **MEMBER BARRIAULT:** --- that we are talking

1 about now.

2 **MR. PILKINGTON:** Okay, so we are not aware
3 of any plans that AECL has to go forward with construction
4 of an incinerator.

5 **MEMBER BARRIAULT:** Okay. Thank you.

6 Does CNSC want to comment on this because
7 it comments on the fact that it releases radioactive
8 material into the environment.

9 **MR. SANTINI:** This is Miguel Santini for
10 the record.

11 No, we don't have any -- AECL does not have
12 any incinerator and we haven't seen any plans from them
13 either.

14 **MEMBER BARRIAULT:** Does Bruce have one?

15 **MR. SANTINI:** I'm not aware of the Bruce
16 site waste facility -- not to our knowledge, I'm told.

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

18 **THE CHAIRMAN:** Well I'd like to follow up
19 on this.

20 This intervenor makes some interesting
21 statement maybe -- that you know, somebody got to count
22 here.

23 First of all, plutonium from Russia -- this
24 is -- I'm talking at -- I don't know, there's no page
25 number but if you look at the -- I think the second page,

1 it says that the growing piles of nuclear waste includes
2 weaponable plutonium shipped from Russia in the U.S. and
3 stored underground.

4 Anybody can comment? I wasn't aware that
5 you guys received plutonium from Russia.

6 **MR. PILKINGTON:** So again it's a topic that
7 we didn't come with a lot of knowledge, but I do
8 understand that there have been experiments done in the
9 past with finding ways to downblend reactor grade --
10 sorry, not reactor grade, weapons grade materials in order
11 to turn it into reactor fuel. And so there may have been
12 experimental amounts of these materials used at Chalk
13 River but certainly no significant quantities.

14 **THE CHAIRMAN:** Mr. Graham?

15 **MEMBER GRAHAM:** I believe we have been
16 briefed before that you had 25-kilos or something had been
17 shipped on two different occasions back a number of years
18 ago for some tests. That was reported, made public but
19 I'm not sure whether that has been used or disposed of,
20 but it was a very small quantity and I think if I check my
21 records, it's about 25 kilos.

22 **MR. PILKINGTON:** Bill Pilkington for the
23 record.

24 And I'm afraid I cannot comment on specific
25 quantities simply because I do not know.

1 **MR. SANTINI:** Miguel Santini for the
2 record.

3 There have been very small quantities of
4 plutonium shipped from weapons from Russia that were used
5 for experimental MOX fuel, but those were in the order of
6 grams -- grams, yes.

7 **MR. JAMMAL:** If I may, to put it in
8 perspective here, this is the amount of MOX that was
9 shipped is the equivalent of a plutonium to be used in a
10 pacemaker in the old design.

11

12 **10-H12.5**

13 **Witness Submission from**

14 **Bill MacCallum**

15

16 **THE CHAIRMAN:** Okay. Thank you. Anything
17 else on this one? Thank you very much.

18 The next witness submission is from Mr.
19 Bill MacCallum as outlined in CMD 10-H12.5. Questions?

20 He makes a statement in the first paragraph
21 here that "while NRU can produce 30 percent of the world
22 requirement, it has the capacity to provide 100 percent of
23 isotope requirement."

24 Is that true?

25 **MR. PILKINGTON:** It's Bill Pilkington, for

1 the record.

2 And certainly in the past the NRU has had
3 the capability to meet the full global demand or I would
4 say that demand has grown to the point that, at this time,
5 on a steady ongoing basis, NRU would not be sufficient to
6 meet full world demand.

7 **THE CHAIRMAN:** Anything else?

8 Okay, thank you.

9 So this concludes the questions regarding
10 interventions. So we're now going into the second round
11 and Mr. Graham, you've got the floor again.

12 **MEMBER GRAHAM:** Just a couple of questions.

13 First of all to CNSC, this is not --
14 there's no licence attached because this is not a licence
15 renewal but are there licence amendments or are there --
16 because there is going to be some -- I read in different
17 places about licence conditions that would be put in
18 place.

19 I'd like you to comment on licence
20 conditions but I'd also like you to comment on: Is AECL
21 operating under your new handbook procedure and are these
22 conditions put into the handbook in that way?

23 **MR. ELDER:** Peter Elder, for the record.

24 We're not, at this time, have identified
25 any changes that have to be done to the licence.

1 So part of the reason for the approval
2 today is they wanted to do something that was outside
3 their licence; this is to bring them back in.

4 There are some ongoing -- we mention in a
5 couple places about new procedures. There's a general
6 requirement that'd licence them to follow those
7 procedures, so they are captured.

8 For licence renewal next year, we are
9 working on the handbook and, if we identify going forward,
10 in terms of -- on the corrective action program or when we
11 get the final fitness for service report that there are
12 licence conditions that we need to add before licence
13 renewal, we'll bring that to you at the updates that we're
14 planning.

15 But we don't have anything that has to be
16 changed today; it's really to make sure that, before they
17 restart it, they were back within the licensing basis.

18 **MEMBER GRAHAM:** Thank you.

19 My other question -- my only other question
20 that I had at this time -- well, I guess I had two.

21 The first one is with regard to the rods
22 and the defective fuel and the defective fuel comments:

23 "... and AECL disassembled and inspected
24 10 of 28 suspected rods as part of
25 initial investigation.

1 AECL found splits in the aluminium
2 cladding ..."

3 which we saw today in the overviewsi

4 "... of two of those suspended fuel
5 rods."

6 Two of ten is about 20 percent. Why were
7 not all 28 inspected?

8 Or have I not got the right context of 10
9 versus 28 and so on?

10 And that would be to AECL.

11 **MR. PILKINGTON:** Okay, it's Bill
12 Pilkington, for the record.

13 We did, in fact, initially inspect the 10
14 which we believed had the highest probability of having
15 defect elements and, following that, we did disassemble
16 and inspect four more.

17 So in essence, we have inspected 14 of the
18 rods.

19 I would point out that we would see
20 diminishing return because we've gone from the most
21 probable rods towards the less and that, in keeping with
22 ALARA, there is significant dose expended in disassembling
23 these rods to be examined.

24 **MEMBER GRAHAM:** Okay, so you've done 50
25 percent of them, 10 to 14, 14 of the 28, and you say it's

1 a diminishing -- we just hope that there won't be a
2 significant development report in the months to come that
3 there were found to be another defective rod.

4 In reading that, it more or less indicates
5 that you still have those rods in stock. Why would they
6 not have been sent back to the -- as defective, sent back
7 to the manufacturer as non-useable?

8 Why would you -- why would you keep any of
9 them and not demand a whole new batch?

10 **MR. PILKINGTON:** So it's Bill Pilkington,
11 for the record.

12 And they, effectively, have been sent back
13 to the manufacturer because the manufacturer is AECL.

14 However, from the point of view of
15 disposing of them, they are quarantined, they will not be
16 used and we'll have to look at the most effective way of
17 recovering the materials.

18 **MEMBER GRAHAM:** Thank you. I didn't
19 realize that.

20 The other -- the only other question I have
21 is with regard ---

22 **THE CHAIRMAN:** Before you leave this, I
23 still want to hear somebody tell me what are the safety
24 issues, if any, with operating with this defective fuel
25 bundles.

1 **MR. PILKINGTON:** Bill Pilkington, for the
2 record.

3 And I will give a position from AECL in
4 that small defects of this type do not represent a
5 significant safety issue.

6 However, we have just put a full charge of
7 new moderator water into the reactor to reduce the tritium
8 and we've reduced the tritium by a factor of 10 which is
9 -- has a very positive impact on both staff exposures and
10 also on releases to the environment.

11 The existence -- the continued existence of
12 defects in the reactor does release radionuclides into the
13 coolant and, once released, these nuclides take a
14 significant amount of time to remove.

15 And so they increase the radiation fields
16 in the facility and, as I said, once released it takes a
17 significant amount of time to bring the coolant back to
18 the very low activity levels.

19 So, really, the issue here is around ALARA,
20 it's around minimizing worker dose and it's around
21 maintaining a clean reactor for operation and maintenance.

22 **THE CHAIRMAN:** So to staff, you're going to
23 -- what's your proposal to -- if this problem kind of fix
24 according to some timeline that AECL puts forward?

25 **MR. ELDER:** Peter Elder, for the record.

1 There are two things we're looking at:
2 obviously, they have to complete their investigation on
3 the cause and make any changes that -- in their fuel
4 manufacturing side.

5 The other one we've required them to do is
6 put in a defined procedure for how they will deal with
7 potential defects that they identify.

8 So a more strict monitoring of their
9 coolant chemistry and then defined actions about what will
10 they do when they find something to make sure they are
11 dealt with before they become any sort of risks to any of
12 the workers.

13 So it's an extra barrier to make sure that
14 they identify and remove the defect fairly quickly, in a
15 timely -- but there's no immediate concern here.

16 This is again something that we want to
17 make sure there wasn't a widespread problem that would
18 cause a problem immediately after restart and that they
19 have then procedures in place to make sure they don't get
20 into a problem where there are increased doses to workers
21 for doing routine maintenance or other things.

22 **THE CHAIRMAN:** Okay, thank you.

23 Mr. Graham?

24 **MEMBER GRAHAM:** The question I had was with
25 regard to the vessel. Your indication of the present,

1 just before we took a short break, was four years for a
2 new vessel.

3 Four years from the time of ordering it
4 'till it was installed; but if there was one on order and
5 it was planned, my understanding is about two years; is
6 that correct?

7 **MR. PILKINGTON:** That's Bill Pilkington,
8 for the record.

9 So that's a very rough approximation but I
10 would agree that that's -- that would be correct.

11 **MEMBER GRAHAM:** Two years for
12 manufacturing, two years for installation.

13 My concern is is that, in planning for the
14 future, the vessel now is about 36 years old. At the time
15 of the licensing -- re-licensing, it'll be about 39 years
16 old and at the end of that licence period, if you had
17 another licence period, it'd be 44 years old.

18 Is there any planning or any policy at AECL
19 to look towards the purchase or the ordering of a new
20 vessel down the road or is it strictly the policy that you
21 -- at the end of life of this reactor, you'll be out of
22 the isotope production business?

23 **MR. PILKINGTON:** It's Bill Pilkington, for
24 the record.

25 And I think the answer to that probably

1 goes beyond AECL because those are long-term strategic
2 decisions for Canada.

3 I would simply offer from AECL's
4 perspective, we have studied vessel replacements and NRU
5 refurbishments in the past, we currently have no plans to
6 extend the life of NRU beyond the life of its components
7 of which the vessel is one.

8 So we believe that through inspection and
9 maintenance that we can continue to operate with the
10 current vessel through the next licence interval and
11 likely through the one beyond that and to be able to show
12 fitness for service.

13 But the horizon beyond 2021, there would
14 need to be a long-term strategy in place.

15 **MEMBER GRAHAM:** Just for rule of thumb,
16 what would a new vessel cost today?

17 **MR. PILKINGTON:** So as a part of the
18 current outage, we did dust off some studies that had been
19 done and we came up with a very rough number for the
20 complete outage which would include a vessel replacement
21 and very minimal upgrading of other parts of the facility
22 in parallel with that, not a full refurbishment of the
23 NRU, and the price tag was in the range of 400 million.

24 **MR. MacDIARMID:** If I might just volunteer
25 one additional comment, it's Hugh MacDiarmid, for the

1 record.

2 The Minister of Natural Resources did
3 commission the expert panel on isotope production options
4 and clearly that process was one that was designed to
5 explore any and all avenues that would be productive and
6 worth pursuing in the future.

7 So our marching orders are to be producing
8 as quickly as we can, produce reliably through to the end
9 of our licence period, secure the renewal through 2011 to
10 2016 and during that period of time a full range of
11 options are going to be pursued.

12 **THE CHAIRMAN:** Thank you.

13 Dr. McDill?

14 **MEMBER McDILL:** Two final questions. On
15 the first fill you found some -- or noticed some tritium
16 which on refill you didn't detect. Is there any sense
17 going forward of where that tritium came from?

18 **MR. PILKINGTON:** It's Bill Pilkington, for
19 the record.

20 And so we have not been able to identify
21 the source of the tritium. We have looked at the systems
22 that, I guess, physically interact with the J-rod annulus
23 trying to identify what might have been the likely source
24 and to this point we're still investigating. But to this
25 point we have not identified a source.

1 And then we looked at the possibility that
2 the tritium was as a result of filling the vessel and that
3 it may have come from the vessel. And so to that end we
4 drained the vessel and did a very thorough visual
5 inspection of the quadrant of the vessel where we had seen
6 elevated tritium in the J-rod annulus.

7 And even before we drained the vessel for
8 that inspection, the tritium levels had essentially
9 returned to background level. We have filled the vessel
10 actually twice since and on neither occasion have we seen
11 any significant increase in the tritium levels as we did
12 the first time that we filled the vessel.

13 So at this point we'll continue to monitor
14 but we will not be taking further action.

15 **MEMBER McDILL:** Thank you.

16 Does staff have any comment to add?

17 **MR. ELDER:** Two things on this as said is
18 we have no concerns about the structural integrity; so
19 we're confident on the structural integrity on this one.
20 Because obviously they haven't been able to find a
21 definitive cause, we've asked to make sure that they have
22 proper procedures in place in case a leak, actually a
23 measurable leak does develop.

24 So they will have procedures in place to
25 take appropriate action in a timely fashion if they

1 actually get a measurable release of -- a measurable leak.

2 But at this point what they're measuring is
3 very, very small quantities and it would be extremely
4 difficult to actually pinpoint a definitive source.

5 **MEMBER McDILL:** And what constitutes a
6 "measurable leak"?

7 Maybe we should ask AECL.

8 **MR. PILKINGTON:** One for which we could
9 have a reasonable expectation of being able to locate it.
10 I would look to the example of very small steam generator
11 leaks in utility reactors and the fact that until you get
12 to a certain level you're really expending dose and
13 staying in a shutdown state with essentially no
14 opportunity to identify the source.

15 **MEMBER McDILL:** Thank you.

16 And my final question is for the scientific
17 and engineering community. When will they have access to
18 the neutron beam lines for further scientific work? Or is
19 that something that you cannot speak to?

20 **MR. PILKINGTON:** Today I have come ready to
21 be able to speak to that question.

22 And so we have talked to officials of the
23 National Research Council and they have not really found
24 an alternative facility for the work that they would do on
25 the NRU. They have taken the opportunity of the shutdown

1 to do maintenance and improvements to their equipment and
2 they're very much looking forward to the return to service
3 of NRU.

4 The facility will essentially be available
5 to them from the time that we raise the power on the
6 reactor. However, they have indicated that there will be
7 time required on their end to re-energize programs that
8 have been put on hold. They would be expected -- they
9 expect to be back to full utilization by next spring.

10 **MEMBER McDILL:** Thank you, Mr. Chair.

11 **THE CHAIRMAN:** Thank you.

12 Mr. Tolgyesi?

13 **MEMBER TOLGYESI:** Merci.

14 I hope that you will include these
15 scientific requirements when you evaluate the long-term
16 options for the NRU because as what you said, it's a
17 unique place where you could do that. So it should be
18 incorporated.

19 I have just maybe one comment. On Figure
20 3.2 it's a little bit hard to read what's there and where
21 it is -- this latest configuration of NRU reactor. It's
22 not too clear, the numbers and letters and you know.
23 What's where?

24 I could read just only that the red "x" is
25 adjacent to the J-rod position 41 but when you're looking

1 at all those -- all the numbers and figures, it's not so
2 easy to read. I don't know if it's only on my copy but I
3 am quite sure it's on all of the copies.

4 I have one question. What you were saying
5 that to do all this repair work you were putting some
6 plates and welding on the top which could go to 3 or 4
7 millimetres or even thicker; it depends on conditions.

8 So how these plates and welding and
9 eventual, if any, heat deformation, you were talking about
10 it could be that the vessel could be -- that the wall
11 could be deformed.

12 How it will affect -- there will be some
13 restrictions. How it will affect the performance of the
14 vessel specifically of the annulus?

15 **MR. PILKINGTON:** It's Bill Pilkington, for
16 the record.

17 And so the deflections on the vessel wall
18 resulting from the repairs would come from the build-up,
19 the additional material that's put on and then also from
20 the deflections from welding stress.

21 And so even adding those together you would
22 be looking at deflections significantly less than 10
23 millimetres. And so in terms of the operation of the
24 reactor, those would be insignificant and in terms of the
25 function of the J-rod annulus which I believe is about 15

1 centimetres across, there would also be no effect.

2 So the way the NRU reactor is designed,
3 there is very low flow in the vessel at the locations of
4 the wall. And so there would not be really any
5 significant change in the operating performance of the NRU
6 because of the physical changes.

7 **MEMBER TOLGYESI:** But when you're looking
8 where the leak is located, it's in a heavy water gutter
9 which is much thinner than the annulus which is 15
10 centimetres. The gutter is quite -- I don't know. It
11 seems to be maybe a centimetre or so and then when you do
12 10 or 15-millimetre restriction, which is more important?

13 **MR. PILKINGTON:** Bill Pilkington for the
14 record.

15 And so the maximum deformations are well
16 above the reference circumferential weld and the vessel
17 wall thickens significantly below the circumferential
18 weld. We would not expect to see any significant
19 deflections in the area that's adjacent to the gutter.

20 **MEMBER TOLGYESI:** And my last is you were
21 saying that gutters were filled with corrosion products
22 and even the lip was corroded so it disappeared. It's
23 some effect of this lip if it disappearing or there is no
24 operational problem?

25 **MR. PILKINGTON:** So originally on the

1 design, I believe the lip was to provide separation for
2 light water leaks and heavy water leaks and the gutter was
3 intended to collect heavy water leakage and it has drains
4 associated with it.

5 So in looking at the work to put the NRU
6 back into operation, our inspections indicated that we did
7 not have significant corrosion occurring as a result of
8 having corrosion products in the gutter. So as we go
9 forward, we'll be looking at a strategy on what to do
10 about that configuration but for the present it was felt
11 the best thing was to not change the condition that we
12 know is not aggressive.

13 **MEMBER TOLGYESI:** And my last. When you
14 are looking at the maintenance schedule, you were talking
15 about 28 day periods of which 23 are production, five are
16 maintenance. If you are looking over the year, it's about
17 12 periods which means 12 times 5 is 60 days -- I will say
18 lost; not lost but not producing isotopes. When you're
19 adding to this one month shutdown, because that's what you
20 will do about annually, this is about a 50 percent
21 increase. How it will affect?

22 **MR. PILKINGTON:** So this is Bill Pilkington
23 for the record.

24 The choosing of five day outages was done
25 specifically because we can continue to harvest isotopes

1 in the period that the reactor's shut down. So in fact,
2 with that 28 day cycle there is no interruption in the
3 production of isotopes.

4 I think the other thing that's important is
5 that we have much better communications with the worlds
6 isotope producers and so we can, in fact, schedule outages
7 and the other producers in the world can adjust their
8 outages and production schedules to ensure that there is
9 no reduction in supply when we're shut down.

10 **MEMBER TOLGYESI:** Is there -- the one of
11 intervenors by Mrs. -- I don't know who was that -- Mrs.
12 Darlene Buckingham -- she was saying that many medical
13 doctors are now saying that this using radioactive
14 isotopes are being overused. Are you witnessing this
15 increase of isotopes, a need for isotopes for medical
16 purposes?

17 **MR. PILKINGTON:** So it's Bill Pilkington
18 for the record. I'm afraid we have nobody in our group
19 today who could give an answer to that kind of a question.

20 I could point out that the medical
21 community has done really a great job over the period that
22 NRU and another significant supplier have been out of
23 service to make the most of the isotope supply that is
24 available; to schedule diagnostics procedures, to not lose
25 isotope to decay, to look for alternatives that can be

1 used for some procedures. So I would say the medical
2 community's done an excellent job of mitigating the
3 shortage but I can't comment on the value of the supply to
4 the medical community.

5 **MEMBER TOLGYESI:** I will ask that Dr.
6 Barriault after. Thank you.

7 **THE CHAIRMAN:** Thank you, Dr. Barriault?

8 **MEMBER BARRIAULT:** Thanks. Merci.

9 On Slide 22 of CNSC, there's a comment that
10 upset me a little bit and it says on a walk-down resulted
11 in numerous finding; field installation not matching
12 documentation. I guess the question I have is that poor
13 record keeping or is it cooking the books?

14 Slide 22. Additional outage activities,
15 NRU upgrade walk-downs. It's third bullet down. CNSC to
16 comment on it.

17 **MR. ELDER:** Okay, first I'll go back and
18 give you a history -- Peter Elder for the record -- in
19 terms of the walk-downs. It's going back and people
20 around will remember that we did evaluation 2006 of the
21 quality assurance around those upgrades.

22 We, at that time, had trouble finding all
23 the documentation that showed they were done in a quality
24 manner. Part of the solution to that, to establish that
25 there was a quality installation, was to have AECL do

1 these walk-downs and what they were looking for in the
2 walk-downs was exactly that -- does the field insulation
3 match their documentation?

4 We asked them to do this because we
5 expected, based on their 2006 audit, to find instances
6 where there was not a match. The walk-downs did find
7 these, a number of them, and then from there AECL used
8 their corrective action program to classify all those, to
9 address them and they're addressing all the ones that had
10 any potential safety impact prior to restart. So in terms
11 of it looks like, you said, that's what the walk-down was
12 looking for. It was looking for mismatch between the
13 field insulation and what was documented. We ---

14 **MEMBER BARRIAULT:** Go ahead. I'm sorry.

15 **MR. ELDER:** --- and we expected them to
16 find things based on what came out of our previous audit.

17 **MEMBER BARRIAULT:** So what I'm hearing then
18 is it was poor record keeping rather than ---

19 **MR. ELDER:** Well, whether it was poor
20 record keeping, it was not following through a number of
21 stages that the proper quality assurance procedures when
22 the upgrades were put in and recognizing they were put in
23 over a number of years.

24 **MEMBER BARRIAULT:** So there's no way of
25 knowing if it was poor record keeping or else somebody

1 making inadvertent entries.

2 **MR. ELDER:** It's very hard to know. All we
3 can end up finding is that we couldn't find the
4 documentation whether it was record keeping or not
5 following procedures, we can only come back with the
6 finding that there was a mismatch and this is where.

7 This is the solution to make sure that what
8 was there matches the documentation.

9 **MEMBER BARRIAULT:** Thank you. I don't know
10 if it's fair -- does AECL care to comment on this?

11 **MR. PILKINGTON:** It's Bill Pilkington for
12 the record.

13 And so I would comment that the
14 installation of these upgrades over short outages over a
15 very long period of time did present -- I think an unusual
16 challenge to both our organization in carrying out the
17 work and also to our organization and the regulator to
18 provide proper oversight.

19 And so the solution, I agree, was for us to
20 go back and walk-down each of these systems and confirm
21 that our design documentation was exactly the same as the
22 field installation and so we did find a number of
23 discrepancies and we have assessed those to determine what
24 we felt needed to be corrected in the field, what could be
25 documentation updates, what would require future planned

1 maintenance activities and so these have all been assessed
2 and acted on accordingly.

3 **MEMBER BARRIAULT:** Thank you. Just two
4 more short questions.

5 My next question, really, is that -- and
6 it's of a, I guess, just a yes or no answer. During your
7 shutdown, did you get the chance to test the backup
8 electrical system on the famous pumps that we had
9 discussed some years ago?

10 **MR. PILKINGTON:** No.

11 However -- Bill Pilkington for the record
12 -- however, having said that, only because with the fuel
13 and water out of the core there wasn't a requirement for
14 that system to be available. As a part of our return to
15 service, all of these systems are being thoroughly tested
16 to confirm that they are fully available to perform their
17 safety functions and in fact we have already operated the
18 DC motors on the pumps in question.

19 **MEMBER BARRIAULT:** Thank you. Mr.
20 Chairman, just one brief question and you can rule me out
21 of order if you want to.

22 If I ask you to do some crystal ball
23 gazing, do you see anything in there that looks like a
24 Maple reactor in the future?

25 **MR. MacDIARMID:** No.

1 Hugh MacDiarmid, for the record.

2 **THE CHAIRMAN:** Anything else?

3 I've got a couple of questions here. Let
4 me start with a kind of a multi parts one.

5 I am -- I don't want to deal with some
6 historical issues. So I'm looking forward to what is it
7 that we can expect to be achieved in the planned -- in the
8 next big planned shutdown within the nine months?

9 And the reason is because on Slide 33, I
10 was struck that you still identify something like 833
11 activities not complete. According from your slide, if
12 you look at Slide 33, I am anal keeping up to commitments
13 on both sides now of the organization.

14 So can we -- can you assure us that within
15 the next -- after the next planned shutdown, the extensive
16 shutdown, that those 833 will not be -- shall we say all
17 be complete?

18 And while you're thinking about that, you
19 know my favourite question I always ask you is when the
20 reflector is going to be fixed, if ever? Because as you
21 know, this NRU, if you're coming back after 14 months, it
22 will still be the old leaky machine and that's something
23 that you'll have to explain to the public why it's still
24 leaking.

25 **MR. PILKINGTON:** Okay. Bill Pilkington,

1 for the record and I'll start with your first question and
2 those 800 and some odd activities are all activities that
3 will be completed before the NRU is back into service. So
4 these are all activities to be completed in this -- within
5 this shutdown.

6 And I would point out this is an
7 accumulation of all planned activities. So every piece of
8 maintenance, every preventative maintenance, every test
9 that needs to be carried out, every significant operation
10 that needs to be carried out, everything is captured; in
11 fact, even training activities.

12 Everything is captured on that work-down
13 curve because we have to make sure that all of them get
14 done at the appropriate time between now and return to
15 high power operation.

16 **THE CHAIRMAN:** Does that include the gaps
17 that were identified in the walkabout?

18 **MR. PILKINGTON:** So that includes all of
19 the gaps that have been assessed to require or suggest
20 that we should do physical work in this shutdown, but it
21 does not include all of the findings.

22 If I can speak to the next planned outage -
23 - so the major activities that would be carried out in the
24 next planned outage would be the inspections that we be
25 called up as a result of the repairs that have been done

1 and the continued effort on mitigation of corrosion.

2 So we'll be taking measurements of CO₂ gas
3 purity and of pH of the water that we drain from the J-rod
4 annulus and we'll be using that to look at whether we have
5 fully mitigated corrosion now and using that to plan what
6 measures we will take in the next outage to improve that.

7 We are also working towards methods of
8 reducing and eventually eliminating the leakage from the
9 reflector. And so in the first five-day outage following
10 return to service, we currently plan to introduce a carbon
11 fibre compound which has shown effective in other
12 utilities at reducing similar kinds of leaks and we are
13 pursuing tooling and repair strategies to be able to
14 better repair leakage from the reflector.

15 And I believe you had a second question
16 that I may not have addressed.

17 **THE CHAIRMAN:** Staff, you want to comment
18 on all of this is going to be done before the return to
19 service, the 800 -- it's a big number.

20 **MR. ELDER:** Peter Elder, for the record.

21 What's on that Slide 33 is the remaining
22 activities on the return to service plan. So this is what
23 we're monitoring and this is what our site inspectors will
24 be monitoring for the next month or three weeks to make
25 sure all those ones are done.

1 Again, we have looked at the plans. We
2 have looked at their procedures for doing this and this is
3 carrying out those procedures. So that's going back in
4 doing all their -- there's a lot of maintenance you can't
5 do until the system is actually operational. So they have
6 to do all that. There are a number of tests they have to
7 do and that's all in those 800 items and that's what we
8 are monitoring in terms of the return to service plan.

9 And below, if you look on the chart, you
10 probably -- it's small. My version is small but I can
11 just read it saying the end of that is July 25th is
12 getting down to zero and having experience, I'm looking at
13 these ones on other big projects. This is the trend you
14 like to see. They've stopped growing about a few weeks
15 ago. It's a very good sign.

16 Usually as you go in and put things back in
17 service, you find items. So the better planning you do,
18 the better you start to work down that curve and you stop
19 adding maintenance items in that. So we're -- they look
20 like they're on track.

21 **THE CHAIRMAN:** So all the other outstanding
22 issues, including documentations, gaps, all of these, by
23 when that will be sort of done, particularly the legacy
24 from '95, '96, or '94-'95, something like that?

25 **MR. ELDER:** What we've done in terms of --

1 Peter Elder, for the record -- in terms of -- we're
2 tracking all of these things in terms of anything that's
3 not going to be done by July 25th and in our view and
4 we've communicated to AECL that we expected all to be done
5 certainly before they show up for a licence renewal
6 hearing in about a year from now.

7 So they've got -- what they have to do at
8 the outage they have to do in the first outage. Anything
9 that they get done during the shorter periods or
10 operational they have time to do but we're looking at that
11 one all being resolved by the time they come back for
12 licence renewal.

13 **THE CHAIRMAN:** Okay. My last question
14 exactly relates to this.

15 What did this stoppage do to the critical
16 part towards October 2011, if anything? Did it slow you
17 down, speed you up?

18 **MR. PILKINGTON:** Bill Pilkington, for the
19 record.

20 It actually did both. That fact that we
21 were shut down gave us an opportunity to access equipment
22 for things like these walk-downs that would have been
23 very, very difficult to schedule around short outages.

24 So in terms of the work that is more
25 difficult or most difficult to get done, it presented us

1 with an opportunity.

2 The other side of that coin is that we have
3 committed our resources very heavily to the repair and
4 return to service and so the things relating more to
5 documentation and analysis we will have to accelerate our
6 efforts in order to be ready for licence renewal.

7 However, I point out that the most
8 difficult challenges around getting access to field
9 equipment is something that was available to us in this
10 shutdown.

11 **THE CHAIRMAN:** Thank you.

12 Doctor McDill?

13 **MEMBER MCDILL:** One last question. You
14 have all of these marvellous wonderful tools. What's
15 going to happen to them?

16 **MR. PILKINGTON:** We do have an arm of AECL
17 whose job is services and so we have great expertise
18 between ourselves and our contractors, all of which could
19 be available to anyone who needs them.

20 In terms of the actual tools, we will be
21 storing the tools until there is a requirement for them
22 and we of course have learned for the design of all these
23 tools and so we have that learning to apply both to our
24 unit and to others.

25 **MEMBER MCDILL:** Thank you.

1 **THE CHAIRMAN:** Thank you. Last chance?

2 Well, thank you very much. Thank you for
3 your patience and perseverance with us here.

4 We shall take -- anything I need to do now,
5 Marc?

6 **MR. LEBLANC:** Well, the Commission will
7 confer with regards to the information that it has
8 considered today and then determine if further information
9 is needed or whether the Commission is ready to proceed
10 with a summary decision in a very short time period. So
11 we will advise accordingly.

12 **THE CHAIRMAN:** Okay. Thank you.

13 We will reconvene in 10 minutes.

14 --- Upon recessing at 6:44 p.m. /

15 L'audience est suspendue à 18h44

16 --- Upon resuming at 7:03 p.m.

17 L'audience est reprise à 19h03

18 **THE CHAIRMAN:** Okay, good afternoon.

19 My name is Michael Binder. Je suis le
20 président de la Commission canadienne de sûreté nucléaire.

21 And the next item on the agenda is the
22 opportunity to be heard to Saskatchewan Research Council
23 on the Order issued on June 18 by the Designated Officer.

24 So I wish to welcome Mr. Joe Muldoon, Vice
25 President, Environment and Forestry for SRC.