Background Paper

Australian National Preparedness and Response Capability for Radiological Emergencies

Terminology

Throughout this background paper, the term 'radiological emergencies' is defined as applying to any incident originating from radioactive or nuclear materials, other than nuclear weapons detonations which are beyond the scope of this paper. The consequences of loss of control or release of radioactive or nuclear materials relate to the consequences from exposure to and/or contamination with radionuclides. Hence the term of 'radiological emergency' is applied where there is loss of control or release of either radioactive or nuclear materials for the purposes of the document.

The International Atomic Energy Agency utilises the International Nuclear and Radiological Event Scale (INES) as a tool for communicating the safety significance of nuclear and radiological events to the public. It is used for the rating of events that result in a release of radioactive material into the environment and in the radiation exposure of workers and the public. It is also used for events that have no actual consequences but where the measures put in place to prevent them did not function as intended. The scale is also applied to events involving the loss or theft of radioactive sources and the discovery of uncontrolled radioactive sources in scrap metal. The INES scale is reflected in the ARPANSA *Guide for Radiation Protection in Emergency Exposure Situations – The Framework RPS G-3 Part 1*.

For this background paper, a 'radiological emergency of significance' is defined as an accident with wider consequences, INES Level 5 or above. For example, a release from a reactor in a nuclear powered submarine, or from the OPAL reactor, would be a radiological emergency of significance. So too would the loss or misuse of a sealed source of high activity, if it potentially exposed a population to significant risk of harm.

The case for action

The infrequency of radiological emergencies of significance within Australian jurisdictions means that arrangements for this type of emergency have not been adequately tested or developed. Australia has never experienced a radiological incident on the scale of Black Saturday, Cyclone Yasi or the Floods of 2022 (incidents of significance). It has experience with small scale radiological incidents that are comparable to vehicle collisions or house fires, and just rarely, low-level hazmat incidents. Large scale everyday hazard emergencies have led to royal commissions and wide-ranging, extensive reviews and overhaul of arrangements. A radiological incident of sufficient magnitude has never occurred in Australia to prompt such a significant review.

There is a relatively basic level of preparedness across the States, Territories and Commonwealth that is adequate to address the low-level radiological incidents that usually occur. However, there is a broad range of deficits (e.g. a lack of defined competencies, lack of common operating procedures between regulators and other agencies with radiological expertise and first responders, lack of depth in preparedness of the health and laboratory sectors), a lack of capacity and some specialist capabilities to deal with radiological emergencies of scale in a coordinated response.

Whilst successfully resolved, a recent incident demonstrated severely constrained availability of technical expertise and resources, and challenges in integrating effective emergency management. It required the resources of two Commonwealth agencies in support of a jurisdictional response in order to locate a lost source. It is extremely unlikely that this level of response could be sustained for more than a relatively brief time, even with the support of other States and Territories.

If a modestly-sized population had been exposed to significant risk of harm, it is likely that even a national response would be challenged to adequately address their needs for assessment and treatment. This is especially the case when considering the likely apprehension and fears in the wider population concerning radiation effects, requiring advice and reassurance whilst also countering misinformation.

As an incident, the lost source mentioned above demonstrated that there are only relatively few personnel with the relevant expertise, equipment and experience across Australia with the capability to address what some other countries perceived to be a relatively low-level incident. In a larger scale, more complex incident, the available resources of personnel and equipment in Australia would soon be exhausted. And this would be compounded by the added requirement for expert advice to all levels of government, across agencies, and to inform the public as the incident unfolds over days, weeks or months.

This limitation affects both national and state/territory preparedness for radiological emergencies, reflected in the following recommendations from the 2018 International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) review:

"The Commonwealth Government, in conjunction with state and territory Governments should ensure that the roles and responsibilities of ARPANSA in emergency preparedness and response both for incidents involving its own licensees and for incidents in the States and Territories are clearly assigned and exercised."

and

"The Commonwealth Government, in conjunction with state and territory Governments, should consider formalizing the existing elements of the framework for safety into a comprehensive national policy and strategy for safety."

Issues impacting radiological emergency preparedness include gaps in policy and strategy, deficiencies in capability, health sector preparedness, laboratory capability and capacity, and workforce development and capacity.

The low level of capacity and capability in Australia across all jurisdictions for radiological emergencies of significance requires considerable investment and strategic coordination on a national level commensurate with the risk. Significant radiological and nuclear incidents that require emergency response are low likelihood and high consequence. Far-sighted planning and investment will help to build appropriate resources to deal with the changing risk.

Prompted by the COVID-19 pandemic, the Australian government has committed to establishing an Australian Centre for Disease Control (CDC), with an all-hazards focus. The initial focus will be on further

building up the National Medical Stockpile; and undertaking communicable disease surveillance, prevention and response. The following opportunities for improvement are recognised:

- developing a centralised and coordinated national approach to public health
- increasing capacity and capability in the public health workforce
- strengthening leadership on key public health issues – from preventive health to environmental hazards
- strengthening public health advice and guidance
- developing systems to meet national and jurisdictional needs for efficient health responses across all hazards.

The consultation paper on *the Role and Functions of an Australian Centre for Disease Control: Prevention-Promotion-Protection* was published in November 2022, and stakeholder consultation was completed shortly thereafter. The consultation paper makes only one mention of radiation, under policy. The report on *CDC Stakeholder Engagement* makes no mention of radiation. ARPANSA was included in the stakeholder consultation.

The establishment of an Australian CDC provides an opportunity to develop a robust radiation and nuclear emergency preparedness and response capability. ARPANSA should be a vital stakeholder in this process.

Issues impacting radiological emergency preparedness

Policy and Strategy

- Nationally integrated emergency management arrangements do not exist for large scale radiological incidents. States and territories have primary responsibility for the protection of life, property and the environment within their jurisdiction, underpinned by relevant Emergency Management legislation applicable to all hazards. Commonwealth emergency management arrangements do not negate or override normal jurisdictional command and control arrangements. However, national coordination is lacking for radiological emergencies, there is no or extremely limited capacity and capability in jurisdictions, no funding, and no explicit objectives or remit for jurisdictions as radiological incidents are not seen as a priority amongst more obvious and likely threats.
- Australia has a federated radiation regulatory system that is not interoperable and scalable across jurisdictional boundaries particularly as it relates to emergency preparedness. Jurisdictional legislation for radiation protection reveals generic emergency authorisations/powers for authorised officers, but little else. The relevant legislative responsibilities of Commonwealth, State and Territory radiation advisory bodies do not include explicit consideration of emergency preparedness. Lack of coordination and resources not only constrains the ability to respond effectively to large and significant scale radiological incidents, but it also limits the resource to adequately address the policy aspects.

Capability

- Incident response needs ‘boots on the ground’ radiation incident response capability, and this is a local jurisdictional response, at least initially. Radiological emergency management arrangements generally specify responsible agencies, and list various tasks (such as: provide advice, protect health

and safety, hazard characterisation, contamination control, source recovery, casualty care, waste management). However, these responsibilities are not mapped to specified competencies for radiological emergencies and workforce modelling for these specified roles is largely non-existent. This applies to all agencies with a response role in radiological emergencies.

- Recent direct jurisdictional experience is likely to inform ARPANSA's understanding of effective engagement with States and Territories. This includes the January 2023 WA Rio Tinto lost source, September 2023 South Australia OneSteel lost source, and October 2023 South Australia counter terrorism desktop exercise involving SA Police, Metropolitan Fire Service and EPA, with Defence and ARPANSA.
- Overall, there are very low numbers of competent personnel in Australia that have the skills and expertise to respond to radiological emergencies. The most technically competent in this field may have limited experience working with other disciplines in the emergency management context. This can impede the ability of radiation-qualified response teams to integrate within a multi-disciplinary emergency management team and compromises the ability to gain trust in the advice given.
- Most States and Territories have radiation capability integrated into State Emergency Management Arrangements. Radiation teams participate in chemical, biological, radiological, and nuclear (CBRN) exercises with first responders, and through familiarity, they are accepted as subject matter experts within the emergency management team. It is a small capability however. In large scale incidents, expanding that capability with Commonwealth organisations unfamiliar with the state or territory emergency management arrangements risks losing integration and effectiveness.
- In emergency preparedness, role statements are used in mapping required capabilities, and developing competencies. This is an important contributor to workforce analysis. Competencies are then used to set the training, accreditation and skills maintenance agenda for effective emergency response.
- Training and education in emergency preparedness for radiological emergencies is ad hoc and incomplete at best, with very limited training targeted to hazardous materials response in jurisdictions, and training within Defence targeted to Defence requirements. The two national bodies with support roles, ARPANSA and ANSTO, have some emergency management capability with varied depth of training and exercise. State/territory radiation regulators have inconsistent training in these areas, leading to some jurisdictions having very modest response capability.

Health Sector Preparedness

- In the health sector, no non-radiological undergraduate program addresses either emergency management or radiological health effects and treatment. The specialist medical colleges generally do not address either issue. Apart from radiation health professionals, health professionals often have extremely limited (no) grasp of radiation injury or its management, and radiation health professionals have limited, if any, involvement in organisational emergency management plans. As a first step, undergraduate courses in health disciplines should include content on radiological injuries and treatment. Running courses is good, but too often participants fail to share their newly acquired learning. It is also a poor way to build sufficient knowledge across a very substantial workforce. Introducing concepts to undergraduates could facilitate generational change in understanding and expertise.
- Although some Australian hospitals have decontamination capability, health worker fear of radiological contamination may compromise management of patients. Lack of knowledge and training is likely to result in chaotic initial response, with consequent health implications. That

might include failure to treat non-radiation acute injuries, preventable trauma deaths, mental health injuries, as well as delays in appropriate management of radiation injuries.

- Australian guidance for health response to radiological emergencies requires review. ARPANSA/TR131, August 2000, *Manual on the Medical Management of Individuals in Radiation Accidents* was superseded by the Australian Government publication *Australian Clinical Guidelines for Radiological Emergencies* in September 2012. There have been other publications emerge overseas (e.g. *The Medical Aspects of Radiation Incidents, 4th ed*, ORISE, 2017; the *TMT Handbook: Triage, Monitoring and Treatment of people exposed to ionising radiation following a malevolent act*, 2009, C. Rojas-Palma et al, a Consortium of European authorities; *High Dose Radiation Effects and Tissue Injury: Report of the Independent Advisory Group on Ionising Radiation*, 2009, Health Protection Agency, UK; *Medical Management of Radiation Injuries*, 2020, IAEA Safety Reports Series No. 101.) There is a need to review, update and disseminate the Australian guidance for radiological injuries to ensure the clinical advice is contemporary.
- No training is being offered to health professionals for health response to radiological emergencies outside Defence, apart from a recent course organised by ARPANSA and delivered by the *US Radiation Emergency Assistance Center / Training Site (REAC/TS)* to a small number of participants. Yet emergency and advanced care of radiological injuries will be delivered in civilian settings.
- Virtually no training is offered to public health professionals, such as medical advisers, who are required to advise governments, responders, health workforce and the community on radiation health risk. Only radiation regulators have any expertise in offering advice on radiation health risk, but very limited experience of offering emergency advice to the entities listed above, with none for large emergencies. Lack of current capacity will impact the timely delivery of advice should a large radiological emergency occur.
- Australian public health professionals have no experience in determining ongoing health risk from a radiation incident. Appropriate judgement is required in selection of areas for evacuation or restricted movement. The major health impacts from the Fukushima Daiichi disaster were cardiovascular and mental health illness in dislocated people, with premature deaths particularly seen in in elderly persons removed from access to usual medical care. Over-reliance on the precautionary principle will result in unintended death and disability from non-radiological causes. The competence of initial health response and public health advice will play a major part in the trust needed for the recovery phase.

Laboratory Capability and Capacity

- There is no Australian capability to perform Dicentric analysis, the gold standard for prognosis in radiation injury. Alternative methods, like the IAEA-endorsed Cytokinesis Block Micronucleus Assay, exist in Australia (identified at an ARPANSA and Commonwealth Department of Health and Human Services workshop on *Australian Capability for Biodosimetry Assessment* 2008), however the capacity of such programs almost certainly require enhancement to adapt for mass casualty circumstances. Availability of such tests is important for decision-making in treatment of patients. Some form of mass screening may provide reassurance to many hundreds of people who were involved in an incident but not exposed. Secondly, in managing the scarce resources of the National Medical Stockpile, strategic judgement is required for equitable distribution of treatment to those who will benefit the most. The only way to inform this is to use some objective measure from an appropriate laboratory test.

- Bioassay capability for urine and faeces, as a measure of internal contamination, is unlikely to exist except in the most limited capacity. Ideally such capability should only be undertaken in NATA-accredited laboratories. These results need to be considered semi-urgently before continued administration of de-corporation agents, a scarce resource also known to have likelihood of causing significant side-effects.
- *A Survey of the Capabilities of Australasian Radioanalytical Laboratories Capacity TRS 168,* published by ARPANSA in 2014, identified limitations in both capability and capacity for Australia-NZ testing of environmental samples. Only two of 8 listed laboratories mentioned in the report appear to be currently registered with the National Association of Testing Authorities, Australia (NATA) for radiation-related testing. The report did not make specific recommendations, and it is unclear what further work has been undertaken. Environmental sample testing will be crucial in determining the extent of environmental contamination, and entry into biota, agriculture, and waterways. It will also be essential in demonstrating the adequacy of clean up, and satisfactory restoration of the affected environment, be it natural or constructed. Environmental sampling programs can generate thousands of samples quite quickly. Some testing will be quite urgent, such as tests on drinking water, or agricultural products, for example. This will be critical for trust and recovery, including economic recovery of agricultural exports.

Workforce Development

- There is significant workforce mapping for AUKUS, focussed on delivery of nuclear-powered submarine operation, maintenance and manufacture by government and Defence. This does not necessarily consider wider requirements, particularly civilian capability and capacity to effectively deliver an adequate emergency response to significant radiological emergencies.
- There is an emerging trend of universities offering training to various sectors for a potential future radiation/nuclear workforce. There are reports of difficulties attracting students to some offerings. There is no external oversight of the design and content of the university offerings and how well-matched these are to the skills required for this workforce, nor is there any workforce mapping to ensure that the correct students are targeted, and future workforce needs will be met.
- The newly established Australian Research Council (ARC) Industrial Transformation Training Centre (ITTC) in Radiation Innovation is likely to be relevant. Led by Professor Mahananda Dasgupta of ANU, in partnership with UniSA and University of Adelaide, the five-year funded ITTC aims to bolster the nation's capabilities in sectors underpinned by nuclear and radiation science and policy. This group has representation from ARPANSA, Defence SA and Queensland Health, as well as Australia Radioactive Waste Agency, CSIRO, ANSTO, BHP and others. Defence SA is seeking opportunities for student placement in South Australian government agencies and industry.
- No one type of agency can meet the training needs for the diverse types of responders and professionals that are required. Training options need to be broadened to include formal academic studies, specific content within existing degree and postgraduate courses, TAFE, short courses, intensive courses, practical skills acquisition, and collaborative cross-disciplinary work, as required. Relevant industry placements need to be available also.
- A national workforce needs analysis, and subsequent development of industry or radiation/nuclear emergency response specific competencies, would help to inform a nationally coordinated program of training.

  There are limited careers promotion programs in STEM (science, technology, engineering, and mathematics) fields currently. This should be extended to options in disciplines relevant to

radiation and nuclear workforce requirements and should begin in schools. A nationally coordinated approach to careers promotion should be taken to avoid fragmenting the message in the competition for workers between the respective sectors (e.g. regulatory, NRWMF, AUKUS and others).

Capacity and Surge Workforce

- There are insufficient numbers of competent personnel in Australia that have the skills and expertise to respond to radiological emergencies other than small, localised emergencies.
- Collaborative partnerships and relationships to support enhanced emergency preparedness have not yet been explored or identified. To reduce the existing profound gap in capability and capacity for larger emergencies, opportunities to consider include:
    - an interim program of upskilling the existing emergency responder/ regulatory/ health workforce, and
    - partnership with related industries or sectors, such as academia and the mining industry, identifying key personnel who could act in support of radiological emergency response with appropriate training.
- Upskilling the existing workforce and building a surge workforce has the advantage of improving capacity and interoperability quickly.

Responsibilities

- *States and Territories* have primary responsibility for the protection of lives, property and the environment and have emergency management arrangements that include radiation incidents. These arrangements come into effect at least several times per year for small radiological incidents, commonly involving transport of nuclear medicines and radioactive sources, and occasional discovery of orphan sources or inappropriate disposal of radioactive waste. However, the infrequency of radiological emergencies of significant size means that arrangements for larger or more complex emergencies have not been adequately tested or developed. The plans developed for nuclear powered warship visits are not sustainable for hosting a more permanent presence of nuclear powered submarines, although they do provide a basis for further development of arrangements.
- *ARPANSA* has responsibility for promoting national uniformity. Key areas of work have been the development of national policies, codes and standards, guidance (including the *Guide for Radiation Protection in Emergency Exposure Situations RPS G-3*), competency requirements, and reducing regulatory burden. National uniformity in radiological emergency capabilities and integration of arrangements has not yet been fully examined. This is complicated by the legislated responsibilities of States and Territories under their respective emergency management Acts. Nevertheless, ARPANSA leadership in this area would be welcome.
- *ARPANSA* also provides emergency preparedness and response (EPR) support systems for radiological incidents. The EPR systems for field, network and laboratory measurements, and information management and decision support systems, are calibrated, tested and exercised to ensure availability, and personnel are trained. The capacity of these systems is finite, and the ability to integrate with State and Territory emergency management arrangements is challenging without adequate national coordination.

- *ANSTO* also maintains an emergency response team. Further, ANSTO delivers a five-day course to support first responder agencies in preparedness and response in radiological emergency situations. Frequent interaction with first responders, through teaching and simulated exercises, helps to build relationships and skills that can assist integration with State/Territory emergency management teams. Like ARPANSA, ANSTO also maintains specialist radiation laboratory services.
- To complement the efforts of State and Territory governments responding to a disaster or emergency, the Australian Government can also provide physical assistance under the *Australian Government Disaster Response Plan (COMDISPLAN)* when the resources of an affected jurisdiction cannot reasonably cope with the needs of the situation. For radiological emergencies, these resources include those of ARPANSA, ANSTO and Defence. Other commonwealth plans address specific types of radiological emergencies under counter-terrorism arrangements, and in arrangements for return of space debris. Defence maintains arrangements for emergencies pertaining to visiting nuclear-powered warships. The *Australian Government Crisis Management Framework (AGCMF)* outlines the Australian Government's approach to preparing for, responding to, and recovering from crises and has recently been revised. The AGCMF provides Ministers and senior officials with guidance on their respective roles and responsibilities. While other Commonwealth Government emergency management arrangements exist, only the most pertinent are listed here.
- The *Department of Health and Aged Care*, maintains the Office of Health Protection and supports the Australian Health Protection Principal Committee (AHPPC). EnHealth, a subcommittee of AHPPC, and its Radiation Health Expert Reference Panel (RHERP), are key contributors to the national work on pursuing national uniformity in regulation of radiation protection, but do not appear to have addressed national uniformity yet in preparedness for radiological emergencies. The *Domestic Health Response Plan for Chemical, Biological, Radiological or Nuclear Incidents of National Significance (Health CBRN Plan)* is maintained by the National Health Emergency Management Subcommittee (NHEMS) of AHPPC. This plan sets out national coordination arrangements for the health response to radiological emergencies, including maintenance of the National Medical Stockpile.
- *The threshold for a radiological incident becoming a national response* is determined in consultation between the relevant State, Territory or Australian Government agencies. Scale is a factor. Under present circumstances, a relatively small incident may have the potential to overwhelm local/regional response resources, due to the location of the event, the level of media interest, and community concern. There is no agreed minimum threshold specified at which a radiological incident may trigger a request for national assistance.
- *The transition between emergency response and recovery phases* is untested for significant radiological emergencies, and responsibility for the decision to transition is dependent on the circumstances but will most likely rest with State/Territory governments under the relevant coordination arrangements in effect. Radiation health and safety advice will be crucial to this decision.

Standards

Arrangements

Effective national response arrangements and capabilities are essential to minimise the impacts from nuclear and radiological incidents and emergencies. Coordination arrangements generally specify the authorising environment, roles and responsibilities. Integration of arrangements occurs through repeated experience, developing enhanced understanding of the relationships and operations of relevant agencies either through frequent or protracted incidents and review, or regular exercising and drills.

The IAEA maintains the international *Emergency Preparedness and Response (EPR) framework*, based on international legal instruments. IAEA safety standards, guidelines and technical tools assist Member States, such as Australia, to build capacity for emergency response. The IAEA Safety Requirements establish the conditions that must be met to ensure the protection of people and the environment. The IAEA Safety Guides provide recommendations and guidance on how to comply with the Safety Requirements and indicate an international consensus on the recommended measures. As a minimum, Australia must meet, or preferably exceed these standards.

Significant changes currently impacting Australian national and jurisdictional arrangements for radiological emergencies include:

- recent and ongoing reviews of the Commonwealth emergency powers, AGCMF, Health CBRN Plan, Australia's radiation protection and nuclear safety regulatory systems (KPMG), and the National Medical Stockpile
- IAEA IRRS 2023 Follow-up mission to Australia
- expected introduction of nuclear-powered submarines
- forthcoming establishment of an Australian Nuclear-Powered Submarine Safety Regulator
- proposed CDC scheduled to commence in early 2024
- efforts by enHealth, RHERP and ARPANSA to promote national harmonisation
- reviews of recent jurisdictional incidents.

These changes present a significant opportunity and imperative for a critical review of the adequacy of Australian radiological emergency preparedness and response capability.

Further, in order to effectively integrate the radiological response team with other emergency personnel and agencies, arrangements for radiological emergencies should also be consistent with the existing Australian approach to emergency management:

- scalable and underpinned by partnerships at every level
- a shared responsibility, as no one jurisdiction, agency or organisation has the knowledge or capacity to do this alone
- comprehensive: addressing prevention, preparedness, response & recovery
- coordinated, integrated, operating on a common platform with adequate, timely information sharing
- flexible, agile and adaptive

- using risk-based prioritisation of resources
- resilient: able to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard.

This will necessitate upskilling of the radiological response team with emergency management qualifications.

Legislation

There is an inherent conflict with almost parallel systems of responsibility for radiological emergencies. The legislation and arrangements for emergency management, primarily those of states and territories, are matched by Commonwealth coordination arrangements. But there is also legislation and regulation for radiation protection at state/territory and national levels. Additional legislation is in development for the establishment of a new independent Commonwealth statutory regulator, the Australian Nuclear-Powered Submarine Safety Regulator.

Whilst duplication is undesirable, there is an urgent need to address the gaps and shortfalls in the current state of preparedness.

Consideration should be given to whether amendments to jurisdictional radiation protection acts could include explicit responsibility for consideration of adequacy of emergency preparedness to assist in improving preparedness. It could also be a legislative requirement for radiation advisory bodies to monitor and make recommendations to improve preparedness in their jurisdiction.

Further considerations

Financial implications

The low level of capacity and capability in Australia for radiological emergencies of significance requires considerable investment and strategic coordination on a national level. Historical counter-terrorism funding was focused on crisis management and lacked investment for safety-related consequence management. Additionally, because of the very low likelihood of radiological terrorism, radiological emergencies have received the least share of counter-terrorism related funding. Therefore, this has not contributed significantly to overall national preparedness for radiological emergencies.

Without impacting counter-terrorism funding, a complementary funding stream is required to address the very considerable gaps in Australian preparedness for the public safety consequences of radiological emergencies. The recent investment in the ARC ITTC is welcomed but will only provide a partial (if very significant) solution to workforce issues across the sector. It does not necessarily address emergency preparedness training needs nor other non-workforce-related gaps in preparedness for radiological emergencies.

Risk analysis

Disaster risk reduction focuses on:

- Vulnerability analysis to identify key points of failure and possible interventions

- Scenario analysis to explore different extreme events, and how the system might respond to reduce vulnerabilities, to better understand how social, physical and natural systems are affected by each other, by our decisions and by the cascading impacts of even a single hazard

'Whole of system' risk assessments that go beyond 'likelihood x consequence' approaches, are better suited to systems where vulnerability varies in space and time, where risks are uncertain or unfamiliar and cascade between sectors.

The definition of health proposed by the World Health Organization incorporates physical, mental and social well-being. Despite the enormous psychological and social cost of toxic disasters, until recently assessments have tended not to take into account this aspect in assessing the adverse effects of disasters. The public health perspective shows how each phase of a disaster and each player in disease onset (host, agent, environment) interact.

Underneath these interactions are *individual perceptions* – by the sufferers, the health care providers, government agency officials and the media – and these perceptions drive the magnitude, persistence, evolution and even the risk and protective factors that are identified after major ecological catastrophes. It is important to understand the variables that promote health and protect against adverse mental health outcomes after disasters and build resilience among the affected populations.

Crucial to maintaining public confidence in government and responding agencies to any emergency is the effectiveness of the response, the timely delivery of public warnings and advice, and the rapid restoration of normalcy. This can only be achieved through mandated, appropriately funded, nationally integrated radiological emergency response arrangements underpinned by defined capabilities and competencies, with sufficient workforce capacity.

Timing/handling:

It is necessary to urgently commence building capacity and capability in radiological emergency preparedness as there is a long lag time to build workforce, and skill it appropriately. There must also be exercises and experience in order to build effective coordination and integration. The work is essential to ensure the robust capability expected by Australians.

Consultation

It is recommended that further consultation with States and Territories, and enHealth will be required as part of a strategic review of Australia's emergency preparedness for radiological emergencies. Consultation should also include emergency responder peak bodies, Defence, academia and industry.

ARPANSA's role

ARPANSA leadership promoting these issues nationally and across jurisdictions is vital. ARPANSA ought to have a lead role in informing the development of an Australian CDC with respect to enhancing Australian capacity and capability for radiological emergencies of significance. In view of the current critical deficiencies in national capacity and capability for these emergencies, ARPANSA needs to maintain its existing capabilities consistent with its mission to contribute to the health and safety of the community by protecting the Australian people and environment from the harmful effects of radiation.

Conclusion

Nuclear powered submarines provide an imperative for a critical review of the adequacy of Australian national emergency preparedness and response capability for radiological emergencies because of imminent changes to the risk environment.