TOXIC THREAT

The danger of nuclear waste in Australia

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Cover Image: The Mochovce Nuclear Power Plant

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Greenpeace Australia Pacific acknowledges the Traditional Owners of Country throughout Australia and the Indigenous peoples of the Pacific Islands, and recognises their continuing connection to land, waters, and culture. We pay our respects to their Elders past and present. Their fight to protect Country from nuclear waste continues.

EXECUTIVE SUMMARY

Opposition leader Peter Dutton wants to build nuclear reactors at seven sites across Australia: One or more conventional reactors at former coal power station sites Liddell and Mount Piper in New South Wales, Tarong and Callide in Queensland, and Loy Yang in Victoria; and at least one "small modular reactor"—which are still unproven technically and financially—in Port Augusta in South Australia, and Muja in Collie, WA each.

In total, the Coalition hopes to deliver up to 14 GW of nuclear energy by 2050,[1] which is equivalent to 14 conventional, large reactors.

In this report, Greenpeace Australia Pacific warns that not only has the Coalition grossly understated the quantity of nuclear waste that would be generated in Australia, it has also not addressed the myriad risks of transporting and processing this waste.

The Coalition has also kept the Australian public in the dark about where the hundreds of billions of dollars required for nuclear waste and risk management measures will come from.

- **The Coalition's nuclear plans could produce 14 billion Coke cans of waste a year.**
  While Mr Dutton has sought to downplay the risks by saying that a small modular reactor would produce only one Coke can's worth of waste[2], the Coalition's plans to build 14GW of nuclear would actually produce the equivalent of, at minimum, 14 billion Coke cans of waste every year—for 80 to 100 years.[3]

  This means that over the planned lifetime of the Coalition's nuclear reactors, Australians will be saddled with the equivalent of 1.18 trillion to 1.47 trillion Coke cans. This is equivalent to the

[1] Liberal Party of Australia (2023, Dec), "A Cheaper, Cleaner and More Consistent Energy Plan for Australia", https://www.liberal.org.au/2024/12/13/a-cheaper-cleaner-and-more-consistent-energy-plan-for-australia

[2] Crowe, D. (2024, June), "Dutton's claim nuclear waste would be size of Coke can 'hard to swallow'", https://www.smh.com.au/politics/federal/dutton-s-claim-nuclear-waste-would-be-size-of-coke-can-hard-to-swallow-20240621-p5jnmy.html

[3] Knaus, C. (2024, June), "Coalition nuclear policy: what does the international experience tell us about Peter Dutton's power plant promise?", https://www.theguardian.com/australia-news/article/2024/jun/24/coalition-nuclear-policy-peter-dutton-power-plants-100-years-run-time

entire volume of water in Sydney Harbour. If stacked end to end, the total number of Coke cans would stretch well past the sun.

- **The Coalition's nuclear plans would subject Australians to the risk of a catastrophic nuclear accident, especially in regional areas.** In countries with a significant nuclear industry, nuclear waste transport accidents and incidents are commonplace, and Australia is not immune to the risk of accidents.

  From a meltdown to a leak to a transportation accident, an accident at any point in the waste management value chain would be devastating. A nuclear accident would have complex and far-ranging consequences, including the disruption of the livelihoods of communities close to nearly 12,000 farms[4], the contamination of waterways and people with high-level nuclear waste, which is severely harmful to human health.

  Almost 200,000 Australians[5] could be at risk of a nuclear accident under the Coalition's proposed plans, while emergency service leaders have warned that Australia's emergency services, which are already bearing the strain of responding to more frequent and severe climate disasters, are not equipped to deal with nuclear emergencies.

- **The Coalition has not shared a plan on how it will deal with or fund the safe management of high-level radioactive waste.** The Coalition has also not laid out any plan to safely process, transport, and permanently store the large amounts of toxic radioactive waste that Australians would have to manage for many generations to come.

  Australia has a track record of failure when it comes to dealing with even low-level nuclear waste, which undermines confidence that we are adequately equipped to handle high-level radioactive waste from nuclear reactors. We have failed to establish a shallow national repository to safely store this material, and have a spotty history of existing and former radioactive waste repositories failing safety audits, the illegal dumping of radioactive waste by corporations going undetected by governments, and bungled clean-ups of nuclear waste.

[4] Department of Agriculture, Fisheries and Forestry (2024, July), "Minister Murray Watt - Joint Ministerial Statement on Nuclear Reactors on Agricultural Land - Thursday, 18 July 2024", https://mailchi.mp/097b0bc49c92/minister-murray-watt-joint-ministerial-statement-on-nuclear-reactors-on-agricultural-land-thursday-18-july-2024

[5] Australian Conservation Foundation (2024), "The Nuclear Plume Map", https://nuclearplume.au/

Peter Dutton has only made vague statements to say that the waste from a standard-sized reactor would be “stored on site under our proposal, and then at the end of the life of that asset, it's moved to a permanent home.”[6] Mr Dutton has shed no light on what this “permanent home” might be, instead kicking the can down the road, saying that it would be the same location “where the government decides for the waste from the submarines to be stored.”

The Coalition’s nuclear costings, which have been discredited by experts,[7] also do not factor in related costs that the taxpayer will bear, including waste management, emergency response capability, and insurance.

- **Nuclear is too risky, too slow, and too expensive for Australia.** In addition to the many deep and serious risks and costs associated with the Coalition’s nuclear plans, experts have also said that nuclear power is too slow for Australia—and little more than a smokescreen to prolong the use of coal and gas in our energy system for as long as possible. For instance, an interim report from a House Select Committee on Nuclear Energy[8] found that it could be “well into the 2040s” before nuclear energy could be generated in Australia, a timeline that is too late to “support Australia's critical energy transition targets and climate commitments, or to assist the coal workforce and communities in their transition away from the coal industry.”

  Australia does not need to risk Peter Dutton’s nuclear plan. We are already almost halfway towards powering Australia with clean, safe and affordable wind and solar power, and should be accelerating progress towards 100% renewable energy, backed by storage, instead.

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[6] Dutton, P. (2023, Dec), "Leader of the Opposition Transcript - Joint Press Conference with the Hon David Littleproud MP, the Hon Sussan Ley MP, the Hon Angus Taylor MP and Mr Ted O'Brien MP, Sydney", https://peterdutton.com.au/leader-of-the-opposition-transcript-joint-press-conference-with-the-hon-david-littleproud-mp-the-hon-sussan-ley-mp-the-hon-angus-taylor-mp-and-mr-ted-obrien-mp-sydney/

[7] Clean Energy Council (March 21st, 2024), ‘Analysis of Frontier Economics report: The economics of nuclear power’, Clean Energy Council, https://cleanenergycouncil.org.au/news-resources/analysis-of-frontier-economics-report-economics-nuclear-power

[8] House of Representatives Select Committee on Nuclear Energy (December 2020), ‘Timeframes for nuclear power generation in Australia’, Parliament of Australia, https://www.aph.gov.au/Parliamentary_Business/Committees/House/Select_Committee_on_Nuclear_Energy/Nuclearpower/Interim_report_for_the_inquiry_into_nuclear_power_generation_in_Australia/Chapter_2_-_Timeframes_for_nuclear_power_generation_in_Australia#Heading110

01. INTRODUCTION

In June 2024, Opposition Leader Peter Dutton identified seven Australian communities as potential sites for proposed nuclear reactors, solidifying nuclear energy as a key pillar of the Coalition's offering in the 2025 Federal Election.

The Coalition has proposed five large reactors at former coal power station sites Liddell and Mount Piper in New South Wales, Tarong and Callide in Queensland, and Loy Yang in Victoria; and two "small modular reactors"—which are still unproven technically and financially[9]—in Port Augusta in South Australia, and Muja in Collie, WA.

While a large majority of the analysis and scrutiny of the Coalition's nuclear plans have focused on issues of cost, timelines, and impact on Australia's energy transition away from fossil fuels towards renewable energy, the highly dangerous nature of radioactive nuclear waste, and the Coalition's absolute lack of a credible plan to handle and fund the safe management of nuclear waste warrants further scrutiny from Australian voters and taxpayers.

This report focuses on three main ways in which the Coalition's nuclear plans are risky for Australian communities:

- The volume of waste generated
- The risks and consequences of a nuclear accident
- The Coalition's lack of a plan to safely store, transport, and deal with nuclear waste.

[9] Australian Academy of Technological Sciences and Engineering (November 2023), 'New report reveals technical and market implications for small modular nuclear reactors in Australia', ATSE, https://www.atse.org.au/news/new-report-reveals-technical-and-market-implications-for-small-modular-nuclear-reactors-in-australia/#:~:text=%E2%80%9CSMR%20technology%20could%20provide%20low,benefits%2C%E2%80%9D%20Dr%20Woodthorpe%20said.

02.
WASTE FROM NUCLEAR REACTORS IS HIGHLY DANGEROUS

The international nuclear fuel chain consists of multiple steps, all of which produce varying volumes of radioactive nuclear waste. The chain starts with uranium exploration, mining, milling, and conversion into feedstock for uranium enrichment plants. This is followed by fuel fabrication, then commercial nuclear reactor operation, leading to nuclear spent fuel, which is either stored or reprocessed.

Known as 'high-level waste', waste from nuclear energy generation is hazardous because it contains radioactive materials that emit ionising radiation, which can be extremely harmful to human health and the environment. This radiation can cause severe damage to living cells, leading to mutations, cancer, and other health issues. Some radioactive isotopes in nuclear waste remain dangerous for thousands or millions of years, requiring secure containment for an extremely long time.

Nuclear waste can contaminate soil, water, and air. Leaks or spills from storage facilities can make land uninhabitable and pollute drinking water supplies. Transportation of nuclear waste also poses high risks, as accidents could result in dangerous radiation exposure. The recent frantic search across Western Australia for a lost radioactive capsule[10], despite its relatively low level of radioactivity compared to high-level nuclear waste, vividly demonstrated the potential for public alarm and serious health impacts for even small breaches of nuclear waste containment.

The only way radioactive waste becomes harmless is through decay, which can take hundreds of thousands of years for high-level waste.

Because high-level waste can remain dangerous for centuries, it must be handled, stored, and disposed of in a way that keeps the public safe for a very long time. There is nowhere in the world[11] that has developed a permanent solution to store high-level waste safely.

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[10] Tiffanie Turnbull (February 1st, 2023), 'Australia's nuclear power debate is heating up again', BBC News, https://www.bbc.com/news/world-australia-64481317

[11] SBS News (July 19th, 2023), 'The fundamental nuclear waste problem Peter Dutton would have to solve', SBS News, https://www.sbs.com.au/news/article/the-fundamental-nuclear-waste-problem-peter-dutton-would-have-to-solve/7in4qrtym

CASE STUDY The Elusive Final Resting Place for Nuclear Waste in the USA

Finding a secure and safe permanent disposal site for high-level nuclear waste remains an unsolved global challenge. No country in the world has successfully begun permanent operations of such a repository.

A stark example of the difficulties involved is the story of Yucca Mountain in Nevada, USA. This project, intended to be America's solution for its high-level nuclear waste, was abandoned in 2009 after over two decades of work and the staggering expenditure of well over A$10 billion.[12]

The Yucca Mountain plan was plagued by controversy from the outset. It faced fierce opposition from the state of Nevada and local communities, citing concerns about safety and environmental risks.[13] The project was also marred by scandals, including the documented falsification of safety data on how radioactive materials might interact with groundwater over the long term.

Scientific scrutiny further undermined the project. Studies indicated that Yucca Mountain could not guarantee compliance with existing radiation protection standards for the far future. Subsequent attempts by the US Environmental Protection Agency to weaken these very standards ignited even greater public and scientific outcry.

The failure of Yucca Mountain underscores a critical reality: **even with immense resources and decades of effort, establishing a safe and publicly acceptable permanent repository for high-level nuclear waste is incredibly complex and fraught with challenges**. This failure is not unique to the US. Other major nuclear power-operating nations—including the UK, Japan, and South Korea – have yet to even finalize a location for their high-level nuclear waste, let alone begin construction or demonstrate the long-term safety of such a facility.

The ongoing global struggle to find a permanent solution highlights the enduring and potentially insurmountable hurdle of safely managing this most hazardous radioactive material.

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[12] Australian Conservation Foundation, Nature Conservation Council & Friends of the Earth Australia (2019), 'Submission to the NSW Parliament Inquiry into Uranium Mining and Nuclear Facilities', Parliament of New South Wales, https://www.parliament.nsw.gov.au/lcdocs/submissions/66348/0064%20Australian%20Conservation%20Foundation,%20Nature%20Conservation%20Council%20and%20%20Friends%20of%20the%20Earth%20Australia.pdf

[13] Office of the Nevada Attorney General (n.d.), 'Yucca Mountain Nuclear Waste Repository', State of Nevada, https://ag.nv.gov/Hot_Topics/Issue/Yucca/

03.
AUSTRALIA COULD BE LOOKING AT 14 BILLION COKE CANS OF NUCLEAR WASTE A YEAR

Peter Dutton has not provided any details on the volume of waste that will be produced by the proposed nuclear reactors at seven sites in the Coalition's nuclear plan. The Coalition has also not revealed exactly what kind of nuclear reactors it plans to build, except to say the 14 GW of power will involve two SMRs along with 5 full-size reactors.

	Large Reactors	Small Modular Reactors (SMRs)
Reactor Type	Conventional, custom-built nuclear power plants; established technology (e.g., Light Water Reactors—LWRs).	Smaller reactors intended for modular factory production; various designs, though none are commercially operational. Light water reactor types are the most advanced, with other designs more speculative.
Capacity	Typically 1,000 MW or more per reactor unit.	Typically less than 300 MW, but some designs up to 450 MW claimed to be SMRs. Dutton often refers to a 450MW reactor.[14]
Waste Output	Produces approx. 25-30 tonnes of highly radioactive spent fuel per GW per year. Life-cycle waste per year: 400,738 tonnes.	Small modular light water reactors produce more highly radioactive spent fuel per GW per year than large reactors, due to lower efficiency, and the waste remains radioactive for longer.[15] Approximately 11 to 13 tonnes per 450MW reactor.

Table 1: A comparison of large and small modular light water reactors.

[14] Mike Foley (June 21st, 2024), 'Dutton's claim nuclear waste would be size of Coke can hard to swallow', The Sydney Morning Herald, https://www.smh.com.au/politics/federal/dutton-s-claim-nuclear-waste-would-be-size-of-coke-can-hard-to-swallow-20240621-p5jnmy.html

[15] Stanford University (2022, May 30), "Small modular reactors produce high levels of nuclear waste," https://news.stanford.edu/stories/2022/05/small-modular-reactors-produce-high-levels-nuclear-waste

While no SMRs are currently in operation, UK company Rolls Royce has a 450 MW SMR, which is based on already existing light-water uranium technology[16]. This analysis will assume that two such reactors are deployed, along with five conventional light-water reactors, to reach Dutton's 14 GW of planned nuclear power.

This gives us the clearest picture of the waste generated from Dutton's nuclear plan, rather than looking at more experimental or less concrete ideas for future SMRs.

By looking at waste generated across the nuclear fuel cycle to operate one conventional light-water uranium reactor we can provide a reasonable estimate of how that translates to a 450 MW SMR.

For a large, standard nuclear reactor (1 GW reactor) running for just one year, the amount of waste produced is huge, and occurs at every step of the process:

- **Uranium Mines:** To produce uranium fuel, mines generate hundreds of thousands of tonnes of low-level radioactive waste. If we use the example of SA's Olympic Dam facility, about 400,000 tonnes of this waste is created each year[17] to produce the material for a 1 GW reactor.
- **Fuel Processing:** Turning mined uranium into usable fuel creates about 170 tonnes of depleted uranium waste per reactor per year.[18]
- **Running the Reactor:** The used nuclear fuel, also known as spent fuel, is high-level radioactive waste. A large reactor produces 25 to 30 tonnes of this each year.[19] The plant also creates other low- and intermediate-level waste - approximately 200 to 350 cubic metres of waste per year.[20]

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[16] Indiana Office of Energy Development (2024), Small Modular Nuclear Reactors: Policy, Market, and Regulatory Considerations for Indiana, https://www.in.gov/oed/files/IOED-SMR-Report_Final_2024.pdf

[17] Jim Green (June 13th, 2024), 'Drink up: Peter Dutton needs one billion Coke cans for nuclear waste', Substack – Nuclear-Free Australia, https://jimkgreen1.substack.com/p/drink-up-peter-dutton-needs-one-billion

[18] Jim Green (June 13th, 2024), 'Drink up: Peter Dutton needs one billion Coke cans for nuclear waste', Substack – Nuclear-Free Australia, https://jimkgreen1.substack.com/p/drink-up-peter-dutton-needs-one-billion

[19] World Nuclear Association (Updated 2024), 'Radioactive Wastes: Myths and Realities', World Nuclear Association, https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/radioactive-wastes-myths-and-realities

[20]Australian Government (2007, Mar), *Uranium Mining and Nuclear Facilities Prohibitions: A Report by the Australian Government Department of Industry, Science and Resources*, https://webarchive.nla.gov.au/awa/20070228230014/http://pandora.nla.gov.au/pan/66043/20070301-0000/www.pmc.gov.au/umpner/docs/nuclear_report.pdf

Overall, running one conventional 1 GW nuclear reactor for one year can generate a volume of radioactive waste exceeding 1 billion Coke cans.

Based on the waste generated by a 1 GW reactor, it can reasonably be estimated that one of the Coalition's proposed SMRs could generate radioactive waste equal to 472 million empty Coke cans per year.

For a fleet of 5 standard reactors and two 450 MW SMRs producing 14 GW, that adds up to over 14 billion coke cans of waste each year.

Waste Category	Unit	Per 1 GW Reactor (Reference)	Per 450 MW Reactor (Scaled)	Waste from 14 GW
Tailings Waste[21]	Tonnes	400,000	180,000	5.6 million
	Coke Cans	1.05 billion	472.5 million	14.7 billion
Depleted Uranium [22]	Tonnes	170	76.5	2,380
	Coke Cans	89,000	40,050	1.25 million
Spent Nuclear Fuel[23]	Tonnes	27.5	12.4	385
	Coke Cans	26,000	11,700	364,000
Low-level waste[24]	Tonnes	540 (Est.)	243 (Est.)	7,560 (Est.)
	Coke Cans	790,000	355,500	11.1 million
Total waste over lifecycle, per year	Tonnes	400,738	180,332	5.61 million (approx)
Total waste over lifecycle per year	Coke Cans	1,050,905,000	472,907,250	14,712,714,000
Total waste over expected operation of fleet (100 years)				1.471 trillion

Table 2: Calculating the waste produced from Dutton's proposed SMRs involves taking the known waste involved in a standard 1 GW reactor and scaling it to the smaller reactor size. This is likely an underestimate, given the lower efficiency of SMRs and the type of high-level waste it produces.

[21] Jim Green (June 13th, 2024), 'Drink up: Peter Dutton needs one billion Coke cans for nuclear waste', Substack – Nuclear-Free Australia, https://jimkgreen1.substack.com/p/drink-up-peter-dutton-needs-one-billion

[22] Brook, B. W. (2010, Oct 27), *ARPS Public Lecture: Clean and Inexhaustible Fission Energy*, https://www.slideshare.net/slideshow/arps-public-lecture-brook/5589262

[23] World Nuclear Association (Updated 2024), 'Nuclear Fuel Cycle Overview', World Nuclear Association, https://world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/nuclear-fuel-cycle-overview

[24] International Atomic Energy Agency (2022), Status of Small Modular Reactor Technology Developments, https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1822_web.pdf

04.
NUCLEAR WASTE MANAGEMENT: PAST FAILURES, FUTURE RISKS

The Coalition has not sought consent from the seven communities where it plans to build nuclear reactors, and communities will have no power to veto the Coalition's plans.[25] This has sparked disquiet[26] and backlash[27] from would-be host communities.

Radioactive nuclear waste is a highly hazardous substance, capable of remaining lethally toxic for tens of thousands of years.

Mr Dutton has revealed no concrete plans on dealing with the nuclear waste that will be generated from these seven reactors, except to say that the waste from a standard-sized reactor would be "stored on site under our proposal, and then at the end of the life of that asset, it's moved to a permanent home."[28]

Mr Dutton has shed no light on what this "permanent home" would look like, instead kicking the can down the road and saying that it would be the same location "where the government decides for the waste from the submarines to be stored." Given the waste generated under Dutton's plan will be many multiples of the nuclear submarine waste, this lack of clarity is concerning.

The Coalition has not outlined any plan to safely process, transport, and permanently store the large amounts of toxic radioactive waste that Australians will have to manage for many generations to come. Nor has it committed to underwrite national nuclear disaster insurance.

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[25] Stephanie Borys (June 20th, 2024), 'Coalition backs away from nuclear consent, as community call goes unheeded', ABC News, https://www.abc.net.au/news/2024-06-20/coalition-backs-away-from-nuclear-consent-community-call/103998784

[26] Kirstie Wellauer (December 22nd, 2024), 'Coalition's nuclear plan frustrates communities, inquiry hears', ABC News, https://www.abc.net.au/news/2024-12-22/coalitions-nuclear-plan-frustrates-communities-at-inquiry/104730522

[27] Keane Bourke (October 18th, 2024), 'Peter Dutton heckled in Collie over nuclear power station plans', ABC News, https://www.abc.net.au/news/2024-10-18/peter-dutton-heckled-over-collie-nuclear-power-station-plans/104490524

[28] ABC News (2024, Jun 21), "What happens to nuclear waste under Peter Dutton's Coalition plan to build seven nuclear power reactors?", https://www.abc.net.au/news/2024-06-21/what-happens-nuclear-waste-coalition-plan-/104003454

The Australian public should be very concerned about this, and demand answers, not least because no solution has been found for long-term management of the vast volumes of nuclear waste anywhere in the world.

Additionally, not only have efforts to establish national radioactive waste facilities repeatedly failed in Australia since the 1990s, but Australia also has a demonstrated inability to manage even low-level nuclear waste.

Past failures

Australia's abysmal track record of managing the small quantities of low and intermediate-level waste does not inspire any confidence that our systems are equipped to deal with large quantities of high-level radioactive waste safely.

Australia currently produces roughly 100 cubic meters of low-level waste and 40 cubic meters of intermediate-level waste annually,[29] produced and held by Commonwealth agencies from limited medical, research and agricultural practices.

Australia has so far failed to establish a shallow national repository to store this material safely and it is currently stored in 40 temporary sites across the country.[30] No credible effort has been made to establish a deep underground repository for long-lived intermediate-level waste.

Several hundred million tonnes of radioactive tailing (solid waste that is leftover after uranium is extracted from ore) are also produced from uranium mining at BHP's Olympic Dam site in SA, and until 2021 at the Ranger uranium mine in the NT. Uranium tailings are almost exclusively managed and contained on-site at the mines where they are produced, typically through engineered structures known as Tailings Storage Facilities (TSFs) or by depositing the tailings into mined-out pits.

A demonstrated ability to manage Australia's current radioactive waste would be necessary to establish confidence that we could manage far

[29] Australian Government, Department of Industry, Science, Energy and Resources (2021, Sep), Australia's National Inventory of Radioactive Waste 2021, https://www.industry.gov.au/sites/default/files/2022-09/australias-national-inventory-of-radioactive-waste-2021.pdf : p. 1.

[30] Australian Government, Department of Industry, Science, Energy and Resources (2023, Nov 17), "Decision on the National Radioactive Waste Management Facility (NRWMF) site", https://www.industry.gov.au/news/decision-national-radioactive-waste-management-facility-nrwmf-site#:~:text=Facility%20(NRWMF)%20site-,Decision%20on%20the%20National%20Radioactive%20Waste%20Management%20Facility%20(NRWMF)%20site,South%20Australia%20for%20the%20facility.&text=The%20National%20Radioactive%20Waste%20Management%20Act%202012%20set%20out%20a,technical%20assessments.

larger streams of high-level radioactive and nuclear wastes arising from nuclear reactors. However, Australia's track record with nuclear waste is riddled with mismanagement or total neglect.

A short history of Australia's nuclear waste management failures includes:

The violation of the rights of First Nations communities: Proposed sites for toxic radioactive waste are often the lands or cultural sites of First Nations groups, and they are the people who suffer the ill effects. The National Radioactive Waste Management Amendment Act systematically disempowers and dispossesses Traditional Owners—for example, a site may be designated a waste dump despite the opposition of Traditional Owners.[31] Aboriginal groups also have a proud history of strong and successful resistance to the imposition of nuclear waste facilities on their traditional lands through effective community campaigning and legal challenges, including significant campaigns and legal challenges at Kimba[32] and Wallerberdina Station in the Flinders Ranges[33] in South Australia, and Muckaty in the NT.[34]

Many existing and former waste sites are not safe: A 2003 SA government audit[35] found the former uranium mine at Radium Hill in SA, a radioactive waste repository "is not engineered to a standard consistent with current internationally accepted practice". In 2017, an inspection at a radioactive waste storage site in Woomera, SA[36] found "significant rusting" on thousands of barrels of nuclear waste, with tests confirming the presence of radioactive isotopes at one location and inspectors warning there was a possibility the drums were leaking—leaving the CSIRO with a $30 million clean-up bill.

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[31] Ngo, A. (2017, Mar), *National Radioactive Waste Management Act 2012*, https://d3n8a8pro7vhmx.cloudfront.net/foe/pages/199/attachments/original/1489231658/NRWMA-Report-FINAL-March-2017.pdf

[32] ABC News (2023, Nov 17), "Barngarla Indigenous group wins conservation award for anti-nuclear stance in Kimba", https://www.abc.net.au/news/2023-11-17/barngarla-indigenous-win-conservation-award-kimba-anti-nuclear/103117676

[33] ABC News (2019, Dec 13), "Flinders Ranges nuclear waste facility scrapped", https://www.abc.net.au/news/2019-12-13/flinders-ranges-nuclear-waste-facility-scrapped/11797206

[34] The Sydney Morning Herald (2014, Jun 19), "Victory for traditional owners over Muckaty Station nuclear waste dump", https://www.smh.com.au/politics/federal/victory-for-traditional-owners-over-muckaty-station-nuclear-waste-dump-20140619-zsedf.html

[35] South Australian Government, Department of the Premier and Cabinet (n.d.), South Australia's Nuclear Waste Management, https://www.dpc.sa.gov.au/documents/rendition/B19328 .

[36] The Age (2017, Mar 7), "Rusted barrels of radioactive waste cost CSIRO $30 million", https://www.theage.com.au/national/rusted-barrels-of-radioactive-waste-cost-csiro-30-million-20170307-gusb6v.html

Corporate criminals have been able to dump waste almost undetected: Marathon Resources in SA illegally dumped low-level radioactive waste in the Arkaroola Wilderness Sanctuary (without detection by the regulator). If not for the detective work of the managers of the Sanctuary, the illegal activities would never have been discovered.[37]

Inadequate clean-ups: The 'clean-up' of nuclear waste at the Maralinga nuclear test site following the site's closure in 1967 was mismanaged, with high levels of radiation prompting a Royal Commission. The 1985 McLelland Royal Commission found that significant radiation hazards still existed at the Maralinga test sites,[38] prompting further rehabilitation efforts. While more recent assessments have shown that most of the contaminated areas at Maralinga fall well within the clean-up standards applied for unrestricted land use, there are still restrictions on permanent occupancy within a 'restricted land-use' (non-residential) boundary surrounding Taranaki, a former test-site at Maralinga.

Future Risks: What could go wrong?

The risks arising from Australia's proven inability to safely and permanently manage even low and intermediate-level nuclear waste are further compounded by the fact that it is almost impossible to safeguard against every possible accident in the future, which has been the experience internationally.

Transport Disaster: Transport incidents and accidents involving radioactive materials are commonplace. In the UK, 16 accidents and incidents involving transport of radioactive waste were recorded in 2012, and 38 in 2011.[39] France has recorded 100 or more events annually, or about two each week.[40] In Australia, ANSTO has acknowledged that there have been 1-2 accidents or 'incidents' every year involving the transportation of radioactive materials.[41] While transport casks used for

[37]The Australian (2024, Jun 21), "Uranium miner accepts blame for dumping waste," https://www.theaustralian.com.au/business/mining-energy/uranium-miner-accepts-blame-for-dumping-waste/news-story/e054ca8cd749f0972a9d64a6b9df0257

[38] Australian Radiation Protection and Nuclear Safety Agency (n.d.), Maralinga Clean-up, https://www.arpansa.gov.au/understanding-radiation/sources-radiation/more-radiation-sources/british-nuclear-weapons-testing#maralinga-clean-up

[39] UK Government, Department for Business, Energy & Industrial Strategy (2015, Jul), Accidents and incidents involving the transport of radioactive materials in the UK, https://www.gov.uk/government/publications/accidents-and-incidents-involving-the-transport-of-radioactive-materials-in-the-uk

[40] Xavier Knemp, Institut de Radioprotection et de Sûreté Nucléaire, *Lessons learned from analysis of events involving the transport of radioactive materials in France between 2012 and 2015,* https://resources.inmm.org/system/files/patram_proceedings/2016/F3022.pdf

[41] Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) (2021, Dec), *Australian Radiation Incident Register: Annual Report for Incidents in 2020*, https://www.arpansa.gov.au/sites/default/files/arir_-_annual_summary_report_2020.pdf page 4

reactive waste ('Type B casks') are designed to withstand significant impacts (like falling from a height of 9 metres onto concrete), human error can undermine even these extreme design measures. A UK report identified several examples of human error in transporting nuclear material, including: incorrect fastening of bolts (some were just hand-tightened), the use of non-compliant bolts and the use of worn out seals, all compromising cask safety.[42] Researchers have calculated that a severe truck accident involving a radioactive cask in an urban area could result in US$20 billion to US$36 billion in cleanup costs, and a severe rail accident could lead to costs ranging from US$145 billion to US$270 billion.[43] Such an event in Australia could cause immediate casualties, widespread contamination, mass evacuations and a costly clean-up lasting decades.

Long-Term Repository Failure: Even when stored in supposedly safe, long-term geological sites, experience shows radioactive waste continues to pose a threat and is vulnerable to environmental changes. A former salt mine in Germany (the Asse II Salt Mine) was used as a radioactive storage site in the 1970s for 47,000 cubic metres of low and intermediate-level waste. It has now been described by the German Environment Minister as being in a 'precarious condition and in danger of collapsing' with 'as many holes as Swiss cheese' due to water seepage over decades.[44] Groundwater leaking from the Asse mine was found to be radioactive, even decades after the facility stopped accepting new waste.[45] Australia's Nuclear Science and Technology Organisation (ANSTO) has revealed "airtight" spent fuel storage canisters were infiltrated by water – 90 litres in one case – and corrosion had resulted at Lucas Heights.[46] What appears to be a safe storage location in the present may not remain that way for the thousands of years that nuclear waste remains dangerous.

Climate change and extreme weather: An extreme natural event, such as a major flood, bushfire, or earthquake, can exceed the design capacity of

[42] MP Harvey, Public Health England, *Radiological Consequences Resulting from Accidents and Incidents Involving the Transport of Radioactive Materials in the UK – 2012 Review*, https://assets.publishing.service.gov.uk/media/5a7de97b40f0b62305b7f90b/PHE-CRCE-014.pdf

[43] State of Nevada, Agency for Nuclear Projects (2000, Jul 19), "Nevada Nuclear Waste News: DOE's Yucca Mountain Project Faces New Challenges," http://www.state.nv.us/nucwaste/news2000/nn10719.htm

[44] Deutsche Welle (DW) (2008, Jun 19), "German nuclear storage facility hit by safety scandal," https://www.dw.com/en/german-nuclear-storage-facility-hit-by-safety-scandal/a-3618649

[45] Nuclear Engineering International (2024, May 28), "Water leaks reported at Germany's Asse II radwaste facility," https://www.neimagazine.com/decommissioning-waste-management/water-leaks-reported-at-germanys-asse-ii-radwaste-facility/

[46] ABC News (2012, May 1), "Radioactive waste to be stored at Lucas Heights," https://www.abc.net.au/news/2012-05-01/radioactive-waste-to-be-stored-at-lucas-heights/3982380

nuclear waste storage facilities—as was seen during the Fukushima disaster, where waste was stored alongside the reactor.[47] Extreme weather can damage containment structures, disrupt cooling systems, and lead to the uncontrolled release of radioactive materials into the surrounding environment. A lightning strike at a UK nuclear reactor, which led to the failure of vital monitoring systems, shows that even minor incidents can create critical failures.[48] The impacts of climate change are also creating new risks. For instance, in Greenland, melting ice sheets may soon release radioactive liquid thought to be safely abandoned.[49] The US Government has also identified climate change-driven rising sea levels and more powerful storm surges as a direct threat to numerous nuclear installations located in coastal areas, and wildfires and extreme heat posing a danger to others.[50]

Incidents in Secure Storage Facilities: Despite engineered barriers and the surrounding geology of underground nuclear storage facilities, unforeseen events like accidents or geological changes can cause unexpected chemical reactions, which can compromise containment, allowing radioactive materials to leak into the environment. The world's only operating deep underground repository for long-lived intermediate-level waste, the Waste Isolation Pilot Plant (WIPP) in the US,[51] was closed for three years in 2014, following a chemical explosion in an underground waste barrel. This incident highlights the inherent risks of managing nuclear waste, even in seemingly secure storage.

Any of the above modes of failure, whether at a reactor itself, a temporary storage site, or a long-term supposedly 'safe' geological storage site, could lead to mass casualties and long term health impacts, or the migration of radioactive waste into the environment, contaminating groundwater, farmland and ecosystems for millennia.

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[48] ABC News (2012, May 1), "Radioactive waste to be stored at Lucas Heights," https://www.abc.net.au/news/2012-05-01/radioactive-waste-to-be-stored-at-lucas-heights/3982380

[49] ABC News (2024, Feb 29), "Climate change could unearth, disturb Cold War-era nuclear waste buried by the US, officials say," https://abcnews.go.com/International/climate-change-unearth-disturb-cold-war-era-nuclear/story?id=107633575

[50] U.S. Government Accountability Office (GAO) (2024, Apr), *Nuclear Power Plants: NRC Should Take Actions to Fully Consider the Potential Effects of Climate Change*, https://www.gao.gov/assets/d24106326.pdf

[51] Nature (2014, Jun 18), "Fukushima and the future of nuclear energy," https://www.nature.com/articles/509259a

Australia's emergency services are not prepared for nuclear

Leading emergency services experts have warned that emergency planning and management has not been considered in any plan for the development of nuclear energy generation in Australia.

As the Emergency Leaders for Climate Action, a coalition for former emergency leaders from every Australian state and territory with more than 1,000 years of experience between them, point out,[52] there are no safety or environmental frameworks in place to manage the risks of nuclear power stations in Australia, except for a minor capability developed to deal with emergency at the Lucas Heights research reactor in NSW. Nor are emergency services trained to respond to nuclear disasters.

The Coalition has released no plans as to how states and territories will be supported to plan for potential emergencies and disasters resulting from the operation of nuclear reactors, as well as the transportation and storage of radioactive waste. They have also not told the Australian public how much it will cost to expand and prepare our emergency services to be nuclear-ready.

ELCA has also pointed out that in international contexts, full-time firefighters from urban fire and rescue services have been required to be first responders to emergencies at nuclear reactors. They have warned that a major nuclear accident in Australia will effectively require Australian firefighters—including volunteer firefighters in regional areas—to put their lives on the line to respond to the accident.

[52] Emergency Leaders for Climate Action (2024, Nov 27), "Emergency leaders say nuclear reactors pose unnecessary risk," https://emergencyleadersforclimateaction.org.au/emergency-leaders-say-nuclear-reactors-pose-unnecessary-risk/

05.
NUCLEAR WASTE MANAGEMENT WILL COST BILLIONS OF DOLLARS

The estimated costs for the Coalition's nuclear plan, as modelled by Frontier Economics, are between $331–446 billion.[53] However, global precedents show that the true cost of radioactive waste management could be in the order of tens of billions of dollars or more, and that clean-up after nuclear accidents could add even more costs. Not only are the costs inherently high, but they also tend to balloon significantly in the decades it takes to build nuclear.

- **Construction of high-level nuclear waste repositories:** In France, the original 2005 estimate for building a national repository for the disposal of high- and intermediate-level waste was €13.5 and €16.5 billion. But estimates ballooned, and in 2016, the final estimate for this project was set at €25 billion[54].
- **Operation of waste repositories:** In 2008, the US government estimated that to build a high-level nuclear waste repository at Yucca Mountain, Nevada, and operating it for 150 years would cost US$96.2 billion (in 2007 dollars) (A$148 billion)—a 67% increase on the 2001 estimate.[55] The South Australian Nuclear Fuel Royal Commission estimated a similar figure in Australia: A$145 billion over 120 years for construction, operation and decommissioning of a high-level nuclear waste repository.[56]
- **Clean-up costs for nuclear sites:** In the UK, estimates of the clean-up costs for a range of civil and military UK nuclear sites including Sellafield jumped from a 2005 estimate of £56 billion (A$109 billion) to over £100 billion (A$195 billion) in 2012.[57]

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[53] Frontier Economics (2024, Dec), *Economic analysis of including nuclear power in the National Electricity Market (NEM)*, https://www.frontier-economics.com.au/economic-analysis-of-including-nuclear-power-in-the-nem/ p.43

[54] World Nuclear News (2016, Jan 18), "Minister sets benchmark cost for French repository," https://www.world-nuclear-news.org/Articles/Minister-sets-benchmark-cost-for-French-repository

[55] World Nuclear News (2008, Aug 6), "Yucca Mountain cost estimate rises to $96 billion," https://www.world-nuclear-news.org/Articles/Yucca-Mountain-cost-estimate-rises-to-$96-billion

[56] Friends of the Earth Australia (2017, Mar), *National Radioactive Waste Management Act 2012*, https://d3n8a8pro7vhmx.cloudfront.net/foe/pages/199/attachments/original/1489231658/NRWMA-Report-FINAL-March-2017.pdf

[57] The Times (2024, Oct 22), "Nuclear cleanup to take 120 years and cost $100bn," https://www.thetimes.com/life-style/property-home/article/nuclear-cleanup-to-take-120-years-and-cost-100bn-qmmczbh5rft

CONCLUSION

Nuclear power is currently illegal in Australia[58], and for very good reason. As this report has shown, it is an incredibly risky undertaking that could generate as much as 14 billion Coke cans worth of waste a year, posing severe threats to the health and safety of Australian communities, regional livelihoods such as farming, and Australia's land and waterways in the event of an accident.

Australia's decades-long track record of mismanaging nuclear waste, to the detriment of First Nations communities and ecosystems, raises serious concerns about the country's ability to safely handle the vast amounts of radioactive nuclear waste that would result from the proposed nuclear reactors. The global experience also underscores that even well-established nuclear nations have yet to find permanent solutions for waste storage, reinforcing the immense difficulty of the task.

All signs point to the fact that if the Coalition's nuclear plans go ahead in Australia, it is a matter of when, not if, a nuclear waste accident will occur—the question is how severe it will be.

The large financial burden of nuclear waste management has also been completely ignored by the Coalition. International examples demonstrate that managing radioactive nuclear waste requires tens to hundreds of billions of dollars, as does clean up and recovery after a nuclear disaster.

Additionally, the risks associated with transporting nuclear waste, potential environmental contamination, and security threats from the interception of the waste further seriously complicate the feasibility of the Coalition's nuclear reactor plan.

Ultimately, this report underscores that the Coalition's nuclear proposal is not only reckless from a safety, security, and environmental point of view, but it is also financially impractical. The Coalition's failure to provide a plan for how it will fund proper nuclear waste management, and the lack of a clear and viable waste management strategy, places future generations at risk of inheriting a hazardous—and expensive—legacy of radioactive contamination.

The upcoming Federal election offers Australians a choice between an energy future of dangerous, expensive nuclear energy, and one of safe and affordable renewables backed by storage. Given the extensive and

[58] Gibson, E. (2024, May 30), *Current prohibitions on nuclear activities in Australia: a quick guide*, https://www.aph.gov.au/About_Parliament/Parliamentary_departments/Parliamentary_Library/Research/Quick_Guides/2023-24/NuclearActivitiesProhibitions

significant risks of nuclear energy, Australians should dismiss the possibility of nuclear energy on our shores for once and for all, and back in the proven solutions that are already powering much of the nation with clean energy today.