

# Nuclear Safety Committee

an advisory body to the CEO of ARPANSA, established under the ARPANS Act 1998  
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## Minutes of Seismic Briefing held on 27 September 2002 ANSTO — Lucas Heights

### 1. ATTENDANCE AND APOLOGIES

#### PRESENT

##### Members

**Ms. Sylvia Kidziak – Chair**

Dr. John Loy

Dr. Peter Jezukaitis

Dr. Rob Lee

Mr. Bob McAneny

Ms. Jean McSorley

Professor Rob Melchers

Dr. Barbara Shields

##### ANSTO Representatives

Dr. Ron Cameron

Mr. John Cramsie

Mr. Shane Harrison

Mr. Ross Miller

Mr. Greg Whitbourne

##### Observer

Mr. Don Macnab — ARPANSA

##### Secretariat

Mr. Keith Dessent – Secretary

#### APOLOGIES

Professor Ian Polmear

Dr. Garry Smith

### 2. OPENING OF MEETING

The Meeting commenced at 10:20 am. The Chair welcomed Members and representatives from ANSTO.

Ms Kidziak summarised the purpose of the meeting as being to receive a briefing on the nature of the reported faulting at the site of the proposed Replacement Research Reactor. It was recognised that ANSTO had undertaken further geological investigations at the request of ARPANSA and following the IAEA Peer Review, which were reported in January 2002. The remainder of the assessment could only be carried out after issuing of a construction licence. Ms Kidziak requested that the briefing focus on the report dated 12 September 2002 titled *Submission to ARPANSA on the Site Geological Investigation for the Replacement*

### **3. BRIEFING ON SEISMIC FAULTING AT THE PROPOSED REPLACEMENT RESEARCH REACTOR SITE**

#### **3.1 Briefing**

Dr Cameron commenced with a presentation to the Committee covering aspects of the geological history of the Sydney Basin and particularly Lucas Heights area, noting the extensive data that indicated wide spread faulting throughout the region that had been mapped extensively, particularly in a number of long tunnels that had recently been constructed north of the site and in the southern coalfields.

Mr Miller then described the two fault structures found in the Replacement Research Reactor excavation. The 'Eastern Strand', the larger fault observed extends for at least 140 meters across the site in a north-north east direction. The faulting displacement is 'normal' on both the north and south walls. It is considered that 'normal' faulting occurred during opening of the Tasman Sea some 50–80 million years ago.

The 'Western Strand' extends at least 120 metres across the site in a north-north east direction. The fault displacement appears to be 'reverse' on the southern wall and 'normal' on the northern wall. If it is a genuine 'reverse' fault, this would indicate that it had formed or been reactivated after the Tasman Sea period.

Dr Cameron then described ANSTO's investigations of the fault. The ANSTO assessment as to whether the fault is 'capable' of causing surface movement was based on IAEA and USNRC Guidelines for power reactors, as there are no universally accepted guidelines for assessing faulting in relation to Research Reactors.

The criteria principally involve a need to demonstrate that the fault has not moved at the surface for a significant geological time. ANSTO consultants had used a number of dating techniques – geomorphology and geochronology of material covering the faulting, optically stimulated luminescence in overlying unfaulted strata, paleomagnetism in material crossing the fault, and fission track and (U-Th)/He dating of borehole material. These methods indicated a consistent picture of no movement in the faulting for at least 5-15 million years.

Consequently, ANSTO concluded that the fault is not capable and that there was no need to change the seismic design hazard spectrum for the facility design.

Members were taken on a visit to the construction site where further discussion took place on the nature and age of the faults.

#### **3.2 Questions and answers**

The following questions were raised by members in the course of the briefing. (Figures referred to in the following questions are as referenced in the ANSTO submission). ANSTO representatives undertook to answer all questions at the briefing.

- *How much difference was there from the faulting that was found to what was expected?*  
There had been no surface indication of faulting, but given the nature of the Sydney Basin, it could not be a surprise that there was faulting discovered. The tunnelling projects that had taken place in the Sydney area showed that fault lines were, on average, about 200 metres apart on such projects. The possibility of the western faulting being 'reverse' did mean that close examination had to be made.

- *Why did the strand on the right hand side of Figure 6.9 stop at the (-1.8,0) (using an (x,y) coordinate convention) position and could it progress further?*

That fault line was dated at 50-80 million years old, which was the estimated time of the opening of the Tasman Sea. The layer below its stop point was stronger rock and that caused its cessation. Given its age and the fact that the stress field in the area had changed to a compression field from a tension field since that fault occurred, it was considered extremely unlikely for any continuation of the strand.

There were “thousands” of these types of faults in the area. The Hawkesbury sandstone at Lucas Heights was approximately 160 metres deep and despite this faulting is a very strong and stable rock type.

Similar faults to those found at the proposed RRR site were regularly found on construction sites around the Sydney area including high-rise building and tunnel sites. When such faults were found at those tunnel sites, they were normally filled with concrete if necessary and the construction continued. Due to the nature of the RRR project however, investigation of the faulting was considered essential.

- *Why were no faults found outside the shaded areas of Figure 6.1?*  
Those areas were not logged. Only the faults of interest were actually logged in detail. One hundred and eighty fractures were found in the investigation trenches but none showed any displacement.
- *The public would be concerned that the fault could become active. How could the public be reassured that the investigations were valid?*

Three independent methodologies had been utilised to find out the age of the faulting. These were:

1. geomorphology;
2. general weathering; and
3. paleomagnetic.

Each of these studies gave relatively consistent outcomes for the age of the faulting. They had been peer reviewed and were considered to have been carried out to international best practice.

The faults were typical of ancient faults seen all over the Sydney area and the conclusion reached was that there was no more likelihood of an earthquake at the proposed site of the RRR than any other location in the Sydney area. Further, the RRR had been designed to withstand an earthquake of a higher magnitude than any earthquake yet experienced in the area.

Based on the studies carried out and the criteria applied by the IAEA, the fault was believed to be ‘incapable’. In addition, there had been probabilistic studies on the likelihood of displacement, were the faults to be capable. The probability of displacement was estimated to have a return period of 2.6 million years.

- *Even given such a long return period of 2.6 million years, was it not possible that an earthquake could happen ‘the next day’?*

Dr Cameron emphasised that the faulting had been demonstrated not to be capable. There had been many earthquakes in the region since the faults were formed and they had not caused any displacement. Even if the faults were capable, the probability of an earthquake occurring during the lifetime of the reactor (50-years) given the large return period was vanishingly small. Further, earthquakes were not necessarily cyclical in their occurrence.

Professor Melchers also advised the Committee that the strain rate evidenced in eastern Australia was very small, which emphasised the relatively low probability of a seismic event. This was evidenced by the nature of the rock once it was exposed during digging operations. Rock under strain experiences

'rock bursts' or spontaneous peeling when exposed during high stress situations. This had not occurred at construction sites in the Sydney area, including the proposed RRR site. This reinforced the belief that the likelihood of a seismic event at the proposed site was as low as anywhere else in the Sydney area and was extremely low overall.

- *Were there other international examples to verify or refute the studies commissioned by ANSTO?*  
Most continents had undergone severe glacial action during their geological lifetime thus destroying data, particularly for paleomagnetic studies. Australia was actually a world leader in these types of ageing studies and the work done in this country was highly regarded internationally.

Dr Cameron reminded the Committee that the peak ground acceleration values used for the RRR study were stringent in comparison to those used around the world. The proposed reactor was designed to seismic accelerations comparable to those used in Japan and other highly active regions.

- *What criterion was accepted for tunnels and other construction projects in the Sydney area?*  
The RRR had been designed to a one in 10,000-year earthquake return period with safe shutdown of the reactor. Other buildings in Sydney are not designed to such stringent criteria.
- A member urged on behalf of Dr Garry Smith that the Sutherland Shire Council be given a tour of the site and a presentation similar to this briefing.

#### ***Committee Comment***

The general conclusion of members following the presentation and questions was that the investigations carried out by ANSTO complied with international guidelines and were thorough.

Based on the information presented at the briefing and in the ANSTO submission, the original recommendations of the Committee to ARPANSA regarding seismic issues need not be changed. Members reiterated the importance of their previous recommendation to the CEO of ARPANSA regarding approval and verification of all safety critical components throughout the detailed engineering phase. (This recommendation had been supported by the CEO ARPANSA in his approval for construction)

The Committee acknowledged that the public perception of the risk might be different from that of the Committee and that this should be addressed in presenting the decision on the matter.

Ms McSorley left the meeting prior to summing up the Committee response.

Ms Kidziak summarised comment made by noting that the committee was satisfied with the outcomes and conclusions as presented by ANSTO based on information that was provided at the briefing. There was no change to previous recommendations the Committee had made in their final report to the CEO of ARPANSA dated February 2002. Members had no further issues to raise at this stage.

Appropriate feedback from ARPANSA on any related issues would be appreciated.

The chair thanked Dr Cameron and ANSTO for their thorough presentation.

#### **4. GENERAL BUSINESS**

There was no General Business. The meeting closed at 2:10 pm.