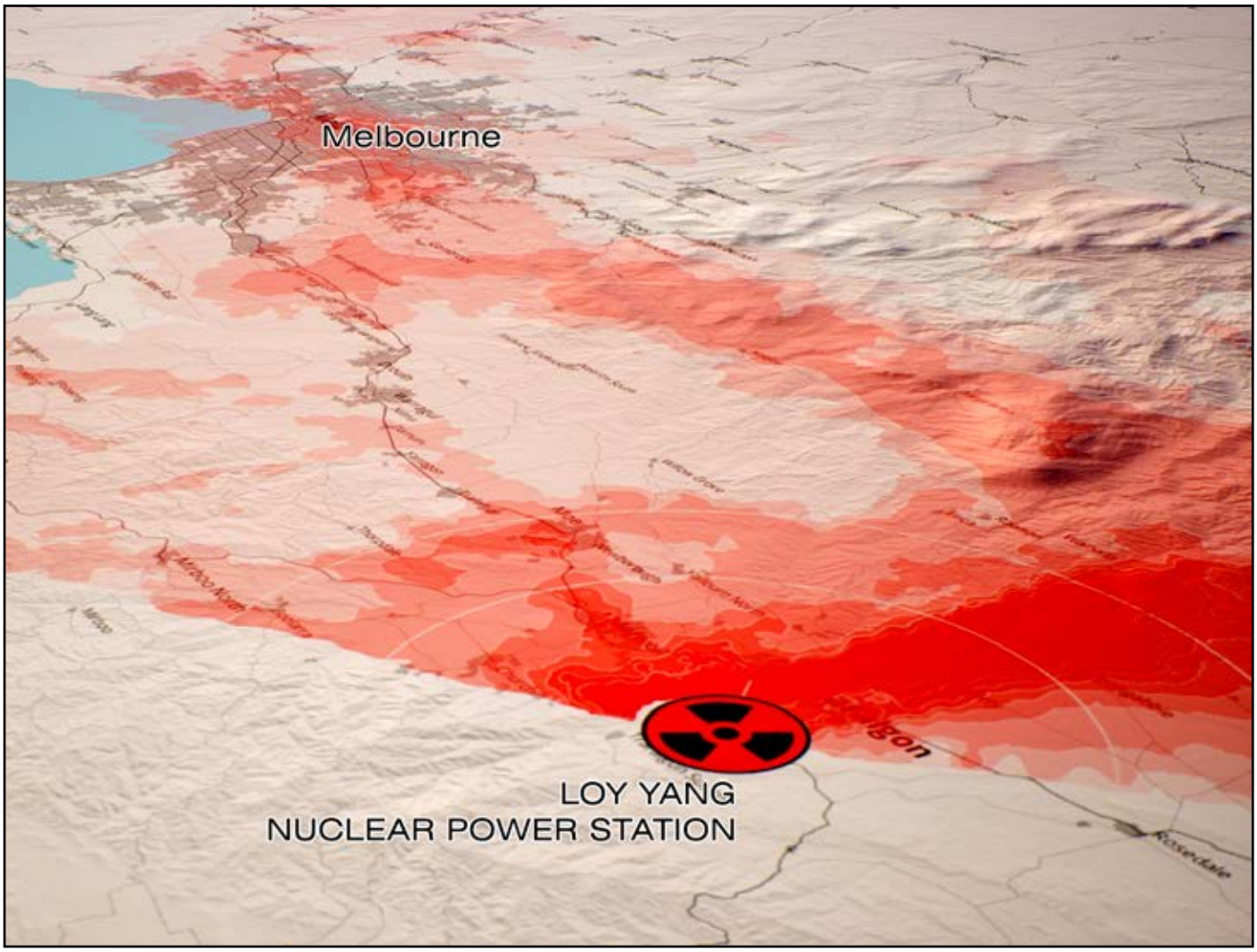

Nuclear accident mapping
Australian scenarios

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NUCLEARPLUME.AU

About these maps

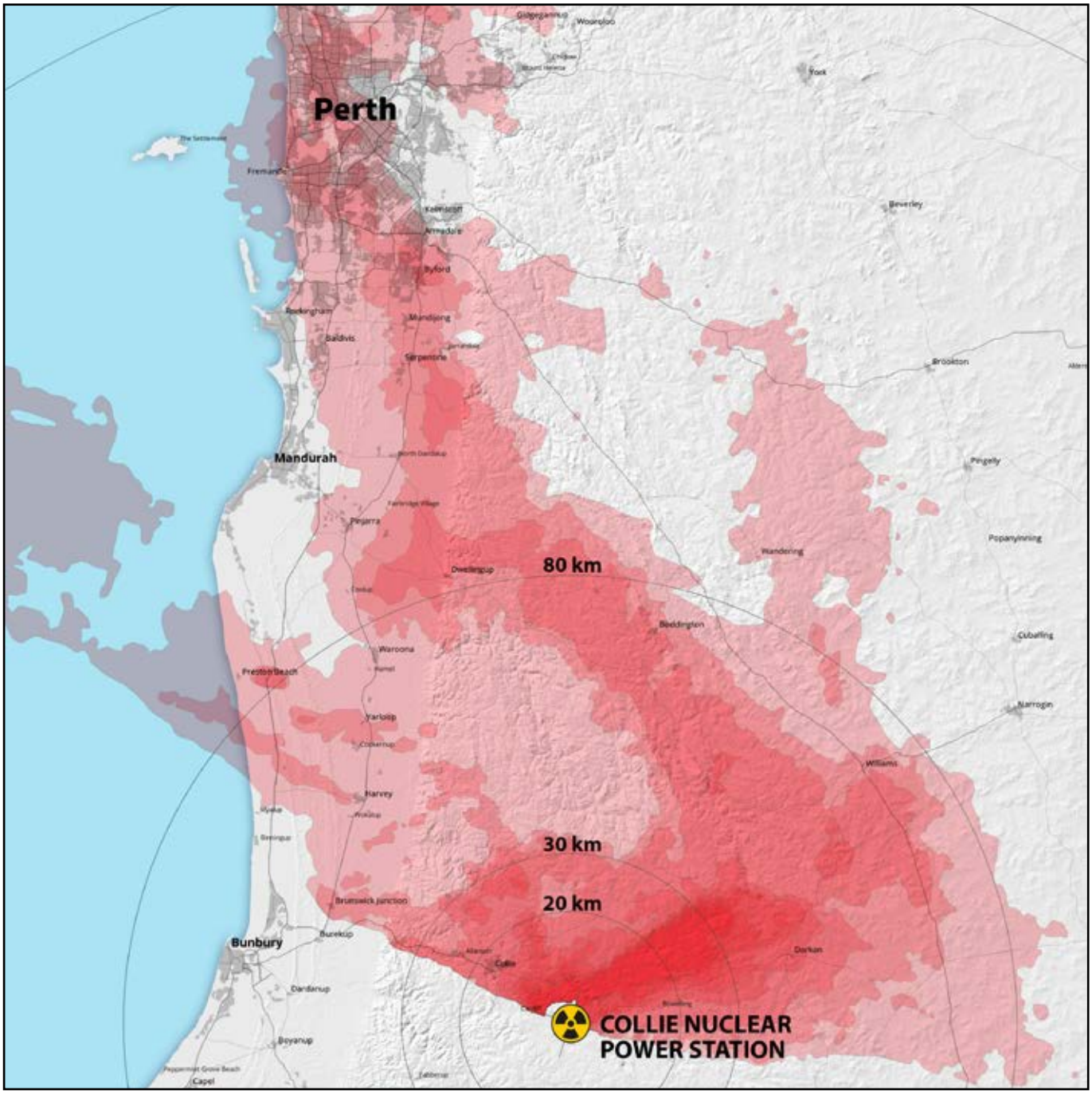
The seven sites on this map have been selected by the federal Coalition to house multiple nuclear power reactors.

You can select the reactor site and wind direction to see how a Fukushima-scale nuclear disaster would contaminate different areas surrounding the seven sites in Australia.

The interactive map uses a radiation plume map of the deposition of radioactive caesium-137 from the Fukushima disaster as of July 2011. The darker the shading, the higher the level of radioactive contamination and the higher the radiation exposures for people in those areas. At distances far from the Fukushima plant, radiation exposures were low but even low radiation doses can cause negative health impacts including fatal cancers and cardiovascular disease.

Caesium-137 has been one of the most significant radioactive contaminants since the March 2011 Fukushima disaster but many other types of radioactive particles contaminated wide areas (iodine-131, xenon-133, etc.).

Other radiation fallout maps from the Fukushima disaster can be seen here and here.

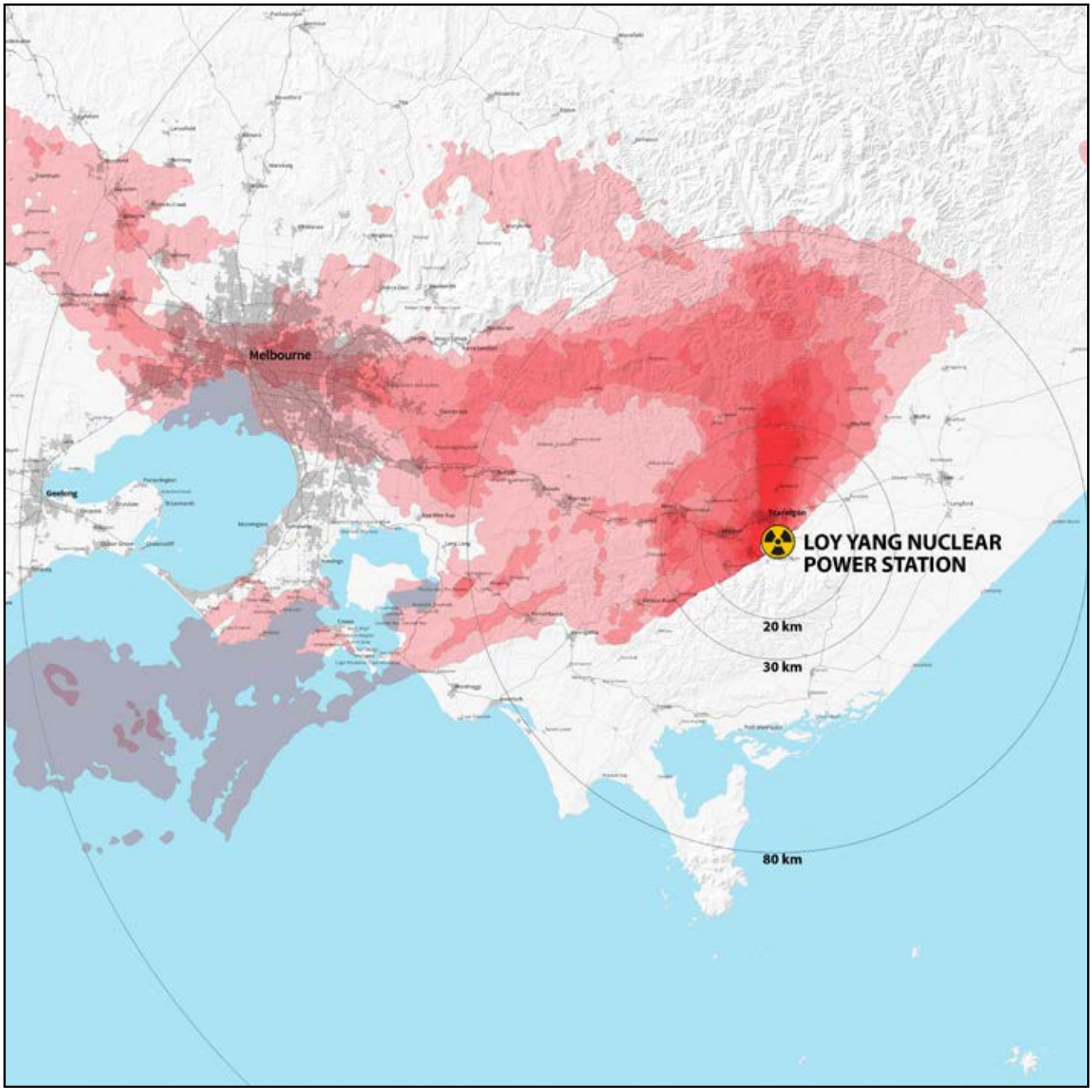


Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

Muja

19km from Collie and 64km from Bunbury in the south-west of Western Australia.

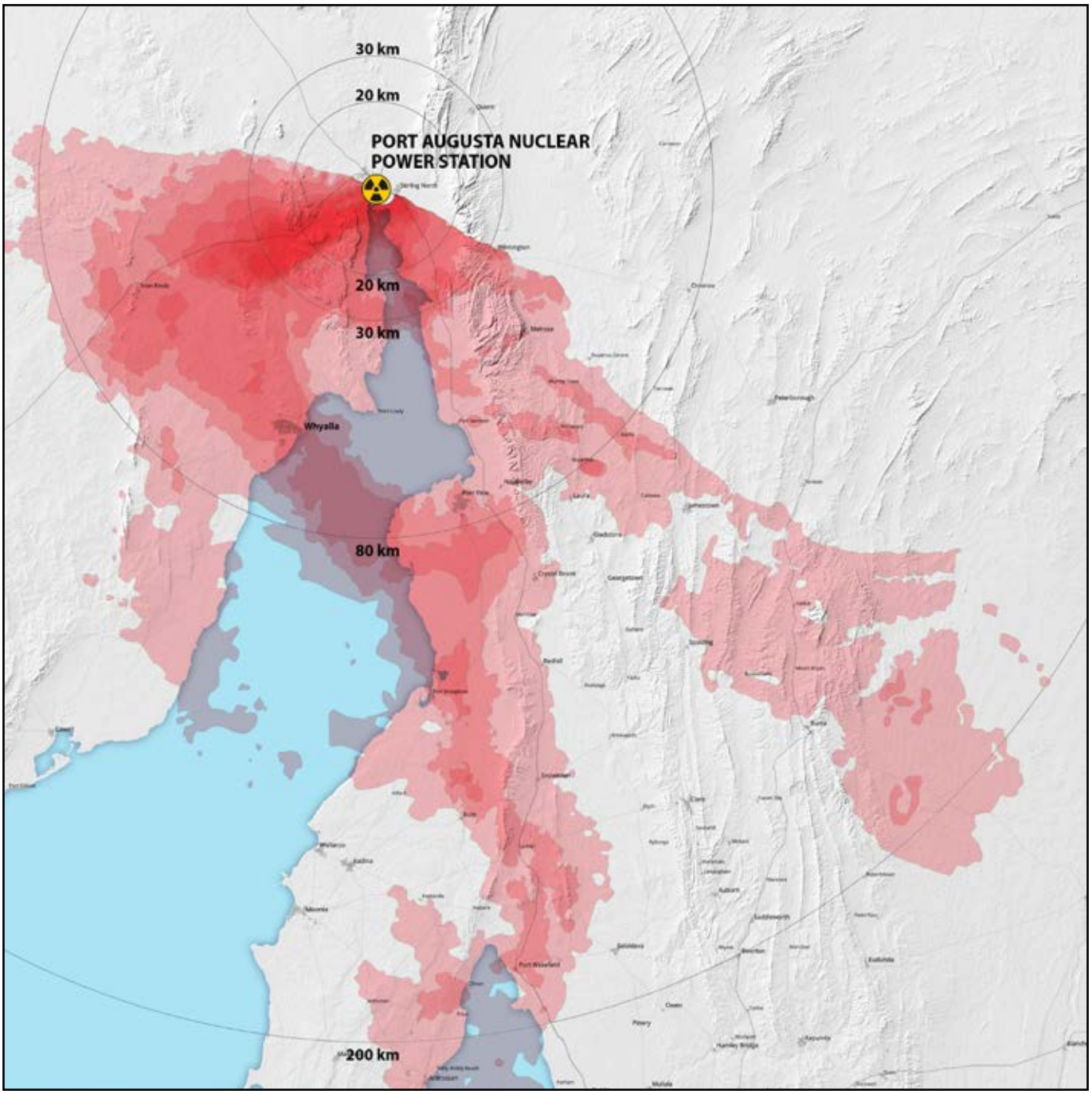


Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

Loy Yang

8km from Traralgon and 15km from Morwell in Gippsland in Victoria.

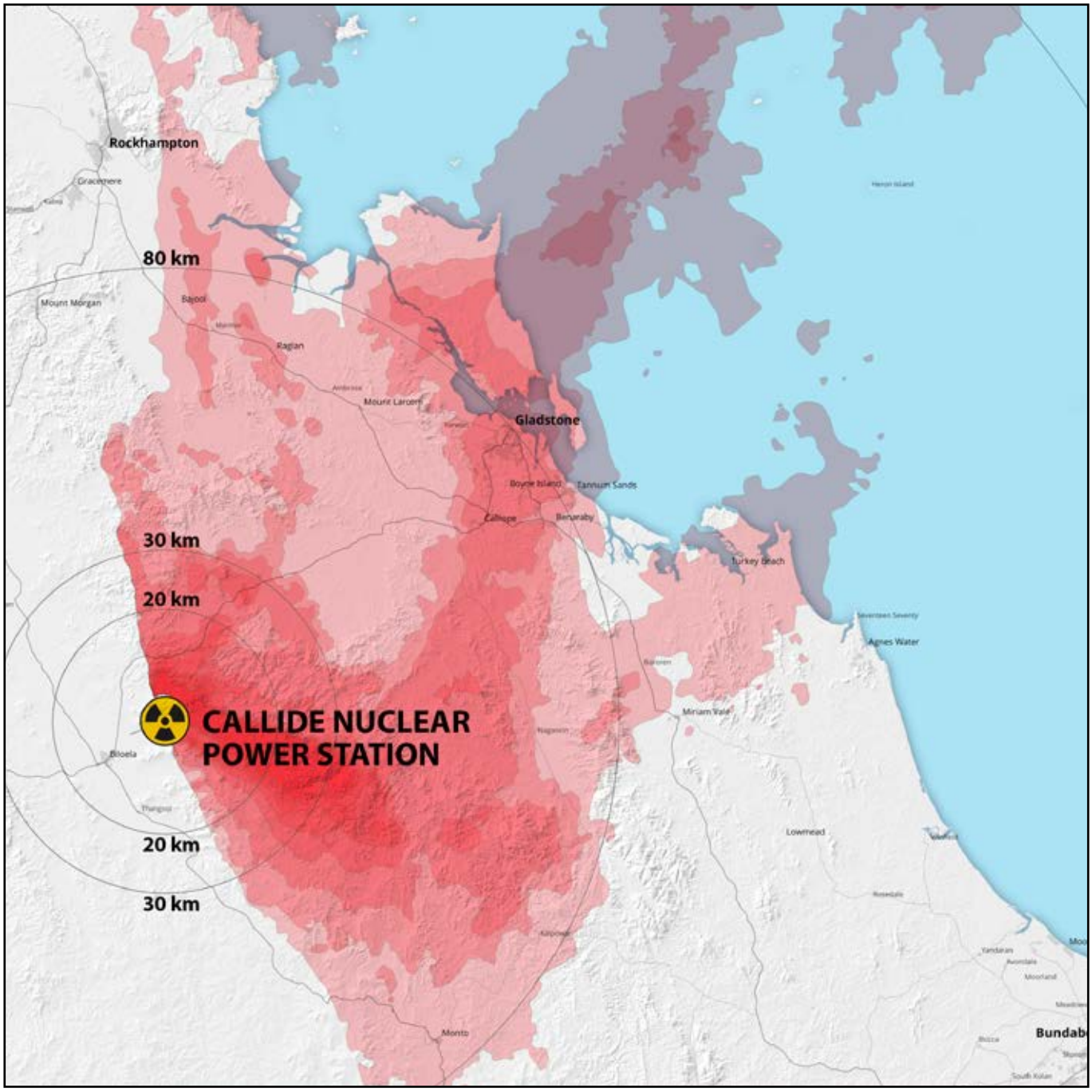


Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

Port Augusta

4km from Port Augusta and 82km from Port Pirie in South Australia.

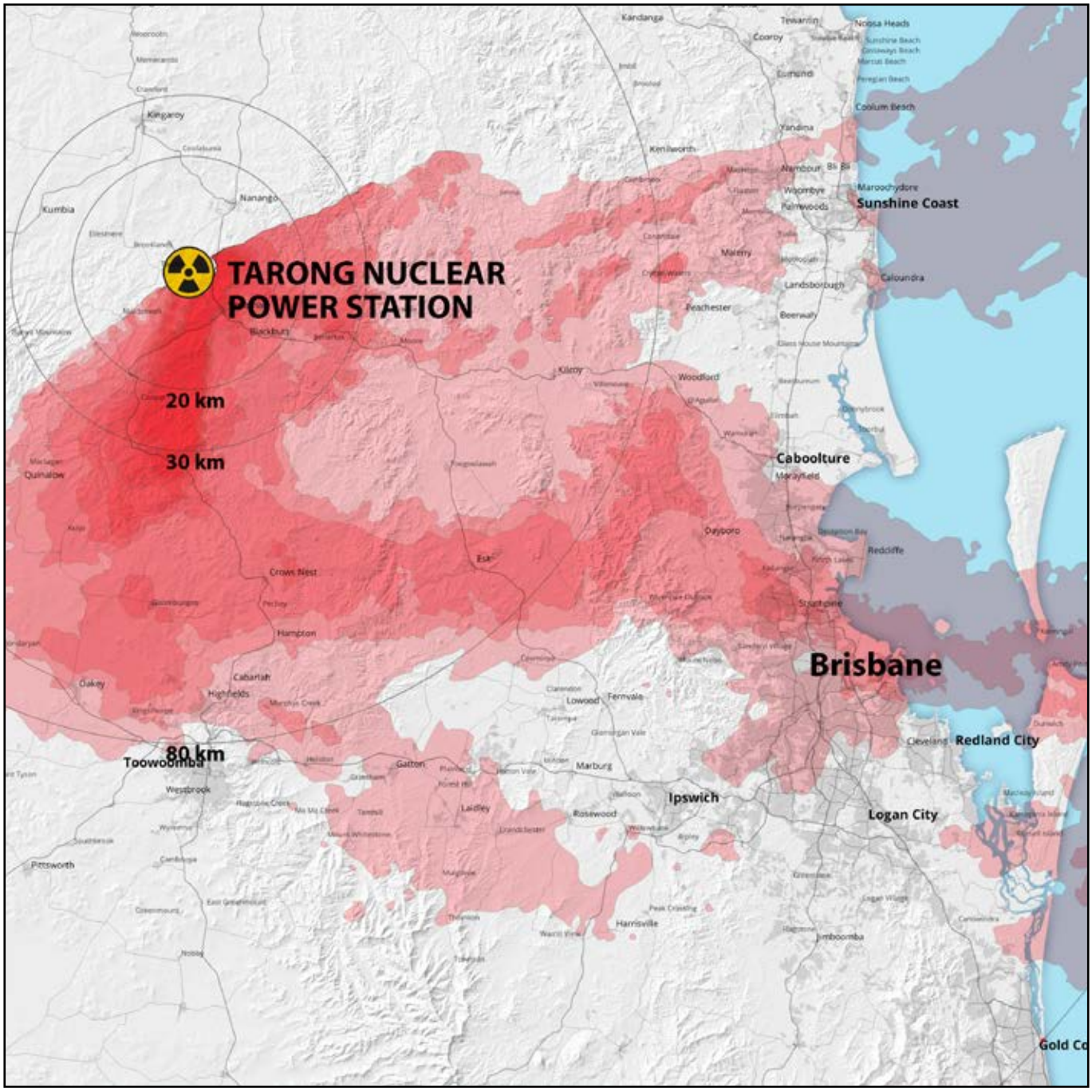


Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

Callide

12km from Biloela and 84km from Gladstone in central Queensland.

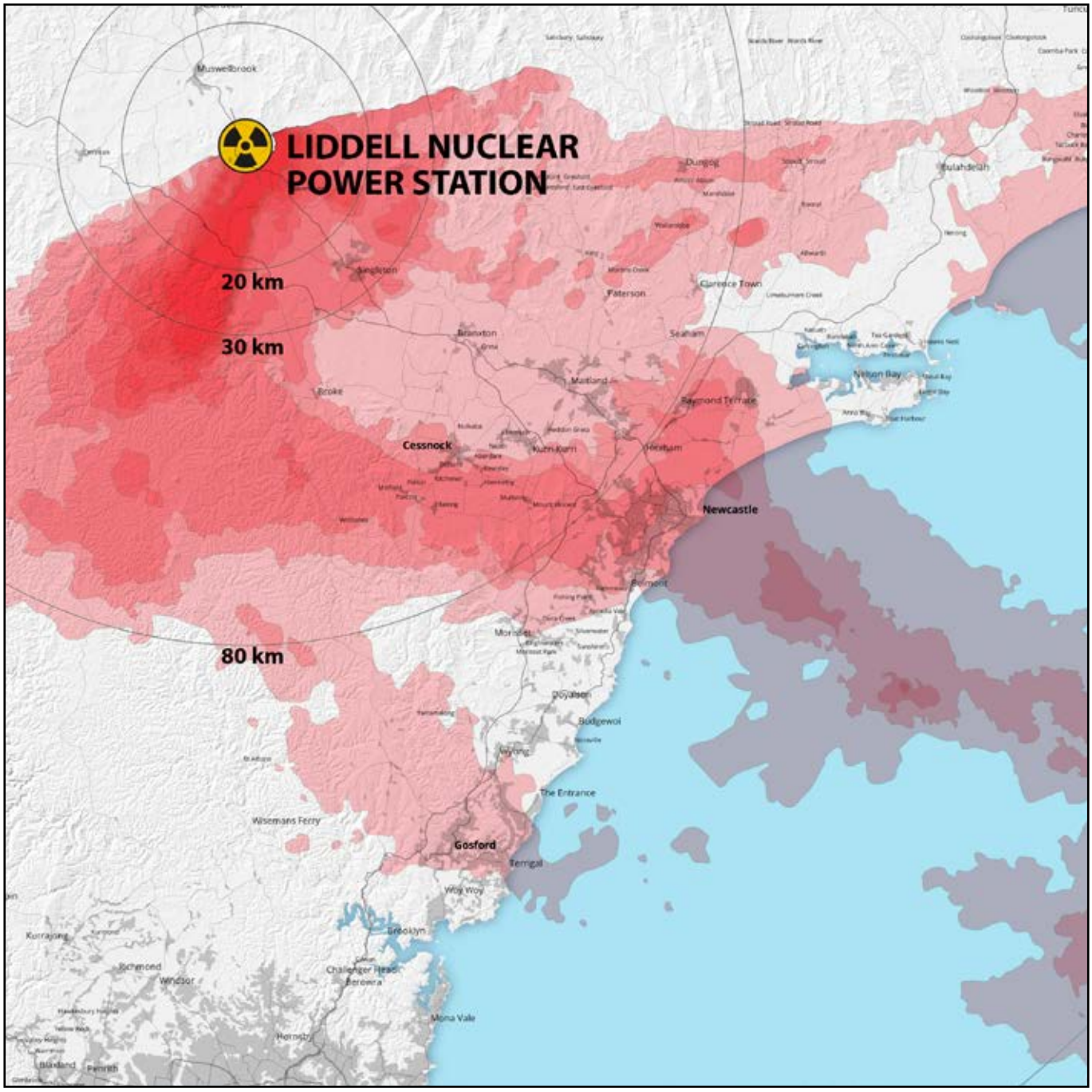


Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

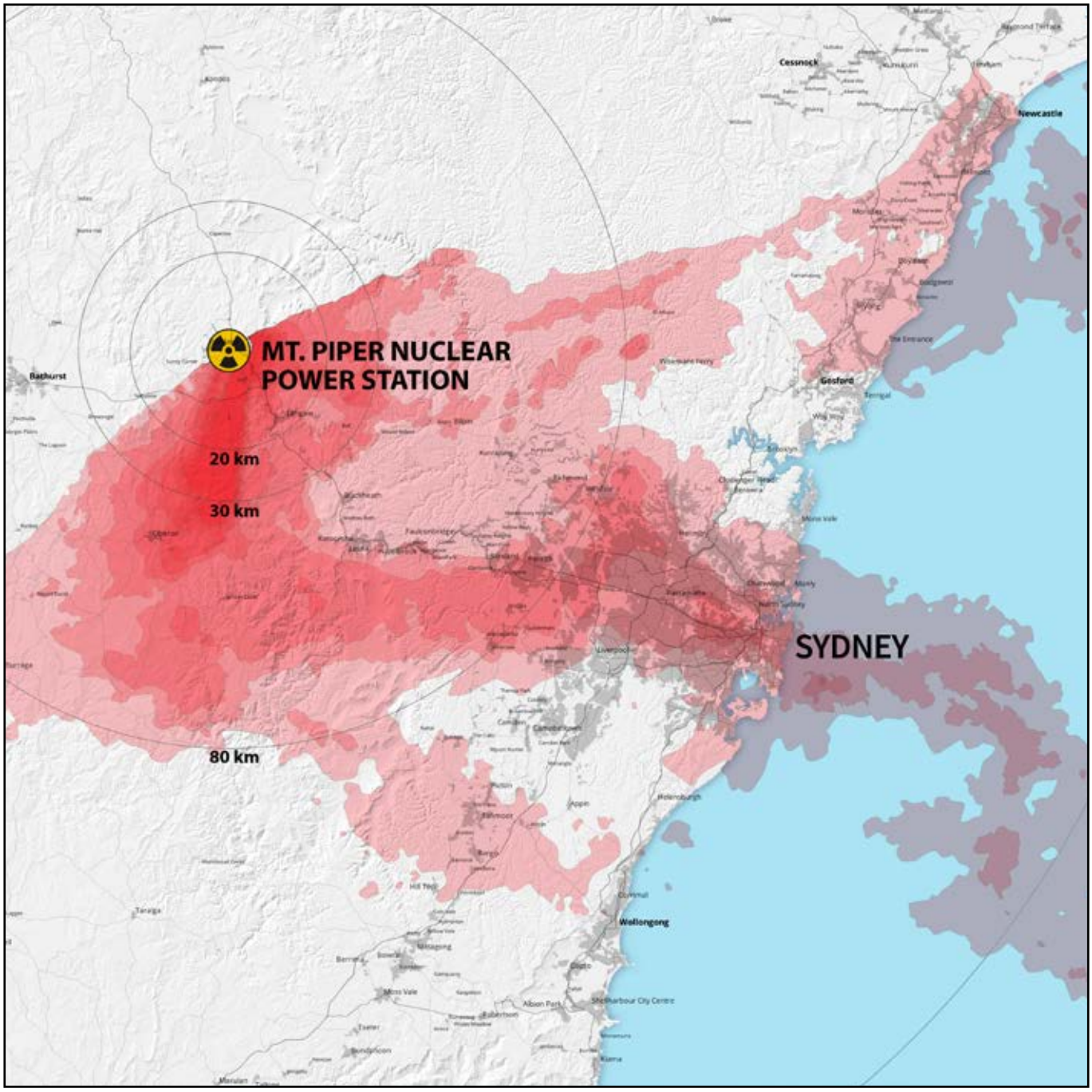
Tarong

28km from Kingaroy and 120km from the Sunshine Coast in Queensland.



Liddell

14km from Muswelbrook in the Upper Hunter Valley of New South Wales.



Initial deposition density of ^{137}Cs (kBq m^{-2})
Decay corrected to July 2011

- 1800+
- 1500-1800
- 1200-1500
- 900-1200
- 600-900
- 300-600
- 100-300
- 50-100
- 10-50

Mt. Piper

5km from Portland and 20km from Lithgow in the central-west of New South Wales.

Nuclear accidents and evacuation zones

Risk assessments consider both the frequency and the impacts of potential accidents.

Frequency: The introduction of nuclear power to Australia would result in a "non-negligible" risk of a "catastrophic failing within a nuclear system" according to Dr. Ziggy Switkowski, who led a nuclear power inquiry under the Howard government in 2006.

Impacts: For nuclear power plants, the impacts of disasters such as Chernobyl and Fukushima are profound and continuing.

Following the nuclear meltdowns, fires and explosions that destroyed reactors at Fukushima in March 2011, there was a mandatory evacuation zone out to 20 kms.

In different parts of the zone from 20 kms to 30 kms, evacuation was either mandatory or residents could choose between evacuation and sheltering indoors. There was an additional mandatory evacuation zone beyond the 30 km zone to the north-west (Iitate).

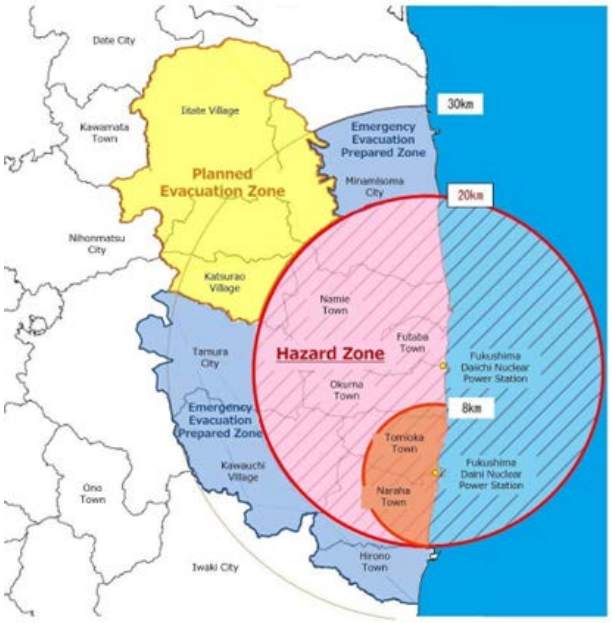
The US Government advised US citizens within 80 kms of the Fukushima plant to evacuate.

Areas were divided into Intensive Contamination Survey Areas (7,836 sq km), Special Decontamination Zone (1,117 sq km) and Difficult-to-Return Zone (335 sq km). The mandatory evacuation zone covered 807 sq kms.

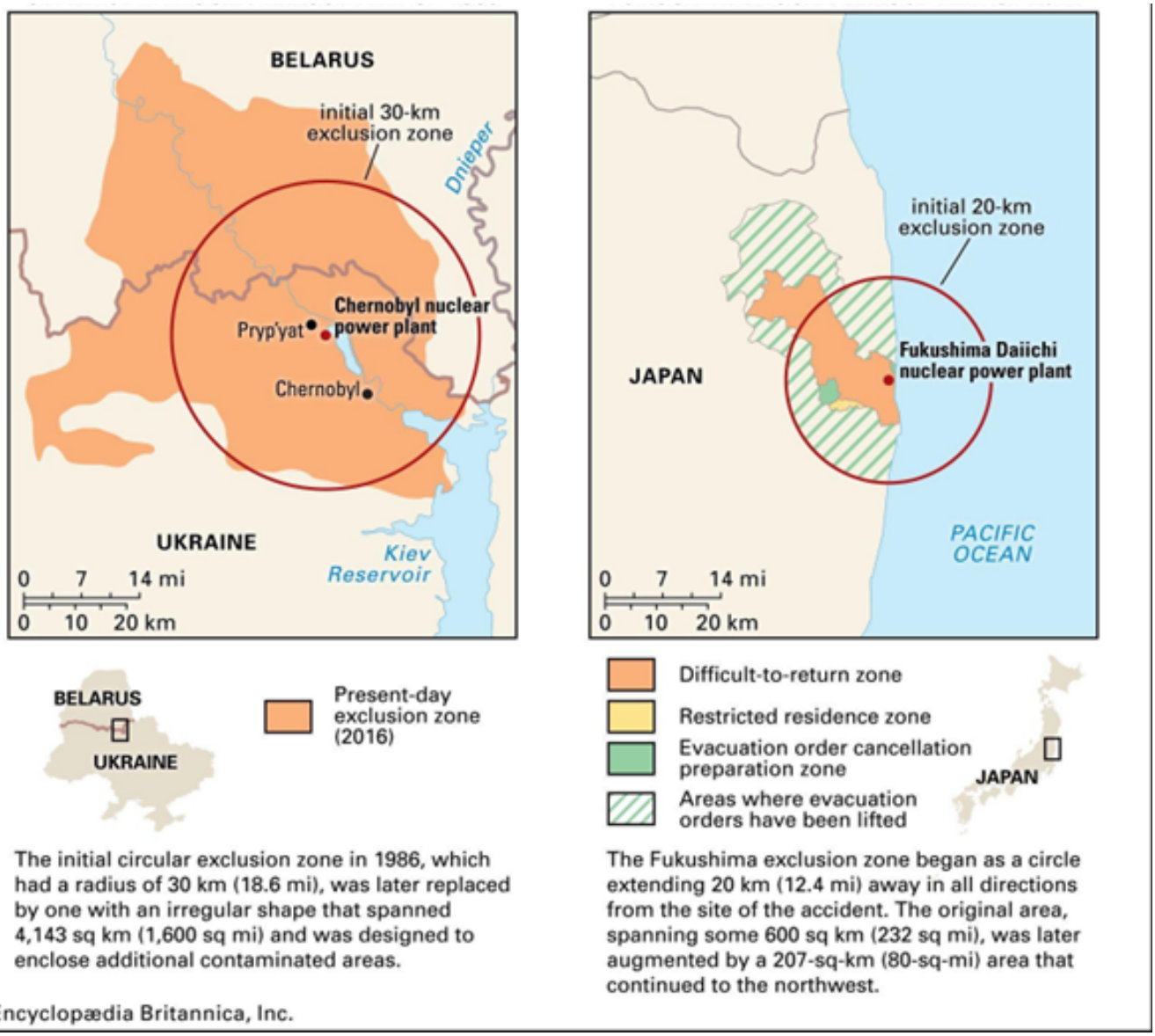
Over 191,000 people evacuated contaminated and threatened areas including 165,000 people who were required to evacuate and an estimated 26,600 who voluntarily evacuated. For many, their displacement and dislocation is ongoing, with the worst affected being women and children.

United Nations Special Rapporteur Cecilia Jiménez-Damary noted in 2022 that "many displaced persons are unable or unwilling to return to their areas of origin due to lingering fears regarding radiation levels, or concerns about access to basic services including education, healthcare, and jobs in these areas."

The UN Special Rapporteur further noted that since the Fukushima disaster, evacuees have faced challenges in accessing basic rights including housing, health, livelihood, participation, and education for children.



Source: Fukushima Prefecture Government



After the 1986 Chernobyl disaster in Ukraine, an initial 30 km evacuation zone (2,827 sq km) was replaced by a larger evacuation zone covering 4,143 sq kms and 350,000 people were evacuated.

So what might this look like in Australia?

Applying a 30km zone at the seven nuclear power sites proposed by the Coalition, nearly 200,000 people would live in potential evacuation zones. A detailed breakdown of the population data is online and a summary is presented here:

State	Proposed site	Number of people within 30 km	Towns / suburbs
NSW	Mount Piper	22,878	53 including Portland, Cullen Bullen, Capertree, Wallerang, Marrangaroo, Lithgow, Lidsdale, Clarence, Sunny Corner, Dargan, Hartley
NSW	Liddell	35,495	43 including Muswellbrook, Aberdeen, Camberwell, Singleton, Jerrys Plains, Denman, Mount Thorley.
VIC	Loy Yang	83,852	57 including Morwell, Moe, Newborough, Yallourn, Traralgon, Traralgon South, Koornalla, Devon North, Churchill, Boolarra, Yinnar, Yallourn North, Tyers, Glengarry, Toongabbie, Cowwarr, Rosedale, Gormandale, Carrajung, Won Wron
QLD	Tarong	21,316	50 including Cooyar, Pimpimbudgee, Maidenwell, Tarong, Brooklands, Boonenne, Taabinga, Coolabunia, Kingaroy, Glan Devon, Nanango, Taromeo, Benarkin, Benarkin North, Blackbutt, Blackbutt North, Yarraman
QLD	Callide	7,841	10 including Biloela, Jambin, Thangool, Lawgi Dawes
SA	Northern	14,170	11 including Port Augusta, Blanche Harbor, Douglas Point, Quorn, Miranda
WA	Muja	9,804	21 including Collie, Mungalup, Allanson, Preston Settlement, Cardiff, Mumballup
		Total: 195,356	Total: 245

Hundreds of schools, hospitals, day care centres and early learning centres are located within 30 km of the seven nuclear power sites:

SITE	**SCHOOLS** within 30 km	**HOSPITALS & MEDICAL CENTRES** within 30 km	**DAY CARE / EARLY LEARNING CENTRES** within 30 km
Liddell / NSW	Muswellbrook South Public School, Muswellbrook Public School, Muswellbrook High School, Denman Public School, Mount Pleasant Public School, Jerrys Plains Public School, Martindale Public School, Aberdeen Public School, Singleton Heights Public School, Singleton Public School, Singleton High School, King Street Public School, Australian Christian College Singleton, St James Primary School, Richard Gill School, St Catherine's Catholic College	Muswellbrook Hospital, Singleton Health Service, Burdekin Park Medical Centre, Brook Medical Centre	Civic Avenue Early Learning, St. Patrick's Early Education Centre, St. Nicholas Early Education, Singleton Preschool, Singleton ELC, St. Nicholas Early Education Muswellbrook, Muswellbrook Preschool, Muswellbrook Child Care Centre, Goodstart Early Learning Muswellbrook, Little Kindy Muswellbrook, eduKare Childcare and Preschool
Mount Piper / NSW	Portland Central School, St Joseph's School Portland, Cullen Bullen Public School, Meadow Flat Public School, Wallerawang Public School, Cooerwull Public School, Lithgow Public School, Zig Zag Public School, Capertee Public School, Lithgow Public High School, St. Patrick's School Lithgow, La Salle Academy	Lithgow Hospital	Pied Piper Preschool, Gowrie NSW Lithgow Early Education and Care, Jack and Jill Preschool, Little Learning Tree Lithgow, First Grammar Lithgow, Learning Kids Montessori Lithgow

SITE	SCHOOLS within 30 km	HOSPITALS & MEDICAL CENTRES within 30 km	DAY CARE / EARLY LEARNING CENTRES within 30 km
Loy Yang / Victoria	Liddiard Road Primary School, LaTrobe Special Developmental School, Chairo Christian School - Traralgon Campus, Lavalla Catholic College, Traralgon South Primary School, Traralgon College Senior Campus, Kosciuszko Street Primary School, Traralgon Secondary College Junior Campus, St Paul's Anglican Grammar School, Hazelwood North Primary School, Stockdale Road Primary School, Grey Street Primary School, Gippsland Tech School, Morwell Park Primary School, Sacred Heart Primary School, Lavalla Catholic College, Berry Street School - Morwell Campus, Morwell Central Primary School, Kurnai College - Morwell Campus, Yallourn North Primary School, St. Michael's Parish Primary School, St Gabriel's Primary, Kurnai College - Churchill Campus, Tyres Primary School, Yinnar Primary School, Lowanna College, Immaculate Heart of Mary Primary School, Lumen Christi School, Gormandale and District Primary School, Rosedale Primary School, Glengarry Primary School	Maryvale Private Hospital, Latrobe Regional Health (LRH) , Latrobe Medical Centre, Hollie Drive Medical Centre, St Lukes Medical Centre, Latrobe Community Health Centre	Traralgon Early Learning Centre, Cameron Street Preschool, Cumberland Park Preschool, Goodstart Early Learning Morwell Central, Little Saints Early Learning Centre, Li'l Bearz Early Learning Centre and Kindergarten, Rising Stars Early Learning Academy, Bluebird Early Education Traralgon, Goodstart Early Learning Traralgon - Park Lane, Goodstart Early Learning Traralgon - Grey Street, Mid Valley Kinder & Childcare, Gunai Lidj Daycare, Kylie Childminding Centre, Goodstart Early Learning Traralgon - Conway Court, Traralgon Playgroup, Gormandale Uniting Kindergarten
Muja / WA	Collie Senior High, Fairview Primary School, Wilson Park Primary School, St. Bridgit's School, Amaroo Primary School	Collie Hospital, Collie Valley Child Health Clinic, Collie Medical Group, Collie Valley River Medical Centre, Collie Child Health Clinic, SWAMS Collie (South West Aboriginal Medical Service)	Kidz Cottage, Collie Early Education , Collie Day Care Centre

SITE	SCHOOLS within 30 km	HOSPITALS & MEDICAL CENTRES within 30 km	DAY CARE / EARLY LEARNING CENTRES within 30 km
Tarong / Qld	Yarraman State School, Yarraman and District Kindergarten Association, Blackbutt State School, Benarkin State School, Tanduringie Primary School, Cooyar State School, Nanango State High School, St Patrick's School, Nanango State School, Nanango Special Education Unit, Coolabunia State School, Taabinga State School, Kingaroy State High School, Kingaroy State School, St John's Lutheran School, St Mary's Catholic College	Kingaroy Hospital, Nanango Hospital, Downtown Community Health Centre, Nanango Medical Centre, Blackbutt Medical Centre, South Burnett Medical Centre	Yarraman and District Kindergarten, Nanango Childcare Centre, Kingaroy Early Learning Centre, Guppy's Early Learning Centre - Blackbutt, Peanut Kids Kindy & Afterschool Care, Goodstart Early Learning Kingaroy, Little Peanuts Early Learning Centre, C&K Blackbutt Community Kindergarten, Kingaroy Early Education Centre, Enhance Family Day Care - Childers, South Burnett Childcare & Kindergarten, Dee's Day Care, CTC - Community Kids
Callide / Qld	Biloela State High School, Biloela State School, Thangool Primary School , Mount Murchison State School, Redeemer Lutheran College, Biloela, St Joseph's Catholic Primary School Biloela, Biloela Kindergarten , C&K Coo-Inda Community Kindergarten, Prospect Creek State School	Bluecare Callide Valley Home & Community Care, Biloela Hospital, Biloela Medical Centre, ACE Medical Centre	Biloela Early Learning Centre & Childcare, C&K Biloela Community Childcare Centre
Northern / SA	Augusta Park Primary School , Port Augusta Secondary School, Seaview Christian College, Port Augusta Special School, Flinders View Primary School, Port Augusta West Primary School, Willsden Primary School, Carlton School, Stirling North Primary School, Caritas College, Port Augusta West Childhood Services Centre, Wilmington Primary School	Port Augusta Hospital and Regional Health Centre, Port Augusta Medical Centre, Carlton Medical Centre, Augusta Westside Medical Centre, Ghan Medical Centre	RICE Project Preschool, Flinders View Child Parent Centre , Flinders Children's Centre, Port Augusta Children's Centre, Augusta Park Childhood Services Centre, Port Augusta Childcare Centre, Edge Early Learning Port Augusta, Port Augusta West Childhood Services Centre, MacKillop Learning Centre, Stirling North Childhood Services Centre, Camden Park Childcare Centre

Health risks

The World Nuclear Association claims that "there have been no deaths or cases of radiation sickness" from the Fukushima disaster and "there have been no harmful effects from radiation on local people". Likewise, shadow energy minister Ted O'Brien claims that the Fukushima disaster "caused no death to workers at the plant nor any radiation casualties".

Such claims are not supported by independent scientific analysis.

The World Health Organisation states that for people in the most contaminated areas in Fukushima Prefecture:

* for females exposed as infants, an estimated 4% increased risk for all solid cancers, a 6% increased risk of breast cancer; and a 70% increased risk of thyroid cancer (from a 0.75% lifetime risk up to 1.25%);

* for males exposed as infants, a 7% increased risk of leukemia.

The World Health Organisation report goes on to note that people beyond the most contaminated areas also face increased risks:

"These estimated increases presented above apply only to the most affected location of Fukushima prefecture. For the people in the second most affected location, the estimated additional lifetime cancer risks over baseline rates are approximately one half of those in the highest dose location. The estimated risks are lower for people exposed as children and adults compared to infants.

"In the next most exposed group of locations in Fukushima prefecture, where preliminary estimated radiation effective doses were 3 to 5 mSv, the increased lifetime estimates for cancer risks over baseline rates were approximately one-quarter to one-third of those for the people in the most affected geographical location."

Radiation biologist Dr. Ian Fairlie who served as the Scientific Secretary to the UK Government's Commission for Investigation of Radiation Risks of Internal Emitters estimates around 5,000 cancer deaths due to radiation exposure from the Fukushima disaster.

An additional 2,313 nuclear disaster-related deaths among evacuees from Fukushima prefecture had been identified by Japanese authorities by September 2020. These deaths are in part related to physical and mental illness resulting from the nuclear evacuation and long-term displacement, and lack of medical support.

The sievert (or millisievert) is a unit used to measure exposure to ionising radiation. The public radiation exposure limit from anthropogenic sources (i.e. from human activity) was arbitrarily lifted from 1 millisievert (mSv) per year to 20 mSv following the Fukushima disaster. The 20 mSv limit was the criterion for decisions about evacuation zones, and later for decisions about lifting restrictions. Had the 1 mSv limit been retained, a vastly greater number of people would have had to evacuate and the gradual lifting of restrictions would be greatly limited and delayed.

To give a sense of the scale of the risk, Assoc. Prof. Tilman Ruff, an Australian public health expert and co-founder of the Nobel Prize-winning International Campaign to Abolish Nuclear Weapons, states:

> "To provide a perspective on these risks, for a child born in Fukushima in 2011 who was exposed to a total of 100 mSv of additional radiation in its first five years of life, a level tolerated by current Japanese policy, the additional lifetime risk of cancer would be on the order of one in thirty, probably with a similar additional risk of premature cardiovascular death."

Security experts: Every reactor is 'a potential dirty bomb'

The Coalition's plan to build nuclear reactors would leave Australia vulnerable to missile warfare and sabotage, the Australian Security Leaders Climate Group warns. Retired Admiral Chris Barrie, former Chief of the Australian Defence Force, said:

> "Every nuclear power facility is a potential dirty bomb because rupture of containment facilities can cause devastating damage. Modern warfare is increasingly focused on missiles and uncrewed aerial systems, and with the proposed power stations all located within a 100 kilometres of the coast, they are a clear and accessible target. ... Do we prioritise the protection of cities and population centres and military bases, or do we divert vital resources to defending seven nuclear power stations scattered across Australia?"

Cheryl Durrant, former Department of Defence Director of Preparedness and Mobilisation, said:

> "In the Ukraine-Russia war, both sides have given strategic priority to targeting their opponents' energy systems, and Australia would be no different. So these nuclear facilities would necessitate expensive and complex missile defence systems as well as allocated cyber and counter-intelligence resources, making our security challenge more complex and expensive."

Financial risks

The financial costs of the Fukushima disaster amount to many hundreds of billion dollars. If indirect economic impacts of the disaster are included, the cost exceeds one trillion dollars. Likewise, Chernobyl was a trillion-dollar disaster. A trillion-dollar nuclear disaster would amount to a cost of $40,000 for every single Australian.

Nuclear reactor vendors will not accept liability for the damage caused by their technology. The astronomical costs associated with nuclear disasters are foisted onto taxpayers. Liability conventions and national laws limit the total amount of compensation available and thus protect nuclear suppliers. This caps the funds available for victims at a fraction of real costs and removes incentives for supplier companies to take measures to reduce nuclear risks.

Housing risks

Housing prices have been shown to fall due to proximity to nuclear plants. The Nuclear Power publication acknowledges:

“Studies have shown that properties located within close proximity to a nuclear power plant may experience a decrease in value due to the perceived risks and potential for accidents. Buyers are often concerned about the safety of living near a nuclear facility, leading to a lower demand for these properties and consequently reduced prices.”

It is important to note that insurance policies from many of Australia’s major insurers - including AAMI, CGU, Allianz, QBE and NRMA - contain specific text excluding coverage for nuclear disasters. None of these will insure homes, cars or possessions against a nuclear accident or release.

Agricultural risks and ingestion zones

Nearly 12,000 farms are located within 80 km of the seven sites targeted by the Coalition for nuclear reactors.

A July 2024 Joint Ministerial Statement released by Agriculture Ministers of the Governments of Australia, Queensland, NSW, the ACT, Victoria, SA, WA and the NT notes that in similar countries, including the USA, states have produced detailed plans to manage radioactive emergencies from nuclear reactors within a similar radius of farmland (known as the “ingestion zone”). These states have set out detailed guidelines to be followed by farmers, processors and distributors within nuclear ingestion zones to attempt to protect their food supply.

Emergency responses to nuclear accidents

In a submission to the parliamentary inquiry into nuclear power generation in Australia, Emergency Leaders for Climate Action warn that nuclear reactors would introduce significant and unnecessary risk to Australian communities and emergency responders, including firefighters already stretched by escalating climate fuelled disasters.

The Australian civilian nuclear regulator ARPANSA sets out the health impact studies, response measures and zones, and procedures that are to be put in place in the event of a nuclear accident (see “Guide for Radiation Protection in Emergency Exposure Situations, Part 1 and 2). In tasking emergency workers to undertake “urgent protective actions” in response to a nuclear accident, the ARPANSA Guide (Part 2, p.18-19 and Table 3.1) authorises ionising radiation exposures to workers of up to 50 mSv.

In the event of an expanding radioactive pollution plume, an “Urgent Protective Action Zone” would be established. The local population could require evacuation and some would be required to undergo ‘decontamination’ and to receive medical treatment. Locals within this Urgent Protective Action Zone face authorised ionising radiation exposures of up to 50 mSv, which is 50 times higher than the maximum annual public radiation exposure limit from anthropogenic sources.

In an even more severe nuclear accident, ‘Category 1 Emergency workers’ could receive doses of up to 500 mSv, a dangerously high exposure 500 times the maximum annual public radiation exposure limit. ARPANSA states that female workers who might be pregnant must be excluded from taking actions that might result in such high radiation exposures.

What about ‘small modular reactors’?

The Coalition proposes building ‘small modular reactors’ (SMRs) at sites in SA and WA and large, conventional reactors in eastern states. Given their smaller size, radioactive fallout zones in the event of an SMR accident would be smaller than illustrated in the interactive map.

However, SMRs would still risk catastrophic accidents and widespread fallout. Some of the proposed SMR designs are quite large for example the Rolls-Royce design promoted by the Dutton Coalition has a capacity of 470 megawatts, which is half the size of most large reactors.

Further, the Coalition opposed the construction of conventional, large reactors anywhere in Australia until the collapse of the NuScale SMR project in the US in late 2023. Earlier that year, Peter Dutton said: “I don’t support the establishment of big nuclear facilities here at all, I’m opposed to it.”

The Coalition’s current preference for conventional, large reactors in the eastern states could extend to SA and WA given the dim prospects for SMR deployment. A 2024 report by the Australian Academy of Technological Sciences and Engineering notes that no small modular reactors exist in any OECD countries and the technology has not been proven technically or financially.

A project of Don’t Nuke the Climate