AUSTRALIAN NUCLEAR ASSOCIATION INC

Submission to Nuclear Fuel Cycle Royal Commission

on

ISSUES PAPER FOUR

Management, Storage and Disposal of Nuclear and Radioactive Waste

Preliminary Comment on Section B of Issues Paper 4

The inclusion of a large area of South Australia on Figure 2 as "zone of major active geological faults" could give the false implication that waste management facilities should not be built in this zone. This large zone includes the most populated areas of the State including Adelaide.

The risk of earthquakes in South Australia is relatively low, but data from the South Australian Department of State Development [https://sarig.pir.sa.gov.au/Map] shows that there have been about 17 recorded earthquakes in South Australia with magnitude 5 or greater with the highest being magnitude 6.

Radioactive waste storage and disposal facilities can be readily designed and constructed to exceed the structural design standard for the earthquake hazard in South Australia. For South Australia, seismic risk is a low order selection criterion for selecting a site for a waste storage or disposal facility. The licensing process will include assessing the earthquake hazard as part of the safety case for the facility. There is no reason to exclude all locations in the "zone of major geological faults" indicated on Figure 2 in assessing sites for radioactive waste management facilities.

Preliminary Comment on Section C of Issues Paper 4

In a discussion of buffer zones, the Issues Paper 4 discusses the buffer zone around the OPAL reactor near Sydney. The buffer zone around the reactor excludes private residences, but the Issues Paper is wrong when it implies that there "is currently 1.6 km between the reactor and members of the community". Facilities within the ANSTO Buffer Zone used by members of the community include major roads (New Illawarra Road, Heathcote Road), activities at the Lucas Heights Waste Management and Recycling Centre and the Sutherland PCYC Minibike Club. The buffer zone around the reactor at Lucas Heights was established many years ago and is much larger than is considered necessary at many overseas research reactors.

RESPONSES TO SPECIFIC QUESTIONS IN ISSUES PAPER 4

4.1 Are the physical conditions in South Australia including its geology, suitable for the establishment and operation of facilities to store or dispose of intermediate or high level waste either temporarily or permanently? What are the relevant conditions? What is the evidence that suggests those conditions are suitable or not? What requires further investigation now and in the future?

There are sites in South Australia that would be suitable for the establishment and operation of facilities to store and/or dispose of all levels of radioactive waste either temporarily or permanently. Amongst other criteria, site selection for a radioactive waste disposal facility will include assessment of geology and access to support infrastructure. Site selection for a storage facility is much less dependent on geology because it is will be a highly engineered facility.

4.1.1 Low Level Radioactive Waste Disposal

Issues Paper 4 does not address the disposal of low level radioactive waste and Question 4.1 specifically does not mention disposal of low level radioactive waste. Nevertheless, access to a disposal facility for low level radioactive waste will be important for any expansion of the nuclear fuel cycle in South Australia other than mining.

Australia needs a safe, effective and a permanent solution for managing the radioactive wastes accumulated as a by-product of a wide range of beneficial uses of nuclear technology. These include the production and use of medical isotopes for therapy and treatment, industrial processes and research.

The Commonwealth Department of Industry and Science is seeking a volunteer site for a national facility radioactive waste management facility for the storage and disposal of Australia's low and intermediate level radioactive waste. The Minister's call for voluntary nominations process closed 5 May 2015 and the Department is undertaking a multi-criteria site assessment on all nominations received to determine which sites are considered appropriate for short-listing [http://www.radioactivewaste.gov.au/].

The Commonwealth volunteer site process was open to sites in all States and Territories. The finally selected site might or might not be in South Australia, but it will accept low and intermediate level waste from South Australia.

The Australian Nuclear Association **recommends** that the Royal Commission support the Commonwealth project to site a national facility for the management of radioactive waste.

International Disposal of Low Level Radioactive Waste

There are about 30 countries around the world that have licensed facilities for the disposal of low level radioactive waste. The storage and disposal of low level and short lived intermediate level radioactive are routine activities in many countries.

Some of the disposal facilities are:

El Cabril Centralised Low Level Disposal Facility, Spain

In Spain, low and intermediate level radioactive waste is disposed of in engineered reinforced concrete cells which will after closure be covered with various layers

including final soil top layer. Once covered there will be a 300 year surveillance and control phase. The facility has capacity for about 160,000 220 litre drums.
[http://www.enresa.es/activities_and_projects/low_and_intermediate_wastes#bloque133]

Low Level Waste Repository - United Kingdom

The Low Level Waste Repository (LLWR) is the UK's national low level radioactive waste disposal facility. It is located close to the West Cumbrian coastline in the North West of England. Established in 1959, the site has safely disposed of the UK low level waste for over 50 years. Containerised waste is grouted prior to disposal in engineered concrete vaults. [http://llwrsite.com/national-repository/]

Centre de l'Aube (CSA), France

Low level and short lived intermediate level radioactive waste disposed of at CSA is conditioned in concrete or metal packages. Waste packages are placed in reinforced concrete repository structures 25 metres square and 8 metres high, that are constructed as needed. Once they are filled, the structures are closed with a concrete slab and then sealed with an impermeable coat. At the end of operation, a cap formed mainly of clay will be placed over the structures to ensure long-term waste containment. Once the authorized limit (one million cubic metres) has been reached, the CSA waste disposal facility will be monitored for at least 300 years.
[http://www.andra.fr/download/andra-international-en/document/editions/379fva.pdf]

Barnwell, South Carolina, USA

In more than 30 years operation, about 800,000 cubic metres low-level radioactive waste and 40 large components including Reactor Pressure Vessels and Steam Generators, have been disposed of at the Barnwell Low-Level Radioactive Waste Disposal Facility the with no regulatory interruptions, and support from the local community. Packaged waste is placed in large concrete vaults located in engineered earthen trenches excavated up to 20 feet below grade.
[http://www.energysolutions.com/waste-management/facilities/barnwell-facility-details/]

Texas Compact Waste Facility (CWF), Andrews County, Texas, USA

The Texas Compact Waste Facility (CWF) provides treatment, storage and disposal of low-level radioactive waste (LLRW) and mixed low-level radioactive waste. The Facility became operational in 2012 and is licenced to receive 200,000 cubic metres of waste. It is owned and licensed by the state of Texas and operated by Waste Control Specialists (WCS). Disposal is into a 350 metre thick nearly impermeable red-bed clay formation with a custom designed and engineered, 2 metre thick, steel-reinforced concrete liner system.
[http://www.wcstexas.com/facilities/compact-waste-facility/]

Rokkasho Japan

Rokkasho Low-level Radioactive Waste Disposal Center is used for the disposal of low level radioactive waste from Japanese nuclear power plants. Operations began in 1992 and the Center had received more than 260,000 drums (about 52,000 m3) of waste to the end of December 2013. Waste drams are placed into engineered concrete cells and backfilled with concrete and covered. JNFL also has a storage facility at Rokkasho for vitrified high-level waste returned from Europe with a capacity of 2880 canisters.
[http://www.jnfl.co.jp/english/file/pamphlet_english.pdf]

Many of the overseas waste management facilities are within 100 km of major centres of population. The El Cabril Facility in Spain designed for disposal of over 50,000 cubic metres of intermediate, low and very low level waste is 60 km from Cordoba (pop 300,000) and 90 km from Seville (pop 700,000). Centre de l'Aube in France licenced for the disposal of 1 million cubic metre of low and intermediate level waste is located in the Champagne region of France, about 60 km from Troyes (pop 60,000) and about 240 km from Paris. The Barnwell Facility in South Carolina, USA, has received 800,000 cubic metres of low level radioactive waste for disposal at a site 70 km from Augusta Georgia (urban pop 400,000).

A radioactive waste storage and disposal facility in Australia does not need to in a remote location. There are no safety concerns that can be more easily met by siting the facility in a remote location. The safety case and public expectations are likely to require the facility to be surrounded by a buffer zone, but that would be similar for a remote location and less remote location. There are clear advantages for the facility to be within a few hours of support facilities, technical services and infrastructure and not too far from the main waste generators.

Between 1992 and 2004, an exhaustive scientific investigation based on nationally agreed criteria identified eight regions in Australia that would be suitable for a national waste facility for low level waste. An area of 67,000 square km in central-north South Australia was identified as the most promising region in Australia. These studies identified sites that had suitable geology, soils with high radionuclide adsorption capacity and were within a reasonable travel distance from support infrastructure. A site about 30 km east of Woomera was selected as the preferred site but the project was abandoned for political reasons. Although this assessment was for a specific site, it would be reasonable to expect many similar suitable sites for the storage and disposal of radioactive waste exist in South Australia.

4.1.2 Intermediate Level Radioactive Waste

Intermediate level waste contains higher levels of radioactivity than low level waste and requires a high level of containment and isolation from human exposure and the environment. Disposal in a facility at a depth of between a few tens and a few hundreds of meters is indicative for intermediate level waste [ARPANSA Safety Guide on Classification of Radioactive Waste, Radiation Protection Series No 20, April 2010]. At these depths the likelihood of inadvertent human intrusion is very low.

Some of the engineered near-surface facilities discussed in 4.1.1 such as Centre de L'Aube in France and El Cabril in Spain have a high enough level of engineered waste isolation to be used for disposal of some types of intermediate level waste

Boreholes have been proposed for the disposal of limited amounts of intermediate level waste including disused sealed sources [IAEA "Borehole Disposal Facilities for Radioactive Waste, Specific Safety Guide No SSG-1, IAEA 2009]. Specially engineered and purpose drilled boreholes offer the prospect of economic disposal of small amounts of intermediate level waste. Disposal of intermediate level radioactive waste in borehole disposal facilities falls between disposal of low level radioactive waste in near surface facilities and disposal of high level radioactive waste in geological facilities. Boreholes might be several hundred metres deep with all waste located at depths greater than 30 m.

For larger amounts of intermediate level waste a large facility might be required at a depth greater than 50 m. For example, the Swedish SFR Facility is located in caverns excavated in bedrock below the Baltic Sea. SFR is 50 m below the bottom of the Baltic Sea [http://www.skb.com/our-operations/sfr/]

Some countries with large amounts of intermediate level waste are storing the intermediate level waste until a geologic facility is established for both intermediate level and high level waste.

4.1.3 High Level Radioactive Waste

Spent fuel from power reactors and high level radioactive waste are routinely and safely stored in countries with nuclear power. Spent fuel and high level waste from reprocessing spent fuel need to be stored for 40 to 50 years to allow radioactive decay to reduce the heat generation rate before disposal in a geological facility

Deep geological disposal in a stable geologic formation is the preferred option for waste management of long-lived radioactive waste in many counties. The Waste Isolation Pilot Plant (WIPP) in the USA is the only purpose-built deep geological repository for long-lived intermediate level waste that is currently licensed for disposal operations. Plans for disposal of spent fuel are well advanced in Finland, Sweden and France. The USA had well advanced plans to establish a high-level waste geologic repository at Yucca Mountain in Nevada for the disposal to spent fuel from power reactors. Although funding for the Yucca Mountain has ceased, the regulatory process continues. Canada and the UK have selected the deep disposal method and have commenced site selection for a high level waste disposal facility.

South Australia has stable geologic formations that appear suitable for the disposal of high level radioactive waste. However, a detailed assessment of the geology would be required to properly assess suitability.

4.2 Are there nuclear or radioactive wastes produced in Australia which could be stored at a facility in South Australia? In what circumstances would the holders of those wastes seek to store or dispose of that waste at facilities in South Australia?

All radioactive wastes produced in Australia could be stored and disposed at a facility in South Australia if the site meets established siting criteria. A facility in South Australia could take radioactive waste from all States and Territories. Western Australia already has a low level waste disposal facility at Mt Walton East, which does not accept radioactive waste from other States. Nevertheless, Western Australia might decide to use the national facility when it is established.

Any expansion of nuclear fuel cycle facilities, apart from mining, will require ready access to a radioactive waste management facility. Mining is dealt with under different legislation which includes appropriate management of the radioactivity in waste streams such as tailings and waste rock

4.3 Would the holders of nuclear or radioactive waste outside Australia seek to store or dispose of that waste in South Australia? Who holds that waste? What evidence is there that they are seeking options to store or dispose of wastes elsewhere including in locations like South Australia? If so, what kinds of waste and what volumes might be expected? What would the holders be willing to pay and under what arrangements?

Over 50 countries currently have spent fuel stored in temporary locations, awaiting reprocessing or disposal. Many of these countries could be interested in sending waste to

South Australia if such a facility was established.

In November 2003, Dr Mohamed ElBaradei, Director-General of the UN's International Atomic Energy Agency (IAEA), suggested to the UN General Assembly that the international community should consider multinational approaches to the management and disposal of spent fuel and radioactive waste.

Multinational facilities are being discussed in Europe and in the Gulf, Middle East and North Africa (MENA) region. However, to date the concept has not been adopted by any group of countries.

4.4 What sorts of mechanisms would need to be established to fund the costs associated with the future storage or disposal of either Australian or international nuclear or radioactive wastes? Are there relevant models in operation which should be considered? What mechanisms need to be put in place to increase the likelihood that the South Australian community, and relevant parts of it, derive a benefit from that activity?

No comment on this question.

4.5 What are the specific models and case studies that demonstrate the best practice for the establishment, operation and regulation of facilities for the storage or disposal of nuclear or radioactive waste? What are the less successful examples? Where have they been implemented in practice? What new methods have been proposed? What lessons can be drawn from them?

Many countries with nuclear power programs have constructed and operated facilities for the safe storage of all levels of radioactive waste. This extensive international experience provides many examples of successful facilities for the storage of radioactive waste that meet international standards and guidance.

Although experience in disposal of long-lived intermediate and high level waste is limited, there are extensive studies supporting geological disposal proposals in Canada, Finland, France, Sweden, UK and USA. The technology for safe disposal is well established.

4.6 What are the security implications created by the storage or disposal of intermediate or high level waste at a purpose-built facility? Could those risks be addressed? If so, by what means?

Any site managing high level waste would have a well prepared security plan to limit access to areas where waste is stored or being disposed. Spent fuel and some forms of high level waste have an additional security issue relating to proliferation risk. Most spent fuel will contain other radionuclides and emit high levels of radiation. Handling such highly radioactive material requires specialised equipment and would not be a realistic path to clandestine diversion.

Any materials of proliferation risk would need to meet the security requirements under the international safeguards agreements which in Australia are managed by the Australian Safeguards and Non-Proliferation Office (ASNO).

Theft from a disposal facility is unlikely to be feasible, except when materials are in transit, but theft from a storage facility might be a realistic possibility (e.g. by terrorists to make a "dirty bomb"). These risks would need to be assessed by security experts.

Illegal access to a waste management site cannot be ruled out as a possibility – and a terrorist attack would no doubt cause widespread terror – but it is difficult to see that such an event could actually have significant radiological consequences outside the site boundary except through physical removal of materials by theft.

4.7 What are the processes that would need to be undertaken to build confidence in the community generally, or specific communities, in the design, establishment and operation of such facilities?

Any proposal to site, build and operate a radioactive waste management facility must be supported by a well planned community consultation and outreach program. A chronology of radioactive waste and spent fuel management issues in Australia prepared by the Parliamentary Library demonstrates the political sensitivity of managing even low level waste [Matthew James and Ann Rann 2011 "Radioactive waste and spent nuclear fuel management in Australia", Parliamentary Library, Parliament of Australia]

4.8 Bearing in mind the measures that would need to be taken in design and siting, what risks for health and safety would be created by establishing facilities to manage, store and dispose of nuclear or radioactive waste? What needs to be done to ensure that risks do not exceed safe levels? Can anything be done to better understand those risks?

The risks associated with radioactive waste disposal are well understood and regulators in Australia already have experience in regulating the risks from management of radioactive materials associated with uranium mining and the OPAL research reactor. The management and storage of spent fuel and radioactive waste from the production of medical radioisotopes has been carried out safely at Lucas Heights, near Sydney, for over 50 years.

The International Atomic Energy Agency (IAEA) has extensive reports and guidance on disposal issues. The risks and criteria for assessing the risk of radioactive waste management facilities have been widely discussed internationally and there are now clear codes and standards. There is considerable international experience in building and operating storage facilities for radioactive waste. There are also many theoretical and experimental studies addressing the disposal of long lived intermediate and high level waste.

The proponent for a waste management facility will have to demonstrate to the satisfaction of the regulator that the risks of the facility are acceptable. What is needed to properly understand those risks is specific geological and engineering data for a particular facility at a particular site.

4.9 Bearing in mind the measures that would need to be taken in design and siting, what environmental risks would the establishment of such facilities present? Are there strategies for managing those risks? If not, what strategies would need to be developed? How would any current approach to management need to be changed or adapted?

The response to question 4.9 is almost the same as the response to question 4.8. The environmental risks of radioactive waste management facilities are well understood. A radioactive waste management facility will have to meet similar environmental assessments to those required for any facility handing significant amounts of hazardous materials. There will be differences because in this case the material contains radioactivity, but the regulatory processes for assessing environmental risk and issues licences are well established processes.

4.10 What are the risks associated with transportation of nuclear or radioactive wastes for storage or disposal in South Australia? Could existing arrangements for the transportation such wastes be applied for this purpose? What additional measures might be necessary?

The IAEA Regulations for the Safe Transport of Radioactive Material (the Transport Regulations) apply to the transport of radioactive material by all modes on land or water, or in the air, including transport that is incidental to the use of the radioactive material. ARPANSA has issued the Radiation Protection Series C-2 (RPS C-2) *Code for the Safe Transport of Radioactive Material*, 2014 Edition, ARPANSA which adopts the IAEA's *Regulations for the Safe Transport of Radioactive Material*, 2005 Edition (No. TS-R-1).

The transport of radioactive waste falls under the general category of radioactive materials for which there is a clear and effective regulatory regime and there is no need for any additional measure for transporting radioactive waste.

4.11 What financial or economic model or method ought be used to estimate the economic benefits from the establishment or operation of facilities for the storage or disposal of nuclear and radioactive waste? What information or data (including that drawn from actual experience in Australia or overseas) should be used in that model or method?

No comment on this question.

4.12 Would the establishment and operation of such facilities give rise to impacts on other sectors of the economy? How should they be estimated and what information should be used? Have such impacts been demonstrated in other economies similar to Australia?

No comment on this question.