



Unearthing Australia's toxic coal ash legacy

How the regulation of toxic coal ash waste
is failing Australian communities

Unearthing Australia's toxic coal ash legacy

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Executive summary and recommendations

Coal-fired power has long been associated with air pollution and climate change. But coal-fired power stations produce another insidious waste problem, hidden in plain sight. Coal ash is one of Australia's biggest waste problems, accounting for nearly one-fifth of the entire nation's waste stream. It is toxic and, if not strictly disposed of, can contaminate air, soil and water and lead to serious health and environmental impacts.

All power stations in Australia have significant issues with their ash dumps, including:

- long-term groundwater contamination at AGL Loy Yang;
- torn liner and groundwater contamination at EnergyAustralia Yallourn;
- no lining to protect groundwater at either Origin Energy Eraring or Delta Vales Point power stations;
- asbestos dumped at Vales Point without community knowledge and without licence.

When coal is burnt to make electricity, it produces mountains of toxic ash waste. At most coal-fired power stations, coal ash is mixed with saline wastewater and pumped into enormous dump sites creating a lethal cocktail of mercury, lead, arsenic, selenium and chromium ('wet disposal').

This toxic slurry can leak into aquifers and soil needed by farmers and the environment, and into rivers and lakes where our families fish and our children swim. When it is left to dry out, winds can blow the toxic dust onto nearby communities where people breathe toxic pollution deep into their lungs.

The toxins in coal ash have been linked to asthma, heart disease, cancer, respiratory diseases and stroke. Although the health impacts of air pollution are becoming more well known, little research has been done in Australia on the health and environmental impacts from contact with or consumption of water and soil contaminated by toxins in coal ash. Communities that live near coal-fired power stations are at serious risk. Despite this, government regulators allow ash dumps to be built and operated in a way that does not prevent groundwater contamination, surface water contamination, pipeline spills, and community exposure to toxic dust emissions.

Coal ash cannot be disposed of safely. Even with best practice methods, there remains a significant contamination risk to the environment and communities. Coal ash dumps must be carefully and strictly managed and rehabilitated to minimise the risk posed to human and environmental health.

Regulation is wholly inadequate. Reporting information is not available to community scrutiny without resorting to Freedom of Information. Regulators don't require operators to maintain a bond or financial assurance for toxic coal ash dumps nor to prepare best-practice rehabilitation and closure plans, and have not planned for future monitoring and maintenance of ash dumps into the future.

In Australia, wet disposal is the primary means of coal ash disposal because it is the cheapest form of dumping. The less contaminating way of dumping ash is to keep it dry and firmly contained offsite. This practice is used by very few coal-fired power stations in the country. Elsewhere, wet toxic sludge full of heavy metals and poisonous materials is left to sit in unlined pits and leak into groundwater tables.

As this report shows, coal ash dumps are already causing water contamination, polluting aquatic ecosystems, and blowing toxic ash over communities who live near them. Cleaning up existing contamination is critical to protecting water sources, preventing air pollution, and planning future land use. Governments must make these coal-fired power stations clean up their act. Exceptionally poorly constructed ash ponds in Australia, including Eraring, Vales Point, and Loy Yang, should be re-sited, reconstructed and managed to allow for thorough clean-up of existing contamination.

By implementing the recommendations in this report, governments can reduce the toxic health and environmental impacts of coal-fired power stations until we transition away from polluting energy to clean energy powered by sun, wind and waves.

Recommendations

1. **Australian governments initiate inquiries into coal ash dumps:** Australian Parliaments need to initiate inquiries into coal ash dumps to understand the full extent of the toxic threat and make strong recommendations to protect human and environmental health.
2. **Rehabilitation plans:** Australian governments should impose an immediate obligation on ash dump owners and operators to prepare best practice rehabilitation, closure plans and post-closure plans in consultation with the communities who live near these toxic sites.
3. **Tougher groundwater regulation:** Australian regulators who oversee ash dumps should immediately develop and implement actions to clean up and manage ash dumps causing groundwater contamination, including re-siting operational ash dumps to thoroughly rehabilitate existing sources of contamination to best practice standards.
4. **Safe containment of existing ash dumps:** Australian governments should impose immediate obligations on ash dump owners and operators to convert wet dumps to dry ash emplacements.
5. **Bond payments to protect communities:** Australian governments should immediately impose a bond or financial assurance on ash dumps to protect Australian communities from bearing the cost burden of poorly managed or poorly rehabilitated ash dumps.
6. **National guidelines:** Australian governments should develop and ensure the implementation of enforceable national best practice guidelines for ash dump management, rehabilitation, and closure and post-closure management (as outlined in this report) to mitigate as far as practicable the future threat of contamination of land, groundwater, and surface water and prevent harm to human health.
7. **Transparency and availability of information:** Australian governments should make access to information about ash dumps transparent and available to the Australian community, including all existing management plans, details of financial assurance, rehabilitation plans, pollution incidents, fines and other enforcement actions taken by regulators, monitoring data, hydrogeological assessment, predictions for future contamination, and predictions for future land-use planning.

1

Introduction

The problem

Coal-fired power stations produce greenhouse gas emissions that contribute to climate change, and toxic air pollution that causes death and disease. But the true cost of coal – both immediate and into the future – is still being unearthed.

Coal combustion produces millions of tonnes of toxic ash and post-combustion by-products. This toxic waste is usually dumped very close to power stations and the communities who live near them.

Coal ash pollution threatens human and environmental health worldwide.¹ Major coal-producing countries together produce about 3.7 billion tons of coal ash each year,² making it one of the world's largest industrial waste streams. Australian power stations alone produce an estimated 10–12 million tonnes of coal ash annually,³ and Australia has well over 400 million tonnes of ash currently stored in dump sites throughout the country.⁴

Coal naturally contains trace amounts of toxic chemicals which are concentrated in the ash when the coal is burned.⁵ Coal ash is a concentrated mixture of these toxins, which are known carcinogens, neurotoxins, and poisons that include arsenic, cadmium, lead, mercury, radium, selenium and thallium.⁶

Despite the large volume and hazardous nature of coal ash, it is disposed of without adequate safeguards to protect communities and environmental health. The standard treatment of this toxic waste in Australia is to mix it with water and then pipe it to nearby 'ponds' or 'dams' that haven't been built to protect groundwater and surface water, and are not well managed to prevent ash blowing onto nearby communities.

The language used to describe these toxic sites downplays the seriousness with which we need to take coal ash. Regulators use words like 'dam', 'pond', and 'landfill' to describe where the ash goes. This report uses 'dump' to describe the site where ash is transferred. The current approach to 'rehabilitation' approved by all Australian governments and regulators is to cap the dump and walk away, which is happening at decommissioned power stations including Hazelwood (Vic) and Munmorah (NSW).

Groundwater is contaminated underneath many Australian ash dumps, yet environmental regulators do not require that operators clean up this contamination at the source. Because many coal-fired power stations sit near recreational lakes and reservoirs – such as near the Latrobe River in Victoria, the Calliope River and surrounding estuaries in Gladstone, Queensland, and Lake Macquarie on the New South Wales Central Coast – the potential for harm to aquatic life and human health is substantial. Water pollution from coal ash can raise cancer and other health risks, make fish unsafe to eat, and can cause long-term damage to aquatic ecosystems.

The United States Environment Protection Agency conducted a risk assessment of coal ash dumps in the US and warned that peak pollution from coal ash dump sites occurs long after the waste is dumped. Peak exposures from coal ash dumps are projected to occur approximately 70 to 100 years after the dumps first began operation.⁷

Power station operators quite often describe coal ash as inert. On its website, Delta Electricity – operator of the Vales Point power station on the NSW Central Coast – states that fly ash (the most poisonous form of coal ash) is an 'inert mineral matter', implying that it is non-toxic.⁸ Referring to coal ash this way downplays the risk it poses to environmental and human health. As this report shows, coal ash (including fly ash) leaches toxic metals into groundwater, contaminates aquatic ecosystems, pollutes surface water, and blows over communities risking health and wellbeing.

Power station operators and the coal ash reuse industry often attempt to downplay the toxicity of Australian coal ash by comparing it with coal ash samples from other ash dump sites around the world.⁹ The toxicity of coal ash depends on the chemical composition of the source coal, which differs from mine to mine and often within coal seams from the same mine. Toxicity also depends on what pollution controls are installed on the power station. Therefore toxicological comparisons need to clearly identify the source of the sample used.

Industry studies have shown that some samples of Australian coal ash are lower in certain toxins, higher in others, and in some instances tests results have shown no statistical difference between toxins such as mercury and lead.¹⁰ Reports and studies that do not state explicitly where the coal ash sample was taken from, which ash dump it was compared to, and what methodology was used to conduct the study cannot be said to be reflective of an 'Australian' example.

Australian coal ash is known to be higher in toxins such as silica.¹¹ Silica exposure can cause lung cancer, kidney disease, and chronic obstructive pulmonary disease.¹² Silica exposure from coal ash dust is more likely to happen when wind carries ash dust from poorly managed ash dumps, such as has happened in Port Augusta and Eraring power stations.

Figure 1

Map of coal ash dumps in Australia



Ash Management - Delta Elec x +

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Community Information Line 1800 115 277
General Enquiries & Complaints (24h hours) Phone (02) 4352 6111.

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Ash Management

A major by-product of coal fuelled electricity generation is ash – fly ash and bottom ash. Bottom ash is collected from the bottom of the boilers while fly ash is an inert mineral matter collected in dust collection plant. There is currently a modest market for fly ash reuse as a cement replacement up to 30% by volume as well as in road construction and other uses. Delta continually reviews opportunities to recycle fly ash.

At Vales Point Power Station, ash is transported by wet sluicing to the ash dam. In a contract arrangement, ash is collected from the outlet of the fabric filter hoppers and transported to an onsite facility where it is processed for sale. The excess is then wet sluiced to the ash dam.

Bottom ash is collected at the ash dam from the wet sluice stream for processing and sale. Cenospheres, (minute floating particles) found in the ash dam, are also harvested and processed for sale. The Vales Point ash dam is divided into separate ponds and as each pond reaches capacity, it is capped and revegetated.

Continuous monitoring and rigorous environmental management programs are designed to minimise the impacts of ash storage at all Delta locations



Coal ash regulation in Australia

The regulation of coal ash dumps throughout Australia differs from state to state, is inconsistent between dump sites, and does not adhere to best practice construction, management or rehabilitation standards as practised in other parts of the world. For example:

- conditions for ash dump management differ from State to State, and in each State, from power station to power station;
- there is no best practice management standard for ash dumps in any State, or at a national level;
- there is no requirement that power station operators prepare ash dump rehabilitation and post-closure plans well before closure of the power station occurs;
- access to information about ash dumps is extremely limited, including access to groundwater monitoring data and ash management plans which have to be acquired through Freedom of Information laws;
- the only State that requires financial assurances be held for ash dumps is Victoria.

“The main concerns I have always held about the ash dam is the leachate. We know they were built in the late 60s. We know the technology was not to line any of these dams. So everything that goes in there, while it is contained in that area, still leaches down into the water table and therefore leaches into Lake Macquarie.”



Sue Wynn,
Manning Park Progress
Association, NSW

Figure 2

Summary of the problems at Australia's 16 active coal ash dumps

	Adequately lined?	Groundwater contaminated?	Financial bond?	Ash management plan?	Rehabilitation/closure plan prepared?
Yallourn (Vic)	✗	✓	✓	✗	✗
Loy Yang (Vic)	✗	✓	✓	✗	✗
Vales Point (NSW)	✗	✓	✗	✗	✗
Eraring (NSW)	✗	✓	✗	✗	✗
Mount Piper (NSW)	✗	✓	✗	✗	✗
Bayswater (NSW)	✗	No information	✗	✗	✗
Liddell (NSW)	✗	No information	✗	✗	✗
Gladstone (QLD)	✗	No information	✗	✓	✗
Stanwell (QLD)	✗	No information	✗	✓	✓
Tarong (QLD)	✗	No information	✗	✓	✗
Tarong Nth (QLD)	✗	No information	✗	✓	✗
Callide (QLD)	Unknown	No information	✗	Unknown	Unknown
Kogan Creek (QLD)	✗	No information	✗	Unknown	✗
Millmerran (QLD)	Unknown	No information	✗	Unknown	Unknown
Collie (WA)	✗	No information	✗	✓	✗
Bluewaters (WA)	✗	No information	✗	✗	✗
[Ewington mine]					
Muja (WA)	Supernatant dam ok, otherwise ✗	✓	✗	Unknown - managed under Contaminated Sites Act 2003	✗
Kwinana (WA)	✗	✓	✗	Unknown - managed under Contaminated Sites Act 2003	✗
[Perron Quarry]					

NB: The NSW EPA conducted an audit on the ash dumps for the operational power stations but did not audit groundwater seepage because it was 'outside of the scope of the audit'. See: <https://www.epa.nsw.gov.au/-/media/F296D19215D348A8BC16DEB4D2021A52.ashx>

Communities that live closest to power stations bear the greatest environmental burden of this toxic mess.

In Victoria, there are coal ash dumps in five locations – at the Yallourn, AGL Loy Yang, Hazelwood, EnergyBrix/Morwell and Anglesea power stations. The coal ash dumps at AGL Loy Yang and Yallourn power stations are still operational with the rest in various stages of rehabilitation. Loy Yang B power station, operated by Alinta, pumps its coal ash to the AGL Loy Yang premises.

There are five operational coal ash dumps in New South Wales for the Eraring, Mount Piper, Vales Point, Liddell and Bayswater power stations. The coal ash dump sites for Wallerawang and Munmorah power stations are in the process of rehabilitation. Redbank power station, currently mothballed, is licenced to dispose of its ash in the Warkworth mine.¹³

Queensland has several operational ash dumps, at Stanwell, Gladstone, Callide, Tarong, Tarong North, Millmerran and Kogan Creek power stations. The Collinsville ash dump is currently being rehabilitated.

Western Australia has several operational ash dumps for the Collie, Muja and Bluewaters coal-fired power stations. The Collie and Muja power station ash dumps are located on site, while the Bluewaters power station pipes its ash waste to the nearby Ewington mine for storage, and the Kwinana power station dumped its ash at Perron Quarry.

Some of the ash dumps in Australia are very close to communities, including residential areas, schools and recreation centres. Most are extremely close to waterways.

Figure 3

Proximity of ash dumps to communities

Ash dump	Proximity to communities	Proximity to waterways
Vales Point, NSW Central Coast	<ul style="list-style-type: none"> • 180m from the nearest houses • 320m from Doyalson Wyee RSL Club • 400m from Doyalson Baptist Church • 900m from Tom Barney oval • 1040m from Wyee Public School 	<ul style="list-style-type: none"> • 200m from Mannering Bay • 1026m from Wyee Creek • 1300m from Colongra Lake
Eraring, NSW Central Coast	<ul style="list-style-type: none"> • 400m from Myuna Bay Sports and Recreation Centre • 2900m from closest house in Wangi Wangi 	<ul style="list-style-type: none"> • Ash dump run-off discharges into Crooked Creek which flows into Whitehead's Lagoon and Myuna Bay • 720m from Stockyard Creek
Yallourn, Latrobe Valley Victoria	<ul style="list-style-type: none"> • 180m from Yallourn North Primary School • 120m from Yallourn North residential area 	<ul style="list-style-type: none"> • 120m from Latrobe River • 327m from Anderson Creek
Tarong		<ul style="list-style-type: none"> • 500m from Meandu Creek
Stanwell	<ul style="list-style-type: none"> • 323m from nearest residence 	<ul style="list-style-type: none"> • 265m Spring Creek • 78m Stony Creek
Kogan Creek		<ul style="list-style-type: none"> • 414m from Condamine River

About this report

This report introduces the serious threats of toxic pollution and regulatory failures of coal ash dumps in Victoria, New South Wales, Queensland, and Western Australia. These states were chosen because they contain Australia's remaining operational coal-fired power stations, and therefore Australia's operational coal ash dumps.

This report does not include information on the potential toxic legacy of closed coal ash dumps in urban areas. Most capital cities in Australia and larger regional centres had coal-fired power stations – including Melbourne, Geelong, Ballarat, Sydney and Brisbane – all of which have been decommissioned. It is unknown where the ash from these operations was dumped, whether on land or into adjacent waterways, or the extent to which those toxic sites were rehabilitated.

This report is the product of research conducted by lawyers at Environmental Justice Australia, with additional specialist expertise provided by lawyers and scientists at Earthjustice in the United States. Information that is publicly available has been used, that is, accessible without engaging with the Freedom of Information process. Despite the toxicity of ash dumps and their proximity to communities, the amount of publicly available information on aspects of the dumps such as ash management plans and rehabilitation plans – where these exist – is extremely limited.

There is a significant amount of information that is vital to the public's right to know about coal ash dumps and how they are managed, which is only available through lengthy and expensive government Freedom of Information procedures. It is highly concerning that comprehensive information about coal ash dumps is not readily available to the Australian public. Communities have a right to know this information and should be included in decisions regarding ash dumps including expansion, rehabilitation, closure and post-closure planning.

This report includes a framework to develop National Best Practice Guidelines for coal ash dump management. It has been prepared to provide community with a checklist of aspects of coal ash dump management, rehabilitation, closure and post-closure planning to be used when engaging with regulators on coal ash dump matters including licence condition amendments, expansions, rehabilitation plans, and proposals for new ash dumps.

This report makes seven **recommendations** that should be implemented immediately by Australian governments to reduce the toxic burden of coal ash dumps on Australian communities and minimise this toxic legacy to protect environmental and human health.

Senate mine and ash dump rehabilitation inquiry

We proposed the need for national best practice management and rehabilitation guidelines and the requirement that ash dump owners maintain a financial assurance for ash dumps during the federal Senate Environment and Communications References Committee inquiry into *Rehabilitation of mining and resources projects as it relates to Commonwealth responsibilities*. These recommendations were accepted by most Committee members.¹⁴ However the Committee did not come to a unanimous agreement on what the recommendations should be overall.¹⁵ Moreover, those Committee members who accepted our recommendations also recommended that the ash dumps not be so rehabilitated that the ash could not be accessed and reused in future.¹⁶

We welcome the recommendations that a national approach to best practice ash dump management and rehabilitation be developed and that financial assurances be imposed on ash dump operators. However it is paradoxical to recommend that rehabilitation of these toxic sites should not preclude future use of the ash.

Ash dump rehabilitation must be comprehensive and adhere to best practice standards to protect the environment and human health, and minimise the impact of this toxic legacy. Ash dumps are contaminated land sites that pollute groundwater and pose a dust risk if not managed to strict standards. Current ash dump sites need to be rebuilt to thoroughly contain this toxic waste so that the former sites can be meticulously rehabilitated to prevent environmental and community harm.

Given the failure of the federal Senate inquiry to deliver unanimous recommendations, it is imperative that State governments initiate their own Parliamentary inquiries to understand the full extent of the impact of ash dumps and the future implications of human and environmental health. These inquiries should include site visits to each ash dump, and terms of reference that include options for improvements to current and future management to protect environmental and human health, preparation to rehabilitation plans, and development of planning for closure and ongoing management when power stations are decommissioned.

Ash dump rehabilitation must be comprehensive and adhere to best practice standards to protect the environment and human health, and minimise the impact of this toxic legacy.

What is coal ash?

Coal combustion generates several forms of solid waste collectively called 'coal ash'. Coal ash consists of fly ash, bottom ash (larger and heavier ash particles that accumulate on the sides and bottom of the boiler), and boiler slag (molten ash collected at the bottom of the boiler). If Australia begins to use pollution controls such as flue gas desulfurisation the sludge from these controls would be included in coal ash.

Fly ash

Fly ash consists of very fine powder-like particles carried out of the boiler by the flue gases. At power stations with effective pollution controls, most fly ash is captured by dust-collecting systems before it escapes the boiler's stack. Particulate control devices used in Australia are electrostatic precipitators and fabric filters (or 'baghouses'). Older pollution controls, such as electrostatic precipitators, are less efficient at capturing fly ash than baghouses which have been installed and retro-fitted into power stations internationally since the 1970s. Older electrostatic precipitators that aren't routinely and strictly maintained can cause fly ash to be released from power station stacks, exposing the surrounding community to coal ash dust.

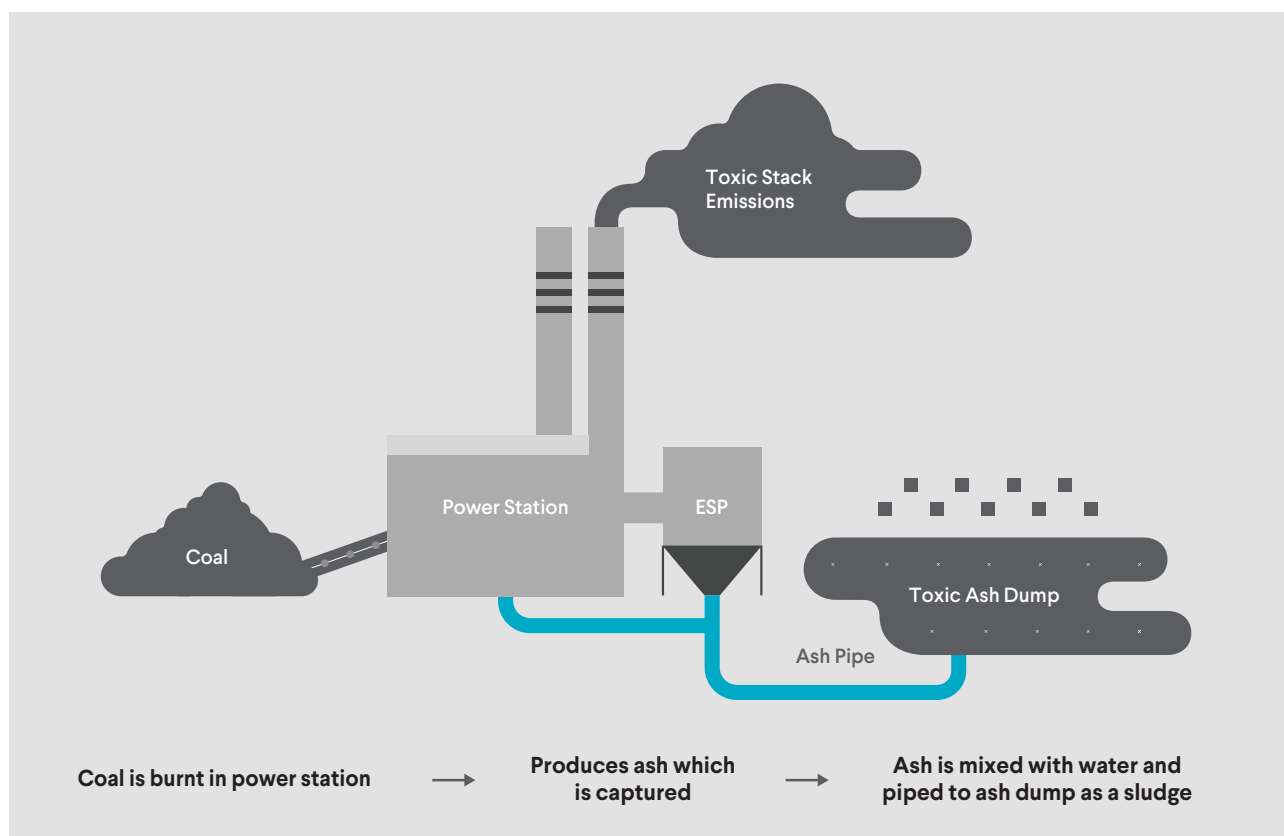
Fly ash is the most toxic form of ash waste generated by power stations. Heavy metals and other chemicals mobilised in the combustion process are captured in the fly ash, infusing the ash with arsenic, lead, boron, selenium, thallium and other toxic pollutants. Mercury adsorbs, or sticks, to fly ash unless another material such as activated carbon is added to the flue gas.¹⁷ The primary component of fly ash is silica, which presents hazards to health if inhaled.¹⁸ Fly ash is usually a light to medium grey colour.

The characteristics of the source coal affect both the toxicity of the coal ash and its volume.¹⁹ Both the form and the concentrations of these trace elements also vary with coal type.

Once the coal is burned it is usually mixed with water and piped to dump sites adjacent to the power station. This is the most common – and most environmentally dangerous – form of coal ash management and is used at almost all Australian power stations.

Figure 4

The main processes involved in coal combustion and generation of coal ash²⁰



2

Coal ash contamination: human health and environmental damage

Burning coal concentrates the metals naturally found in coal. This means that coal ash contains a much higher concentration of toxic pollutants and metals on a per volume basis compared to its raw form.²¹

Toxic elements in coal ash include arsenic, barium, boron, beryllium, cadmium, chromium, cobalt, lead, lithium, manganese, mercury, molybdenum, radium, selenium, thallium and other dangerous chemicals. These toxins cause a range of health impacts in every major organ of the human body (see image below) including cancer, kidney disease, reproductive harm, and damage to the nervous system, especially in children.²²

A United States Environmental Protection Agency (US EPA) risk assessment found that living near unlined ash dumps increases the risk of damage to the liver, kidney, lungs and other organs as a result of being exposed to toxins at concentrations far above safe levels.²³ Another recent United States study found the prevalence of health and sleep problems were significantly greater in children living near coal ash dumps.²⁴

In Australia many ash dumps are built on top of former ash dumps that were not lined, not rehabilitated, and not designed to protect groundwater, surface water and land from contamination. Although some of the new ash dumps built on top of former ash dumps, such as the ash dumps at Yallourn power station, are lined (although not to best practice and not without evidence of groundwater

contamination), the issues associated with contamination from former sites are exacerbated from both a management and rehabilitation perspective.

The US EPA risk assessment warns that peak pollution from coal ash dump sites occurs long after the waste is dumped. For example, peak exposures from coal ash dumps are projected to occur 78 to 105 years after the ponds first began operation. Thus old dump sites, even if they cease receiving coal ash, still pose very significant environmental and human health threats.²⁵

Coal ash dumps that are not constructed and managed to best practice standards pose a significant contamination risk to surrounding groundwater, surface water and air quality of communities. Contaminants from coal ash can and do leach through the bottom of ash dumps and into groundwater, run off into surface waters such as rivers and lakes, and dry out and blow over communities. All of these issues occur in Australia, as outlined below.

Figure 5

Harm to human health from breathing and ingesting coal ash toxicants

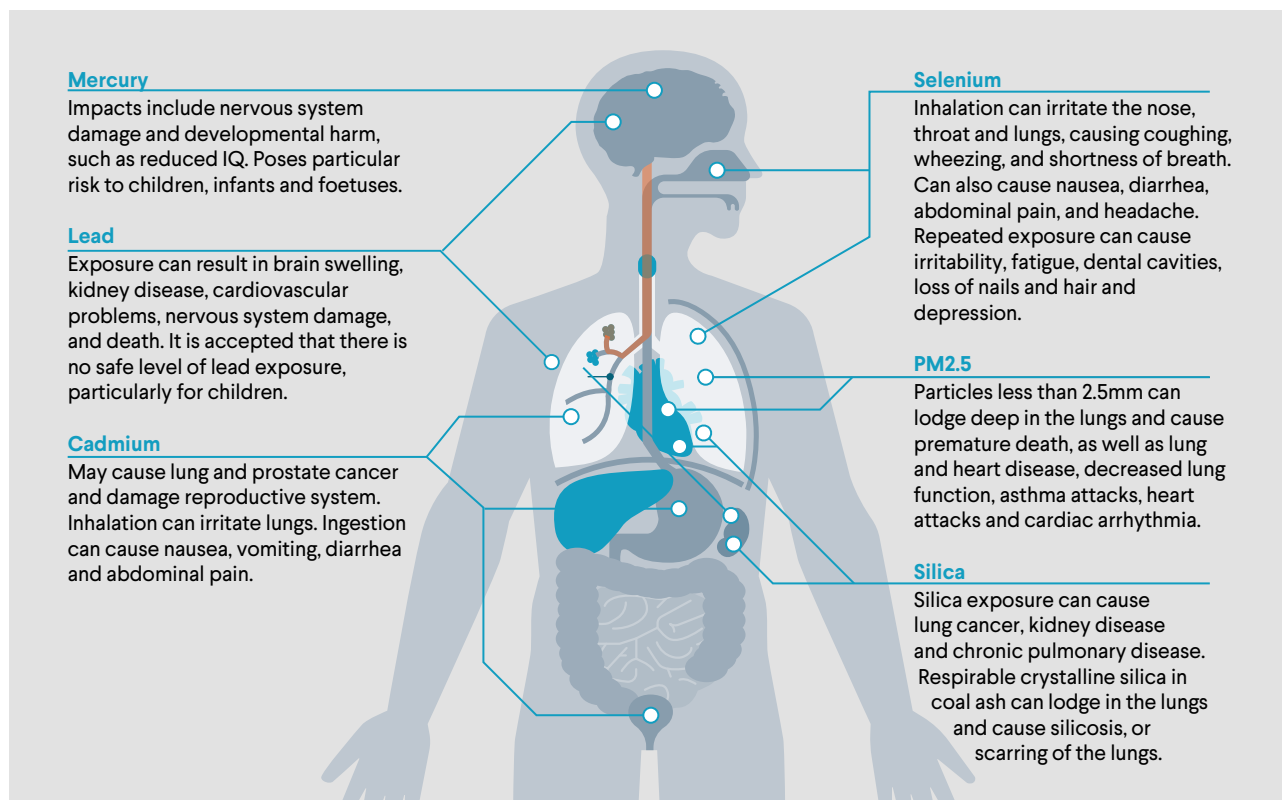
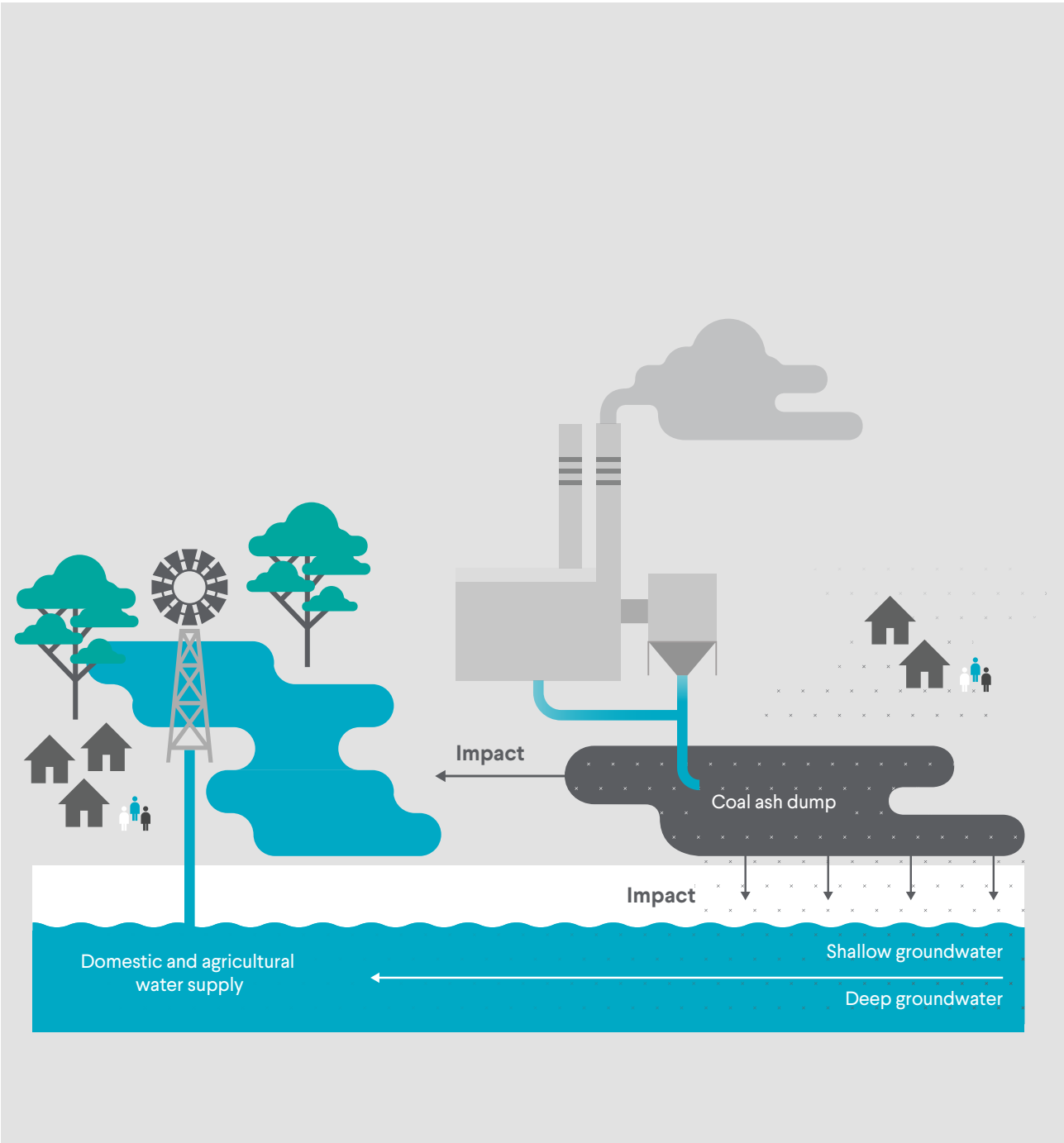


Figure 6

Exposure pathways from coal ash dumps



Exposure pathways

Toxic heavy metals and other pollutants in coal ash can enter groundwater, surface water bodies, soil and air, risking human health, aquatic life, birds, wildlife and water quality.

Surface water contamination

Because large volumes of water are needed to operate steam powered turbines, coal-fired power stations are generally located very close to rivers, lakes or other bodies of water. Since power stations dispose of ash very close to power stations to avoid the expense of transporting large volumes of solid waste, these water bodies are at risk of contamination. Direct discharges of leachate or wastewater from coal ash dumps and/or the migration of contaminated groundwater can pollute these lakes, rivers and streams. These heavy metals can bioaccumulate in aquatic life and ecosystems, threatening the health of these ecosystems and human health if contaminated marine life is consumed.

Discharge of contaminated wastewater from coal ash dumps is a significant source of pollution to lakes and rivers. Waters near dumps, including large lakes, commonly receive heavy doses of arsenic, cadmium, mercury, selenium, thallium and other toxic contaminants. As described below, water testing by the Hunter Community Environment Centre on the New South Wales Central Coast has shown elevated levels of selenium and cadmium in Lake Macquarie near to ash dump overflow points.²⁶

These dangerous discharges have serious consequences for communities that live near coal-fired power stations and their dumps. In the United States, tens of thousands of kilometers of rivers are polluted by coal ash and heavy metals from ash dumps.²⁷ The US EPA identified more than 250 individual instances where ash dumps have contaminated groundwater or surface waters.²⁸

In Australia, many of the aquifers underneath ash dumps are contaminated, including beneath the ash dumps of the Loy Yang (Victoria), Yallourn (Victoria) and Muja (Western Australia) power stations.

Harm to aquatic life

The toxic metals in coal ash do not break down or dissolve over time. Many toxic metals like selenium bio-accumulate and increase in concentration as they travel up the food chain. Harm to fish and other wildlife from ash dumps and toxic run-off can be significant. Scientists have documented that coal pollutants, such as selenium and arsenic, build up to 'very high concentrations' in fish and wildlife exposed to coal dump leachate or run-off, and that those accumulating toxins can ultimately deform or kill animals.²⁹ Fish and other wildlife that do survive can have toxins so high in their bodies that human consumption is dangerous.

Groundwater contamination

Groundwater contamination occurs when coal ash is inundated with water, and ash toxins leach into the underlying aquifer. Water reaches disposed ash via rain, surface run-on, disposal in a coal ash dump, or by placement of the ash directly into groundwater or mine pools. If an ash dump is unlined or inadequately lined, the water will transport ash contaminants from the disposal area. Under certain conditions, coal ash contamination in groundwater can flow several kilometres through aquifers and eventually migrate to the surface of rivers, creeks and streams.

Fugitive dust/air pollution

When coal ash is dumped dry, or left to dry out, dust can be emitted into the air by loading and unloading, transport, and wind from the ash dump site if the ash is not strictly suppressed by spraying it with water or covering it with dirt. Once in the air, this 'fugitive' dust can migrate off-site. As a result, workers and nearby residents can be exposed to significant amounts of coarse particulate matter (PM₁₀) and fine particulate matter (PM_{2.5}). Both have been linked to heart disease, cancer, respiratory diseases and stroke.³⁰

Coal ash contains significant amounts of silica, in both crystalline and amorphous form. Respirable crystalline silica in coal ash can lodge in the lungs and cause silicosis, or scarring of the lung tissue, can result lung disease,³¹ and can cause kidney and lung cancer.³²

When inhaled, toxic metals such as arsenic, chromium (including the highly toxic and carcinogenic chromium VI), lead, manganese, mercury, and radium can cause a wide array of serious health impacts, ranging from cancer to neurological damage.

Soil contamination

Fly ash contaminates soils surrounding coal-fired power stations when fugitive dust is not properly controlled at ash dumps or when the power station stacks lack equipment to capture ash. Under these conditions, soil may accumulate elevated levels of heavy metals, including arsenic.³³

Plants grown in coal ash-contaminated soils can experience elevated levels of toxic metals.³⁴ Fly ash can render the soil solid and impermeable because of the cementitious qualities of ash.³⁵ Soil contamination can lead to elevated levels of contaminants in run-off or in the underlying groundwater.³⁶



Paul Winn from the Hunter Community Environment Centre conducting water sampling at Lake Macquarie. Source: HCEC.

Lake Macquarie citizen science by Hunter Community Environment Centre

In 2019 the Hunter Community Environment Centre (HCEC), based in Newcastle, NSW, conducted water and sediment sampling in Lake Macquarie near water discharge points close to both the Vales Point and Eraring power stations. HCEC's report *Out of the Ashes: Water Pollution and Lake Macquarie's Ageing Coal-Fired Power Stations* shows concentrations of a number of heavy metals, including arsenic, nickel, aluminium, copper and lead, to be at levels likely to be having a harmful impact on aquatic ecosystems, including edible fish, molluscs and crustaceans.³⁷ Alarmingly, selenium concentrations found by HCEC at the Eraring power station ash dump overflow point are 55 times higher than the level recommended to protect birds and fish.³⁸

Lake Macquarie is a popular place for locals and tourists alike to swim, sail, fish and go crabbing. As part of their research for *Out of the Ashes*, HCEC obtained a report by the NSW

Office of Environment and Heritage that showed cadmium levels in mud crabs were so high that there is no safe level of consumption. However a NSW Environment Protection Authority (NSW EPA) media release in January 2019 stated that Lake Macquarie crabs contaminated with cadmium were safe to eat provided consumption was restricted to six 150g servings per month for an adult and three 75g servings for a child.³⁹

High levels of cadmium in the body can contribute to kidney failure, lung cancer, prostate cancer, and damage to the reproductive system. The NSW EPA's failure to provide rigorous information about health risks has potentially exposed people who eat fish and crab from Lake Macquarie to undue risk.

"We found after doing water testing that there were significant levels of heavy metals being discharged into Lake Macquarie. And some of those metals weren't being regulated effectively by the EPA. Vales Point Power Station for example doesn't have any restrictions on the amount of heavy metals that are released into Lake Macquarie from the power station."

Paul Winn,
Hunter Community Environment Centre



Source: Google Earth

Yallourn power station coal ash management issues

EnergyAustralia Yallourn power station produces about 260,000 tonnes of coal ash per year.⁴⁰ The ash dumps hold about six months' worth of ash waste and are built on top of a former ash dump inside a worked-out section of the Yallourn open-cut brown-coal mine.⁴¹ Ash is piped from the power station into dumps where the ash settles, the water is drained, and the ash is excavated and trucked to another worked-out section of the mine.⁴²

Groundwater under the former ash dump was contaminated prior to the construction of the new dumps.⁴³ The current ash dump is lined with plastic, however there have been historical issues with maintaining the integrity of this liner as the ash is excavated and removed to a different section of the former mine area.⁴⁴ Experts and EnergyAustralia suspect that damage has been caused to the floor liner, however this has not been fully investigated because the ash dumps operate on six-month cycles of filling and excavation.⁴⁵ In other words, EnergyAustralia won't construct a best practice ash dump to ensure that cleaning, inspection and repairs to the current lining are undertaken and that groundwater contamination is stopped at the source. Nor does the Victorian EPA require them to.

In February 2015, a rupture in an EnergyAustralia ash disposal pipeline led to 8.6 megalitres of ash liquid being dumped into the Morwell River (enough to fill 3.5 Olympic swimming pools).⁴⁶ The Victorian EPA investigation found that the owner EnergyAustralia was in breach of its licence and was subsequently fined \$7,584. The Morwell River joins the Latrobe River further downstream, which is a tributary to the internationally important Ramsar-listed Gippsland Lakes.

Consecutive environmental audits for Yallourn's ash dumps identify problems, including the absence of thorough groundwater contamination detection.⁴⁷ EnergyAustralia Yallourn is obliged by its licence to ensure that a strict monitoring program is implemented for the ash dumps,⁴⁸ but this monitoring system including its design and monitoring data is not publicly available. The 2017 environmental audit for Yallourn states that there is evidence that groundwater has been contaminated by ash dump leachate to the south of the ash dump,⁴⁹ while other sources state unequivocally a contamination plume is underneath the dump site but remains within the Yallourn power station boundary.⁵⁰

Publicly available information reveals that the Victorian EPA has not required EnergyAustralia Yallourn to remediate the site to prevent ongoing ash dump contamination, despite information that groundwater contamination is occurring and knowledge that the liner of the ash dump is damaged. No publicly available information shows whether the EPA requires EnergyAustralia Yallourn to prepare rehabilitation and closure plans for the ash dumps, whether the EPA will require EnergyAustralia Yallourn to ensure the current ash dump liner adheres to best practice to prevent further contamination, or to establish a comprehensive monitoring system to monitor the groundwater contamination plume.

EnergyAustralia Yallourn power station produces about 260,000 tonnes of coal ash per year.



Ash dust plume from Eraring power station ash dump. Source: HCEC

Coal ash dust in NSW – Wallerawang and Eraring power stations

In 2007, high winds caused ash dust to escape the Kreosene Vale Ash Repository (KVAR), the site for the fly ash waste generated at the Wallerawang Power Station, exposing the nearby community of Lidsdale in the NSW Central West region to toxic dust.⁵¹ At the time of the offence the power station was operated by Delta Electricity which was owned by the NSW government.

Delta had contracted a third party to manage the KVAR. Dust management included the progressive capping of the ash mound by spraying it with either tar or lignosulfonate, keeping the ash wet to prevent dust escaping the boundary of the premises, and building batters (walls) to adequately contain dust at the site. The NSW Land and Environment Court found that none of these measures had been adequately undertaken, but that no environmental harm was caused by the offence.⁵² The court recognised the complexity of managing fly ash on a scale as large as that at the KVAR site.⁵³

The NSW EPA charged Delta for breaching its licence condition to maintain the premises in a condition which minimises or prevents emissions of dust from the premises. Delta plead guilty and was fined \$45,000 (out of a potential \$1 million).⁵⁴

In 2011, the NSW EPA fined Origin Energy Eraring \$15,000 after strong winds carried ash dust from the Eraring ash dump site in 2016.⁵⁵ Eraring was fined a further \$15,000 in March 2019 for dust emissions from the coal ash dump.⁵⁶ The Environmental Protection Licence (EPL) for Eraring does not contain specific conditions about ash management at the site other than dust must be managed to minimise emissions from the premises,⁵⁷ and it is unknown what actions the EPA requires the operator to implement.



3

Coal ash disposal management

Coal ash cannot be disposed of safely. Even with 'best practice' methods, there remains a significant contamination risk to the environment and communities. Coal ash dumps must be carefully and strictly managed and rehabilitated to minimise the risk posed to human and environmental health by this toxic substance.

Coal-fired power stations can dispose of or reuse coal ash in several ways. The least harmful disposal method is dry disposal in landfills with careful siting, design, monitoring and water treatment as needed in perpetuity.⁵⁸

The most environmentally hazardous disposal methods are:

- wet dumps (so-called 'ash ponds' or 'ash dams');
- disposal in surface coal mines;
- use as fill in low-lying areas or road embankments; or
- being mixed into agricultural soils including potting mix.

The most common form of coal ash waste management in Australia is the most harmful disposal option – wet ash dumps, where ash is mixed with water and piped to a nearby dump site. These dumps are quite often built on top of former ash dumps, on top of overburden piles (the dirt removed from a mine to access the coal), inside worked-out sections of coal mines, dumped inside quarries, or purpose-built sites adjacent to power stations.

Potentially less harmful disposal: dry, lined dumps

Dry coal ash dumps should be constructed above the ground surface and well away from both surface and groundwater sources. Dumps are usually built in sections called 'cells', in which dry ash is placed in an 'active' cell and compacted until the cell is filled. Completed cells are covered with soil or other material, and then the next cell is opened.

These dumps are usually natural depressions or excavations that are gradually filled with waste, and frequently layers of a landfill may reach well above the natural grade. Water contamination will occur if contaminated leachate and run-off from dumps are not properly controlled. Harmful quantities of fugitive dust are often generated and dispersed by wind if ash is dumped when it is dry.⁵⁹ This has to be carefully managed by utilising dust-suppression techniques, including spraying the ash with water, covering it with dirt, and compacting it tightly.⁶⁰

Most harmful disposal: surface impoundments or 'ponds'

The most common method of coal ash disposal is piping it wet into surface dumps. This method is predominantly used and approved of by Australian environmental regulators. Wet disposal into dumps poses the greatest risk to groundwater and surface water, and should be phased out so that coal ash dumps are dry disposal until the power station eventually closes and the dump site is rehabilitated.

Wet dumps can be natural depressions, excavated ponds, or diked basins that contain a mixture of coal ash and wastewater. The solids gradually settle out of this slurry, accumulating at the bottom of the dump. This process leaves a standing layer of water at the surface. This water contains varying levels of the toxic chemicals in coal ash, and such discharges can and do pollute adjacent groundwater and surface water and permanently leave contaminated sediments in lakes and rivers.⁶¹

In Australia, wet disposal is the primary means of disposal because it is the cheapest form of dumping. The bottoms of most dumps in Australia are unlined or inadequately lined, and contamination of underlying groundwater occurs at most sites.⁶² Many ash dumps in Australia have been constructed on top of former ash dumps sites, such as those at Eraring and Yallourn power stations. Groundwater is contaminated under the Loy Yang, Yallourn and Muja power stations.

Despite the risks to communities who live near them, there is very little publicly available information in Australia on the engineering of ash dumps. In NSW, the Dams Safety Committee oversees the structural integrity of 'prescribed dams' which include the Vales Point, Eraring, Bayswater and Liddell power station ash dumps. The power stations have to report to the Committee but these reports are not made public. Similarly, where State Governments require that ash dump operators prepare Ash Dam Management Plans, those plans are not publicly available.

Minefills

Minefill (or mine disposal) involves the disposal of coal ash in surface or underground mine voids.⁶³ Ash is dumped, often with overburden, into worked-out sections of active coal mines (where all the coal has been removed) or abandoned coal mines. Mine disposal is commonly employed where the power station and the mine are located near one another.

Ash is used as minefill in Australia in places including Olympic Dam, Mt Isa, and Ipswich,⁶⁴ as well as the Yallourn (Vic), Warkworth (NSW), Ewington (WA) and Kogan Creek (QLD) mines.

EnergyAustralia's Mount Piper power station, near Lithgow in NSW, trucks its dry ash to the Western Main open cut mine adjacent to the power station, and into the ash dump extension known as 'Lamberts North'.⁶⁵ Investigations into groundwater quality at Lamberts North shows the presence of heavy metals including nickel and boron, and chloride in certain monitoring bores around the site.⁶⁶

In addition to presenting a contamination risk to groundwater, surface water and causing fugitive dust, the disposal of coal ash in surface mines can prevent effective rehabilitation of the mine site and is likely to prevent future productive use of the land and underlying aquifer.



Ering ash dam cells made from ash.

Ering ash dam expansion – ashes upon ashes

The Eraring power station ash dump, owned by Origin Energy Eraring, is constructed on top of the former Wangi power station ash dump, with bunding and internal cells constructed with ash.⁶⁷ It appears that at least since 2008 Origin's approach has been to allow 'cementitious dense phase application' of ash to operate as a liner,⁶⁸ that is, a thick concrete-like crust of coal ash, rather than constructing an additional liner to act as a barrier between the ash sludge and the dump floor. All the publicly available environmental assessments for the Eraring ash dump, including the current application for its expansion, assume groundwater contamination will occur.⁶⁹

The dump has not been constructed to prevent pollution. Nor does it appear that Origin Energy Eraring, nor the NSW EPA or Dams Safety Committee, propose to rectify the lack of best practice lining for such a toxic facility.

This demonstrably inadequate approach fails to safeguard land and groundwater from contamination, and fails to protect community health. However Origin Energy Eraring is applying for an extension of its ash dump by an additional five million cubic metres of toxic waste without including a proposal to line the ash dump in accordance with best practice such as including thick plastic liner or impermeable clay.⁷⁰

Given the size and nature of the ash dump, the Environmental Assessment for the ash dump expansion should provide comprehensive detail of how Origin Energy Eraring plans to rehabilitate and close the ash dump – but it doesn't. Closure and rehabilitation planning is limited to an 'anticipation that the site will be rehabilitated to a point that will allow further uses, for example industrial and/or community uses', and that Origin 'will rehabilitate the final footprint of the [ash dump] in a manner generally consistent with the surrounding landform'.⁷¹

The inadequate construction of the Eraring ash dump creates significant challenges for pollution control following the decommissioning and rehabilitation of the power station site. Expanding the ash dump compounds these already foreseeable and significant rehabilitation challenges. The Eraring ash dump is contaminated land. Without best practice rehabilitation the dump is likely to continue to be a legacy contaminated land site which has serious ongoing risk implications for groundwater, surface water contamination, future land use planning and ultimately human health.

MARCH 29 2019 - 12:45PM

Myuna Bay Sport and Recreation Centre to close after review of Eraring power station's ash dam

Helen Gregory

Local News



Helen Gregory, Newcastle Herald, 29 March 2019

Community at risk from unstable Eraring ash dump?

The structural integrity of the Eraring ash dump is in question after Origin Energy Eraring stated in March 2019 the dump was a threat to the adjacent Myuna Bay Sports and Recreation Centre – enjoyed by the NSW Central Coast community since 1944⁷² – in the event of an earthquake.⁷³ After receiving an engineering report it commissioned highlighting the threat, Origin Energy Eraring contacted the NSW Office of Sport – during the NSW caretaker period prior to the state election – and recommended the Sports and Recreation Centre be closed. To the absolute shock of the Lake Macquarie community, with no consultation and no previous warning that the ash dump was such a risk, the Office of Sport closed the much-loved Centre.

This raises significant questions about why the earthquake threat had not already been addressed, how long it had been a threat to the community, why the Dams Safety Committee – who oversee the structural integrity and safety of the Eraring ash dump – hadn't alerted the public or required Origin Energy Eraring to do so, and why the community had no warning that the dump was unsafe in the first place.

Rather than dictating to the NSW Office of Sport and the local community what they should do, Origin Energy Eraring should be made to remove the toxic ash from the dump to a purpose-built site that adheres to best practice construction, siting, lining and management thereby removing the threat from the community, and ensure that current dump site is comprehensively rehabilitated.

The NSW Central Coast community should not live with either this toxic threat, nor without its much-loved Sports and Recreation Centre.

“The community members of Eraring are really concerned about what the prospect of ash dam failure means. If they’ve closed Myuna Bay Sports and Recreation Centre because the ash dam might fail, what does this mean for the community that lives here? We’ve not received any communication from the government or Origin. There’s a responsibility for governments to inform communities about these hazards. If there is an earthquake and we are deluged with coal ash, what are the safety measures? Is someone going to warn us? There are so many unanswered questions. We’re just not informed at all. **We’re left to sink or swim. And I don’t want to swim in coal ash**”



Charmian Eckersley,
Eraring resident



Catastrophic coal ash spill

Kingston, Tennessee, USA: In 2008, 5.4 million tons of coal ash sludge flooded an area of 300 acres when a dike suddenly collapsed at the Tennessee Valley Authority Power Station in Harriman, Tennessee.⁷⁴ The toxic sludge swept away multiple houses, filled two rivers, and destroyed a residential community.⁷⁵

Clean-up of the coal ash took years and cost over US\$1 billion. More than 30 clean-up workers died of illnesses allegedly caused by exposure to the toxic ash during the clean-up, and more than 200 remain ill, ten years after the disaster.⁷⁶

In 2018, the sick workers and families of the deceased workers won a lawsuit for liability against the clean-up contractor who refused to allow the workers to wear protective respirators.⁷⁷

Coal ash dam disaster, Tennessee, US, 2018. Source: Dot Griffith photography

In 2015, the US EPA created national regulations for coal ash disposal in the United States – the Hazardous and Solid Waste Management System – Disposal of Coal Combustion Residuals from Electric Utilities (the CCR Rule). Prior to the CCR Rule being enforced, ash dump management under state regulatory programs, supposed to fill other federal regulatory gaps, were found to be insufficient by the US EPA to protect land, water and communities living near ash dumps. These inefficiencies are exemplified by the 2008 Tennessee Valley Authority's Kingston Fossil Station's coal ash dike collapse.

4

Australian coal ash laws and management

Victoria

Coal ash dumps are regulated and managed under the *Environment Protection Act 1970* (Vic) (EP Act) with the Victorian EPA as the primary regulator.⁷⁸ Ash dumps are classified as landfill for the purposes of Victoria's environmental regulatory regime and must be operated in accordance with an EPA-issued licence.⁷⁹

Coal ash dump operators must comply with their licence conditions to ensure that discharges of waste from ash dumps do not escape the boundaries of the premises, do not produce nuisance dust or airborne particles, do not contaminate surface water, groundwater or land, and are monitored in accordance with the EPA's Landfill Licensing Guidelines.⁸⁰ Operators must also ensure that they comply with State Environment Protection Policies for land and water.⁸¹

The EP Act contains general obligations on coal ash dump operators to not pollute air,⁸² surface and groundwater,⁸³ and land.⁸⁴ However provided that an operator complies with its licence conditions, the operator cannot be held accountable for causing contamination or pollution of the environment.

The EPA can, and does, make allowances for groundwater contamination caused by coal ash leachate that would otherwise be a breach of the law. The AGL Loy Yang groundwater contamination, discussed below, is one such example of the Victorian EPA permitting contamination of groundwater from a coal ash dump.

In February 2015, a rupture in an EnergyAustralia Yallourn ash disposal pipeline led to 8.6 megalitres of ash liquid being dumped into the Morwell River (enough to fill 3.5 Olympic swimming pools)

Victoria imposes financial assurances on ash dumps

The licences for Hazelwood, Yallourn and AGL Loy Yang all require that a financial assurance be maintained so that if required, EPA can claim or use the financial assurance or any part of it.⁸⁵ The purpose of a financial assurance is that the EPA is assured that there are appropriate funds available in the event that a clean-up is required.⁸⁶

The calculation for financial assurances for ash dumps is determined in consultation between the power station operators and the EPA. Many of the ash dumps in Victoria are located within worked-out sections of the adjacent brown coal mines. The EPA has stated that the determination of financial assurances is complicated by the fact that the power station operators are also required to pay a bond for mine rehabilitation, and the EPA does not want to 'double-dip' on requiring rehabilitation bonds where these are already imposed by the mining regulator.

The amount and form of these financial assurances is unknown. The EPA will not release the amounts publicly, claiming that the information is confidential. It is therefore impossible to determine the adequacy of the financial assurances held in Victoria.

Problems with Victoria's management of coal ash

Most of the Latrobe Valley power station ash dumps have been constructed inside worked-out sections of the adjacent brown coal mines, or on top of overburden piles. Alinta Loy Yang B power station pipes its ash to a dump site owned and operated by AGL Loy Yang and has no licence conditions regarding ash management.

The EPA has not developed best practice guidance for pollution prevention from ash dumps, but instead considers that the best practice for landfills receiving municipal waste largely applies to preventing coal ash pollution.⁸⁷ This approach has not mitigated groundwater contamination from Latrobe Valley power station ash dumps. The EPA has taken very little action to require power station operators to clean up ash dumps at the source of contamination or the polluted land and/or water.



Loy Yang power stations. Source: Garrett Eckerson.

AGL Loy Yang Power Station coal ash management issues

In 2001 the Victorian EPA issued clean-up notices to AGL Loy Yang for coal ash leachate contamination of groundwater underneath the coal ash dump. Under these clean-up notices the EPA designated the contaminated groundwater a 'groundwater attenuation zone'.⁸⁸ This is a groundwater contamination plume underneath a premises for which EPA has determined it cannot prevent impacts on groundwater quality.⁸⁹ When EPA declares such groundwater contamination plumes, the water quality is sacrificed, and the intention of the EPA and the operator should be to minimise and control the contaminated groundwater.⁹⁰

The EPA has waived – in other words, abandoned – groundwater quality objectives in AGL Loy Yang's licence for its groundwater contamination plume for sulfate, aluminium, total dissolved solids and chloride. This means that AGL Loy Yang does not have to comply with groundwater protection laws for those contaminants. The EPA has not imposed clean-up obligations on AGL Loy Yang to rehabilitate the contamination at its source to prevent further contamination.

The contaminated groundwater plume is identified in AGL Loy Yang's licence. The groundwater attenuation zone perimeter is very large, approximately one-fifth of the entire AGL Loy Yang premises which includes the open-cut brown coal mine and appears larger in perimeter than the mine itself.⁹¹

The EPA guideline publication *The clean-up and management of polluted groundwater* states that in all cases polluted groundwater must be cleaned up to the extent practicable, that clean-up and management must address the full extent of groundwater pollution both onsite and offsite, and ongoing management must continue until the

protection of beneficial uses is restored.⁹² Where the source of groundwater pollution cannot be removed, it must be controlled so that the pollution source is contained and/or treated to prevent further migration of the pollution. The pollution source must be controlled throughout the entire duration that pollution is present and comprehensive groundwater quality monitoring must be installed to demonstrate that beneficial uses of the groundwater remote from the source, e.g. at the site boundary, are not impacted.⁹³

It is not clear from the clean-up notices or AGL Loy Yang's licence whether there are any control or management requirements for the coal ash contamination of groundwater to minimise the potential of pollution migration beyond the groundwater attenuation zone boundary. AGL Loy Yang recently claimed that in order to address the ongoing groundwater contamination from the ash dumps, all three Latrobe Valley power stations would need to be simultaneously shut down for an extended period of time, although it did not give a comprehensive justification for that statement.⁹⁴

There are no existing rehabilitation requirements for the AGL Loy Yang ash dump. The AGL Loy Yang and Loy Yang B power stations could operate until 2048. This means that unless required by the EPA, neither operator is obliged to undertake rehabilitation of coal ash dumps. The EPA can impose rehabilitation obligations for the ash dumps as conditions of licences of operation,⁹⁵ but it has not done so.



EnergyBrix / Morwell Power Station. Source: Wikipedia

EnergyBrix/Morwell Power Station coal ash management issues

In 2014 the EnergyBrix power station ceased operations after its owner went into administration. The power station was mothballed (provisionally but not permanently closed) and no remediation of the site was undertaken. In 2017 the EPA issued clean-up notices to EnergyBrix, citing serious contamination issues at the site, including the contamination of land and water from the ash landfill, at concentrations that preclude beneficial uses of that soil, sediment and groundwater.⁹⁶

The current EnergyBrix licence does not require an obligation to provide a financial assurance. The EPA has confirmed to us that there was no ash landfill at the EnergyBrix site and therefore no requirement for the operator to provide a financial assurance.⁹⁷

The Latrobe Valley community has the right to guaranteed remediation of the ash dumps consistent with best practice. Power station owners should be required to maintain financial assurance well in advance of retiring or well before a company goes into liquidation to ensure this remediation is assured and prevent the taxpayer footing the rehabilitation bill.

The EPA in Victoria has done very little to control groundwater contamination from operational coal ash dumps despite knowledge that the Loy Yang ash dump is contaminating groundwater. The EPA has not required AGL to clean up the source of contamination.

New South Wales

In NSW, ash dump operators have primary responsibility for ensuring the safety of their dumps, with the Dams Safety Committee and NSW EPA having statutory responsibilities to enforce, respectively, dump safety requirements and pollution law. Coal ash dumps are regulated under the *Dams Safety Act 1978* (DS Act), and *Protection of the Environment Operations Act 1997* (POEO Act).

Dams safety legislation and Dams Safety Committee

Under the DS Act, the Dam Safety Committee has primary responsibility to ensure the safety of dumps identified in the DS Act (called ‘prescribed dams’),⁹⁸ which include the Eraring, Vales Point, Bayswater and Liddell ash dumps.⁹⁹ The Dams Safety Committee fulfils a range of powers and functions to ensure the safety of prescribed dumps, including take-over powers during emergencies and powers to require operators to take actions to make a prescribed dam safe,¹⁰⁰ and imposes reporting requirements on operators. The Dams Safety Committee has prepared several guidelines, including a guideline for tailings dams. Power station ash dumps are considered tailings dams for the Dams Safety Committee’s purposes.

Under Dams Safety Committee guidelines, power station ash dump operators are required to provide a five-yearly surveillance report and an annual inspection report.¹⁰¹ These reports are not publicly available. The NSW Central Coast community has no way, without engaging in lengthy Freedom of Information procedures, to scrutinise when stability of the Eraring ash dump described above first became a threat to the safety of patrons of the Myuna Bay Sports and Recreation Centre. This information should be publicly available.

NSW pollution law

Under the POEO Act, the NSW EPA has statutory responsibility for surface water, groundwater, and air pollution from coal ash dumps. Under the POEO Act licencing scheme, the EPA issues Environment Protection Licences (EPLs) to power station operators, which contain conditions relating to the ash dumps for environmental monitoring, ash dump capping and rehabilitation materials, what materials can be dumped into the ash dumps, and where required, pollution reduction programs to determine better management of ash waste.

Under the POEO Act, a licensee must prepare pollution incident response management plans for all activities their licence relates to,¹⁰² including for ash dumps. Some, but not all, of the EPLs have water and ambient air monitoring conditions for ash dumps.

Problems with NSW’s management of coal ash

Conditions in the EPLs are inconsistent, including the extent and number of groundwater monitoring bores for each dump, ambient air quality monitoring at dump sites, and what materials can be used to cap and rehabilitate ash dumps. The Vales Point EPL has conditions for both air and water monitoring points specific to the ash dump, and the Eraring EPL has conditions for water monitoring points around its ash dump, however it is not clear in the Bayswater, Liddell and Mount Piper EPLs where air and/or water monitoring points are in relation to these ash dumps.

Both Eraring and Vales Point power station ash dumps can receive waste materials generated at the premises other than coal ash waste, but it is not clear from the Vales Point EPL what materials can be used to cap the dump. The size of the Vales Point ash dump and its proximity to communities and Lake Macquarie warrants full transparency regarding what can be used to cap the dump. As discussed below, this lack of transparency has resulted in asbestos being found in capping material brought in by a contractor without the community being aware.

Although both the EPA and the Dams Safety Committee impose monitoring and reporting obligations on ash dump operators (where the ash dumps are prescribed dams for the purpose of the DS Act), much of this information is not publicly available. Unlike in Victoria where the EPA has oversight of ash dumps and environmental audits for these sites are publicly available, in NSW the responsibility for pollution and dump integrity is spread over two government agencies. Community members and other interested parties have very little access to information without having to request documents through the Freedom of Information process.

Moreover it is unclear if, and how, these two authorities work together to ensure that ash dumps are safe and that pollution risks are mitigated. If the dump is constructed and lined in accordance with best practice, then pollution risks are mitigated. However a recent EPA audit of ash dump compliance makes very little mention of the Dams Safety Committee and does not mention any cooperation between the two authorities.¹⁰³ If the regulation of ash dumps is spread over two government authorities then the community has a right to expect that these authorities are working closely together to ensure the dumps pose no environmental or human health risk and that communities are protected against potential dump collapse.

Lack of financial assurances

The POEO Act empowers the NSW EPA to impose a financial assurance on an EPL to ensure enough funds are available for carrying out works or programs that are required under a licence, such as a rehabilitation plan.¹⁰⁴

Despite the size and toxicity of the ash dumps in NSW, the NSW EPA has not imposed an EPL condition that ash dump operators maintain a financial assurance. Given the legacy issues and the complexities likely to arise during the decommissioning and rehabilitation process, NSW power station operators should be required to provide financial assurance. This would protect the NSW taxpayer from bearing the costs associated with rehabilitation and management and provide certainty with respect to the dump's rehabilitation.

“They took out fish nurseries when they built these ash dams so they have affected the ecology of the lake. What you see is utter devastation. Coal ash is dead – that's the truth. It covers a huge area – kilometres – and continues to expand because we continue to have a coal-fired power station. That has really affected my life here in that sense because I know that environmental devastation is on my doorstep. And it also has an effect because we want to know that that is safe for our health.”



Sue Wynn,
Mannering Park Progress
Association, NSW



Vales Point power station. Source: Nicola Rivers

The toxic waste inside a NSW ash dam

Ash dumps in NSW contain more than toxic ash from the coal-combustion process. The EPLs for the power stations state what additional materials the ash dumps can receive. The Eraring ash dump is licenced to receive additional wastes generated at the power station, including fabric filter bags used to capture air pollutants, boiler chemical cleaning residues, coal conveyor wash-down, and mine dewatering from Awaba State mine. The Vales Point ash dump can receive additional wastes including residual detergents and oil sheens, coal mine dewatering, dirty water drains, soil contaminated with oil and chemicals, fabric bag filters and chemical cleaning solutions. The Mount Piper ash dump can receive wastes including fabric bag filters, chemical clean solution and cooling tower sediments. Both the Liddell and Bayswater EPLs list wastes that the power stations can dispose of, but it is not clear from the EPLs where this waste is disposed of. The EPA can approve other materials to be disposed of in these ash dumps. However these approvals are not publicly available and it is unknown what these materials are.

In late 2018, a company contracted by Vales Point power station to rehabilitate a section of the ash dump was found to have been dumping asbestos, domestic waste and other materials not approved by the EPA.¹⁰⁵ Delta Electricity, the operator of power station, reported this breach to the EPA, who subsequently charged Delta a \$550 administration fee for issuing a clean-up notice, and ordered them to undertake a risk assessment.

“The EPA have been contacted on many occasions. The best case scenario when they find the licences have been breached is a \$15,000 fine. That is not solving the problem. The problem is that these dams are here for eternity until the government or the perpetrators actually start remediating the site. It's no good just capping it with clean fill which recently the contractor for the government was found to be mixing asbestos with. So not only are we creating all this fly ash, we're contaminating that fly ash.”



Gary Blaschke, OAM,
Local resident and President
of Disabled Surfers' Association
Australia.



Vales Point ash dump from above, NSW Central Coast. Source: supplied

Vales Point and Liddell power station coal ash management issues

Vales Point power station is owned by Sunset Power International Pty Ltd. Like Eraring power station, it is located on the NSW Central Coast in close proximity to communities and Lake Macquarie.¹⁰⁶ The Vales Point ash dump covers some 400 hectares of land that straddles the jurisdictions of the Central Coast and Lake Macquarie local government areas.

As outlined above, the Vales Point ash dump contains a mixture of ash and several other toxins including bag filters and asbestos.

Despite this, in 2018 the NSW Department of Planning and Environment granted development consent to Sunset Power to build an up-to 55MW solar power station on 80 hectares of rehabilitated ash dump.¹⁰⁷ The degree to which Sunset Power will rehabilitate the site to mitigate long-term environmental impacts is unknown. The Environment Assessment for the solar project contains very little information about the rehabilitation of the site before the solar panels are installed. The site has been filled and capped, however the potential for the toxic waste to leach through the ground and into water tables has not been addressed.

This situation does not meet community expectations of its regulators. Before the ash dump is repurposed as a solar farm it must be comprehensively rehabilitated to best practice standards, and a strict on-going monitoring and maintenance system must be implemented. Thorough remediation of land to best practice standards should be mandatory before any ash dump site is repurposed

for any use. At time of writing, the Central Coast Council currently considering a plan for future development immediately to the east of the Vales Point ash dump. The Draft Greater Munmorah Structure Plan describes plans for residential, recreational and industrial developments in the area,¹⁰⁸ including housing for an additional 5000 residents. However the Plan fails to list the Vales Point ash dump as a toxic hazard that might constrain development or require Council's ongoing attention.

Liddell power station is owned by AGL Macquarie.¹⁰⁹ In 2017, the NSW EPA issued an Official Caution to Liddell for unacceptable fugitive dust emissions from its ash dump which is a contravention of management conditions in its EPL regarding ash dump management. In 2018 the NSW EPA issued a penalty notice to Liddell for an ash slurry overflow.

In March 2017 the NSW EPA conducted a compliance report into the coal ash dumps for the Liddell power station.¹¹⁰ The report found instances of non-compliances at the site, including seepages from dump walls not being managed to prevent surface water pollution, not operating the Liddell ash dump in a proper and efficient manner, and dump water levels not being managed appropriately to minimise or prevent discharges from the dump.¹¹¹ The audit requires Liddell to take actions to remedy these non-compliances, including the preparation of pollution reduction programs.

Queensland

Queensland produces 5.5 million tonnes of coal ash per year.¹¹² Coal ash is by far the biggest single type of waste produced in Queensland, double that of the next highest, which is organic waste.¹¹³ In Queensland, as in other states, coal ash operations are managed through an environmental licensing scheme. The Queensland Environmental Protection Regulation 2008 (EP Regulation) defines fly ash, but not bottom ash, as a 'regulated waste'.¹¹⁴

Coal ash disposal requires a licence or 'environmental authority' (EA) from the Department of Environment and Science.¹¹⁵ The management requirements for fly ash are set out in each power station's respective EA, and the holder must comply with their obligations under the *Environmental Protection Act 1994* such as taking all reasonable and practicable steps to prevent and/or minimise the chance of an environmental harm occurring,¹¹⁶ and must comply with the duty to notify in the occurrence of an environmental harm.¹¹⁷ Queensland has Model Operating Conditions for ERA section 60 – waste disposal which apply to coal ash dumps and include conditions for rehabilitation.¹¹⁸ These rehabilitation obligations include a requirement that the water quality does not cause environmental harm, that an environmental nuisance caused by dust is minimised (not prevented), that the final landform is stable and protects public safety, and that contamination concentrations under the final capping layer are in accordance with National Environmental Protection (Assessment of Soil Contamination) Measure 1999.¹¹⁹ These conditions do not include explicit monitoring obligations, public access to information, public engagement and consultation in rehabilitation plans, or a requirement that sources of contamination are thoroughly cleaned up.

Under their EAs, the Gladstone, Stanwell, Tarong and Tarong North power stations are all required to prepare Ash Management Plans. The EAs for Millmerran, Callide or Kogan Creek do not contain conditions for the preparation of Ash Management Plans. These Ash Management Plans are not

publicly available, making it impossible to determine how these dumps are managed and whether the power stations are required to prepare rehabilitation and closure plans.

The Gladstone power station and its ash dumps, both operational and rehabilitated, are located within a flood zone.¹²⁰ The Ash Management Plan for the power station is not publicly available. It is unclear what measures are implemented to ensure the surrounding waterways are protected from contamination during flooding events. Nor is it clear what mitigation measures are implemented to prevent ash dump contaminants seeping into the Calliope River and surrounding estuaries. The Calliope River flows into the Coral Sea towards the southern end of the Great Barrier Reef.

The Tarong and Tarong North Power Station EAs contain the most extensive conditions relating to specifications of the ash dumps, implementation of an Ash Dam Management Plan, ash handling, monitoring, decommissioning and rehabilitation.¹²¹ Comparatively the Callide Power Station's EA contains significantly fewer ash management and storage obligations. No conditions exist regarding monitoring of the prescribed ash dumps or future rehabilitation. The conditions detailed in the Kogan Creek Power Station EA are similarly sparse regarding ash management, however this is because the power station itself doesn't dispose of the ash by-product. It is transported back to the mine site for disposal.¹²² Yet the relevant EA for the Kogan Creek Mine only authorises one environmental-relevant activity which is the mining of black coal.¹²³ The EA itself makes no allowance for the disposal of ash produced by the power station.

The lack of information in the public domain regarding Queensland's ash dumps prevents independent scrutiny of how ash dumps are regulated and managed. The only way communities can access this information is through the Right to Information process which can be a prohibitively expensive and lengthy process.



NEWS

Power station responds to pollution report

Mat Collins, South Bay Burnett Times, 21 November 2018

<https://www.southburnettimes.com.au/news/power-station-responds-to-pollution-report/3581348/>.

Coal ash from Tarong power stations ends up in Brisbane suburb

In 2016 it was discovered that 1,400 tonnes of coal ash was being illegally stored in an industrial warehouse in Gympie and in the Brisbane suburb of Pinkenba, next to a residential area. This coal ash was from the Tarong and Tarong North Power Stations operated by Stanwell Corporation. It had been stored there by Coal ReUse, which had the exclusive rights to resell coal ash produced at these power stations. In July 2016 it was reported that Coal ReUse was facing up to \$7 million in fines for these activities.¹²⁴ Stanwell Corporation denied any knowledge of, and liability for, the alleged breach by its contractor.¹²⁵

Initially the Queensland Department of Environment and Science determined that Coal ReUse was storing regulated waste without approval. However a subsequent investigation by the Department concluded that they had no power to enforce against Coal ReUse as storage of coal ash in this way did not breach the approvals given to them by the Department, and they could not force the operator to remove the coal ash. The Department subsequently dropped its pursuit of the contractor.¹²⁶ Coal ReUse later went into receivership.

After asking the Department of Environment and Science what happened to the coal ash dumped in these sheds, we were informed that we had to lodge a Right To Information request. At time of writing the fate of this ash – whether it was removed, by who, and where to, if it was removed at all, and at what cost to the Queensland taxpayer – is unknown.

Queensland produces 5.5 million tonnes of coal ash per year. Coal ash is by far the biggest single type of waste produced in Queensland, double that of the next highest, which is organic waste.

Western Australia

Western Australia also uses a licensing scheme for coal ash operations. The licences for the WA ash dumps are issued by the Department of Water and Environment Regulation (DER). Ash dumps that are known contaminated sites, such as Perron Quarry where the ash from Kwinana power station is dumped, are registered on the DER's contaminated sites database.¹²⁷

Each power station licence has conditions pertaining to ash dumps, ash dump monitoring and infrastructure requirements. Each ash dump requires an Ash Dam Environmental Management Plan, however, the Ash Dam Management Plans are not publicly available. DER has confirmed to us that it does not require a rehabilitation or closure plan for ash dumps because the current licences are for operational premises.¹²⁸

There are inconsistencies between the licences for ash dumps in WA, including discrepancies in construction and lining requirements to protect groundwater and land from contamination. For example, one of the Collie power station ash dumps must be lined with a low permeability clay whereas only one of the Muja ash dumps must be lined with both clay and an impermeable plastic liner that has a leak detection system.

Neither the licence for Ewington Mine that takes Bluewaters' ash nor that for Perron Quarry ash dam which took Kwinana power station's ash contains conditions for infrastructure requirements – that is, siting location, construction and lining of the dumps – although this may be addressed in the respective Ash Management Environmental Plans. These Plans, however, are not publicly available.

Perron Quarry is identified as a contaminated site under the *Contaminated Sites Act 2003* and listed in the contaminated sites database. DER has confirmed that the ash dump is unlined. Reports produced from the database show that the former limestone quarry has had ash dumped in it since the 1980s; that barium, manganese and unidentified heavy metals are present in the ash at concentrations exceeding safe soil levels; that these toxins are potentially leaching into the groundwater; and the groundwater underneath the ash dump is unsuitable for potable and non-potable purposes including irrigation.¹²⁹

The report also shows that a groundwater monitoring report has not been undertaken since 2006, but that there is a saline, i.e. salty, groundwater plume underneath Perron Quarry.¹³⁰ Despite this, investigations into monitoring and management of the groundwater plume do not meet DER guidelines for contaminated sites.¹³¹

Ash from Bluewaters power station is mixed with overburden and dumped above the water table in the Ewington mine, not in a lined, purpose built site.¹³² There is no information on the contaminated sites database about water contamination at the site.

In its last Annual Audit Compliance Report Form, Muja power station reported that it had not complied with its licence because it could not locate the documentary evidence for the ash dump inspections.¹³³ Muja is obligated to undertake inspection reports under its Ash Dam Environmental Management Plan. It is unknown how DER responded to this non-compliance, and whether any enforcement action was undertaken. This information is important to determine the incidence, or risk level, to ground and surface waters and the community's right to know how the power station is complying with the law.

It appears that Muja power station has had issues with ash dump seepage. In 2016 the power station was required to undertake an ash dump seepage improvement plan that included an assessment of the extent of a seepage plume resulting from ash dump leachate, remedial measure to be undertaken, and an engineer's assessment of the permeability of the ash dump.¹³⁴

In its last Annual Audit Compliance Report Form, Muja power station reported that it had not complied with its licence because it could not locate the documentary evidence for the ash dump inspections. Muja is obligated to undertake inspection reports under its Ash Dam Environmental Management Plan. It is unknown how DER responded to this non-compliance, and whether any enforcement was undertaken.

Munmorah power station. Source: James Whelan.



5

Coal ash reuse – is it safe?

According to the Ash Development Association of Australia, coal ash is reused in Australia for a range of products including asphalt, cement manufacture, concrete manufacture, road and embankment construction applications, and carpet manufacture.¹³⁵

The least harmful fate of coal ash is 'encapsulation', where coal ash is incorporated into a solid substrate such as concrete, bricks and tiles. Such reuse is much safer than other reuses because the potential for leaching of toxic chemicals to water or the re-emission of particulates to air is greatly reduced.¹³⁶ The primary encapsulated reuses of coal ash in Australia are concrete and bricks. However industry proponents advocate for the use of this toxic material in agricultural products – about 1.8 million tonnes from over 10 million produced annually.¹³⁷

The ability of ash to be used depends entirely on its heavy metal content. As outlined above, fly ash is the most toxic of ash generated by burning coal. Moreover, many ash dumps are licenced to accept other toxic wastes such as fabric bag filters, boiler cleaning chemicals, acid solutions and solid acids, and asbestos.

Most of Australia's power stations on-sell coal ash, but the rates of use in comparison to how much is generated is very small.¹³⁸

Encapsulated reuse in concrete, bricks and tiles

Certain types of fly ash can be used as a partial substitute for Portland cement in concrete. Fly ash can improve the performance of concrete, including increasing its durability and strength. Reduction in the production of Portland cement also conserves resources and avoids adverse impacts from cement production, including mercury and greenhouse gas emissions. The US EPA evaluated the use of fly ash in concrete and determined that it does not pose greater health or environmental hazards than the use of Portland cement.¹³⁹

Coal ash used as fill

Coal ash is produced in very large quantities and is expensive to dispose of properly, and therefore many coal-fired power station owners dispose of the ash as fill in low-lying area, quarries, road beds and construction projects. Kwinana power station, for example, dumps its ash at Perron Quarry, while Bluewaters, Yallourn, Kogan Creek, Mount Piper and Redbank power stations dump their ash into nearby mines.

This so-called 'reuse' of coal ash can be very dangerous if ash is placed in areas of shallow groundwater, near surface waters, or allowed to sit uncovered where it can be dispersed by wind. Large coal ash fill projects present the same dangers to health and the environment as unlined dumps, polluting groundwater. These fills can be even more dangerous than ash dumps, as nearby residents may not be aware of the placement of the ash, and no safeguards, such as monitoring or impermeable liners, are used.

Coal ash reuse regulation in Australia

The regulation of coal ash reuse in Australia generally falls under waste resource management laws. However the regulations vary in each state. Even where Notices or Orders of Compliance are in force for the use of coal ash, these orders have little regulator oversight and are largely industry self-regulated.

In NSW the Coal Ash Order 2014 applies to anyone who generates, processes or recovers supplies of coal ash.¹⁴⁰ Generators of coal ash must undertake sampling and testing of the coal ash before supplying it to ensure that heavy metal and other contaminants are within the range specified in the Order.¹⁴¹ A generator of coal ash must provide a supplier with written statements certifying that compliance with the Order has been achieved, and copies of both the Order and Coal Ash Exemption 2014 (or links to them) either at or before the time at which the generator supplies coal ash.¹⁴² Although generators and suppliers of coal ash must maintain records of testing and report to the NSW EPA if it discovers it is non-compliant with the Order,¹⁴³ this process is largely self-regulated. As discussed below, it can lead to oversights with potentially serious environmental and health impacts.

In January 2019, AGL Macquarie announced to the Australian Stock Exchange that the coal ash it generates from its Bayswater and Liddell power stations was suspended from sale after the company discovered the heavy metal content of the ash exceeded the levels set by the EPA in the Coal Ash Order.¹⁴⁴ These heavy metals included chromium, cadmium and copper. An AGL spokesperson told us that these exceedances may have been occurring since the company bought the power stations in 2014, demonstrating an alarming gap in the testing and reporting process from generator to third-party.

At time of writing it is understood that the EPA is investigating the matter, but has not taken any enforcement action. To date there has not been a public announcement from AGL Macquarie or the NSW EPA as to which products contain this ash, however an AGL spokesperson told us that the coal ash was sold to a range of companies for purposes that included agricultural products such as potting mixes.

In Queensland, the Coal Combustion Products Notice outlines what coal ash can be reused for, and the limits on heavy metals and other toxins.¹⁴⁵ The ash can be used for a range of products including cement and concrete products, asphalt, paints, road pavement, and a soil conditioned for agricultural purposes. It also imposes an obligation on generators, suppliers and users of coal ash to write to the Chief Executive of the Department of Environment and Heritage Protection with details including of the intended use of the ash within 10 days of supplying and using the ash.¹⁴⁶

There are no coal ash reuse regulations for Western Australia or Victoria.

6

Best practices for coal ash disposal

Because of its toxicity, coal ash cannot be disposed of safely and poses a significant contamination risk to the environment and communities. The best way to prevent this risk is to stop producing coal ash. In the meantime, coal ash dumps must be carefully and strictly managed, rehabilitated and monitored to minimise the harm these toxic sites pose to human and environmental health.

Australia's ash dump regulations fail to prevent groundwater contamination, surface water contamination, pipeline spills, toxic dust emissions, and poisoning aquatic life. As one of the largest, if not the largest, industrial waste stream in Australia, a national approach to construction, management and rehabilitation of ash dumps is urgently needed.

No state in Australia has prepared best practice guidelines for ash dump construction, management, rehabilitation, closure, and post-closure management. The closest is the Australian National Committee On Large Dams (ANCOLD) guide to tailings dams,¹⁴⁷ but because Ash Management Plans – where these exist – are not publicly available it is unknown if the ANCOLD guidelines are uniformly applied throughout Australia for coal ash dumps. These guidelines have not been updated since 2012 and are not easily accessible to the public, currently costing \$195 to access.¹⁴⁸

In Victoria, power station licences require coal ash dumps to be audited by an environmental auditor every two years. These audit reports make recommendations on how management of the dumps can be improved to comply with licence conditions. Copies of these reports are given to the Victorian EPA, however the EPA only investigates further if it is not satisfied with an audit report. As noted above, consecutive audit reports for Yallourn identify an absence of thorough groundwater contamination detection,¹⁴⁹ even though the power station is obliged in its licence to maintain a monitoring system to allow the EPA and the power station to detect changes in environmental conditions.¹⁵⁰

In Queensland, Western Australia, and New South Wales, reports must be submitted to various regulatory authorities on the state of the ash dumps¹⁵¹ and on structural integrity.¹⁵² However it is unclear whether the regulators themselves conduct an investigation of the ash dumps and this information is not publicly available.

Australia urgently needs uniform, enforceable, community-accessible best practice guidelines for managing, rehabilitating, closing and on-going closure monitoring and maintenance of ash dumps. These guidelines must eradicate inconsistency in ash dump construction, management, operation and rehabilitation, and require the clean-up of contaminated groundwater and surface water. A national approach to the rehabilitation and management of ash dumps is fundamental to the ability of communities to use the natural resources around them, to safely plan for future land use, and to feel confident that companies have been required to comply with stringent and enforceable laws to avoid a looming toxic contamination legacy.

In 2015, the US EPA created the first national regulations for coal ash disposal in the United States – the *Hazardous and Solid Waste Management System – Disposal of Coal Combustion Residuals from Electric Utilities* (the CCR Rule).¹⁵³ In the CCR Rule, coal-combustion residuals include fly ash, bottom ash, boiler slag and flue gas desulfurisation sludge.¹⁵⁴

Prior to the CCR Rule being enforced, ash dump management under state regulatory programs, supposed to fill other federal regulatory gaps, were found to be insufficient by the US EPA to protect land, water and communities living near ash dumps. These inefficiencies are exemplified by the 2008 Tennessee Valley Authority's Kingston Fossil Station's coal ash dike collapse, outlined above.

The CCR Rule provides a good starting model for Australia to prevent water and air contamination but contains gaps that must be closed to achieve ultimate protection of human and environmental health and to ensure that industry pays the full cost of safe management and disposal of toxic coal ash.

The CCR Rule was designed for new ash dumps or ash dump expansions. Cleaning up existing contamination is critical to protecting water sources, and preventing air pollution. Poorly sited and constructed ash dumps in Australia, including Eraring, Vales Point, Yallourn, and Loy Yang should be re-sited and reconstructed to best practice standards, so that the former sites can be thoroughly remediated and all contamination is cleaned-up.

The safest method of ash disposal is dry disposal in a properly sited, engineered landfill with the safeguards (liner, leachate collection for precipitation, monitoring wells) described in the below National Best Practice Guidelines and engineering standards. Where one State's regulatory approach is weaker, an environmental injustice exists for the communities that live near ash dumps or downstream from contaminated water.

The following National Best Practice Guidelines generally align with the US EPA's CCR Rule and must be implemented in Australia. Some of these measures are already required in individual Australian State laws and regulation, however the lack of a national approach means that ash dump management is inadequate and inconsistent.

These guidelines and engineering standards can be used as a checklist for communities in a number of instances, including:

- when licence conditions for ash dumps are being assessed or reviewed and community submissions are open;
- when assessing the detail of regulatory compliance reports of ash dump operators;
- when assessing Annual Performance Statements for licence compliance;
- when assessing the adequacy of enforcement orders issued by regulators that impose clean-up obligations of ash dump pollution or penalty infringements for licence non-compliance;
- if a new ash dump is proposed; and
- when planning decisions are made to repurpose the land on which an ash dump or former ash dump is located.

The Guidelines can also be an advocacy tool to demand best practice treatment of coal ash dumps to protect community and environmental health.

Australia's ash dump regulations fail to prevent groundwater contamination, surface water contamination, pipeline spills, toxic dust emissions, and poisoning aquatic life. As one of the largest, if not the largest, industrial waste stream in Australia, a national approach to construction, management and rehabilitation of ash dumps is urgently needed.

National Best Practice Guidelines and engineering standards

Although coal ash dumps can never truly be made safe, and will create an ongoing toxic legacy, these Guidelines are key to reducing the environmental and human health risks from coal ash dumps in Australia.

National Best Practice Guidelines and engineering standards

1. Keep ash dry.
2. Build ash dumps away from all water sources and known subsidence and/or seismic zones.
3. Line all ash dumps, including operational dumps, with impermeable materials.
4. Impose strict structural integrity requirements.
5. Impose detailed, strict and enforceable operating criteria in licences.
6. Mandate compressive groundwater monitoring systems and impose contamination remediation where it is occurring.
7. Prepare comprehensive closure and post-closure plans.
8. Ensure transparency of information.

1. Keep ash dry.

The key to safe disposal of coal ash is to keep ash dry and prevent the release of toxic contaminants to water. Handling of dry coal ash requires the control of fugitive dust, but control mechanisms exist to minimise dispersal, including regular spraying of ash with water and covering it with dirt. It is critical that ash is kept dry long after the closure of the dump.

Capping of ash is often proposed as a method to prevent precipitation from infiltrating into the ash in dump rehabilitation and closure plans. Infiltration of precipitation is just one way that water can enter the ash. Wherever the bottom of the dump is located below normal groundwater elevation, groundwater will continue to flow through the ash and generate leachate causing adverse impacts on water quality. Even where the bottom of the ash dump is located above normal groundwater elevation, high water events (associated with high water in the river) can cause ash to be re-wetted. Coal ash dumps should not be placed above 'uppermost aquifers' or in wetlands.

2. Build ash dumps away from known subsidence and/or seismic zones.

To ensure there is no probability of adverse effects on human or environmental health from ash waste, coal ash dumps, within fault areas, in seismic impact zones, and in unstable areas.

3. Line all ash dumps, including operational dumps, with impermeable materials.

Best practice guidelines should provide requirements for new ash dumps and impose a mandate that existing dumps must retrofit or close if they were not built with a composite (or alternative) liner and where concentrations of contaminants are 'statistically above' groundwater protection standards established in Australian regulations.

Any newly constructed ash dump should include, at minimum, a composite liner comprising an upper component consisting of a 30mm geomembrane liner (GM), directly placed on top of a lower component consisting of at least 60 centimetres of compacted soil or clay with a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec).¹⁵⁵ Failure to establish complete and intimate contact between a high density polyethylene (HDPE plastic) liner and underlying clay will cause the composite liner to fail and result in leaks. A more protective liner system than the composite liner described above is a double liner that consists of either two single liners, two composite liners, or a single and a composite liner.¹⁵⁶ Double-liner systems are used in all hazardous waste landfills in the United States and should be mandatory in Australia.

All liners (both double and composite) will eventually leak due to deterioration that causes cracks and holes, and rips caused by faulty liner installation and/or waste deposition.¹⁵⁷ For that reason, a leachate collection and removal system

is necessary to prevent the leachate from entering groundwater. The leachate collection system consists of gravel or some other porous medium, which is designed to allow leachate to flow rapidly to the top of the HDPE liner. Leachate collection systems can only be installed in dry dump sites. This is another reason why ash disposal in dry dumps is far safer than disposal in wet coal ash dumps.

4. Impose strict structural integrity requirements.

This applies to new and existing ash dumps, and lateral expansions, to prevent damages associated with structural failures. Owners and operators are required to regularly conduct a number of structural integrity-related assessments and make these reports publicly available.

The following design standards applicable to coal ash dumps will increase their safety, but there is no substitute for the elimination of wet disposal of coal ash entirely and the conversion to dry methods of disposal in engineered landfills.

Engineering Safeguards

A dump operator must demonstrate that the dump meets detailed structural stability standards and hydrologic and hydraulic capacity requirements. Coal ash dumps that fail any one of these structural standards must undergo immediate remediation and close.

Inspections and Monitoring of Ash Ponds

Dump operators must conduct annual structural stability assessments by a qualified professional engineer to document whether the design, construction, operation, and maintenance of the dump is consistent with recognised and best practice engineering methods for the maximum volume of fly ash and water that is dumped.¹⁵⁸ Such annual inspections should be made publicly available and submitted to government regulators. If any deficiencies are discovered, they should be documented in detail and immediately resolved. Proof of remedial actions should be publicly available and submitted to the regulatory authority.

Since coal ash is an inherently unstable material, dumps must be visually inspected weekly by a qualified person for any appearances of actual or potential structural weakness and other conditions which potentially disrupt the operation or safety of the dump (for example, signs of structural weakness or distress).¹⁵⁹ Weekly dump inspections are necessary to uncover any appearances of actual or potential structural weakness and other conditions that are disrupting or have the potential to disrupt the operation or safety of structure, and all instrumentation installed on the dump should be monitored at least monthly for evidence of movement or instability. The dump owner must prepare annual inspections performed by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the unit is consistent with recognised and generally accepted best practice engineering standards.

All inspections should be publicly available for examination, preferably by posting on a publicly accessible internet site; be submitted to a government agency; and clearly document all deficiencies found. The owner/operators should similarly be required to remediate all deficiencies and post evidence of all corrective action after completion.

Fugitive Dust Control

To reduce risks of exposure to fugitive dust emissions, owners of ash dumps must adopt measures that effectively minimise fly ash from becoming airborne.¹⁶⁰ Ambient air monitoring and dust detection monitors must be placed around ash dumps, and all monitoring data must be publicly available.

5. Impose detailed, strict and enforceable operating criteria in licences.

Licences must include compressive operating criteria for air, run-on and run-off controls for ash dumps, hydrologic and hydraulic capacity requirements for surface impoundments, and assessment requirements.

6. Mandate comprehensive groundwater monitoring systems and impose contamination remediation where it is occurring.

Ash dump operators must be required to implement a comprehensive groundwater monitoring network, including sufficient well locations, monitoring frequency, pollutants to be measured, benchmark values, and statistical analyses that will be used to interpret future data.¹⁶¹ The following considerations must be taken into account when designing groundwater monitoring systems:

- Characterisation of groundwater around the dump. There is rarely a single 'downgradient' direction, and groundwater flow can change over time, so it is important to capture as much of the area as possible. The monitoring wells should be located at the waste unit boundary to ensure that contamination leaving the disposal unit is detected at the earliest possible time.
- Quarterly well monitoring to capture seasonal groundwater quality changes, and provisions for increased monitoring when contamination appears.
- Measured pollutants to include the following coal ash indicators: boron, calcium, chloride, fluoride, pH, sulfate, total dissolved solids, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, manganese, mercury, molybdenum, selenium, thallium, and radium 226 and 228 combined. Pollutants known to be elevated in the dump or in local groundwater should be measured routinely.
- Identification of benchmark values above which concentration of pollutants is considered too high. Each contaminant should contain two benchmark values – a health-based value and a statistical value (see below). Concentrations above the health-based value will indicate that water is unsafe to drink and must require corrective action to restore the groundwater to safe water quality levels.

- Statistical tests to compare one well to another unpolluted well (inter-well comparison). Benchmarks in an inter-well test are representative values from unpolluted (background or upgradient) wells. Downgradient concentrations above these benchmarks will indicate that a pollutant is elevated due to the release of coal ash leachate and that increased monitoring, and perhaps corrective measures, are necessary.

The purpose of requiring groundwater monitoring at the boundary of the ash dump is to prevent the off-site migration of toxic contaminants from the coal ash. It is imperative that clean-up or corrective action be mandated when downgradient monitoring wells indicate that groundwater pollution is occurring.¹⁶² In general, an adequate corrective action program includes:

- immediately notifying to regulatory authorities and the public about the contaminations;
- determining remedial action to restore groundwater or surface water to pre-release condition;
- engaging the surrounding community, including on the development of regulatory approval of the clean-up plan;
- completing the clean-up within a strict time period; and
- obtaining determination by regulatory officials and a qualified professional engineer that the clean-up is thorough and complete.

7. Prepare comprehensive closure and post-closure plans.

All ash dumps should close in accordance with specified standards and operators should monitor and maintain the facilities for a period of time after closure. These requirements are essential to ensure the long-term safety of closed ash dumps. The standards should include timeframes to initiate and complete closure requirements and the preparation of closure and post-closure care plans. See section 8, Closure/post-closure of coal ash dumps, below.

8. Ensure transparency of information.

Regulators and operators should maintain a publicly accessible website for information about ash dumps. All documents should be publicly available, preferably on a publicly accessible website, including:

- monitoring data;
- reports used to develop the plan;
- the final plan;
- communications between ash dump operator and regulators overseeing the rehabilitation and closure plan;
- any penalty infringement notices or court orders issued for non-compliance; and
- all community update reports.

Unplanned closure of Flinders power station ash dump risks lives

In May 2016 the Northern power station in Port Augusta, South Australia closed. Very little notice was given by the power station owner, Alinta. No closure and post-closure rehabilitation plans were either required or in place when the power station powered down for the last time. Port Augusta Council has referred to the remediation of Northern Power Station as a case study of what not to do.¹⁶³

The ash dump at the Northern Power station is 270 hectares. Port Augusta is known for its strong wind. The predominant method of dust control ceased following the closure of the power station, and the ash dried, posing an immediate threat to the environment and nearby residents.¹⁶⁴

Port August Council first reported dust emissions from the ash dump site to the South Australian Environment Protection Authority (South Australian EPA) in July 2016.¹⁶⁵ In October 2016, five months after the power station shut, the power station closure plan was approved by the South Australian EPA. The post-closure and dust management plans for the power station were approved in November 2016, nearly six months after closure.¹⁶⁶

Once the post-closure plans were approved, Flinders Power used an aerial application of chemical dust suppressions, which are supposed to retain a surface seal for 12 months. The power station assured the Port Augusta community that it would closely monitor weather forecasts for high winds or severe weather events to ensure the capping agent was not compromised and to minimise adverse impacts to human and environmental health.¹⁶⁷

In late December 2016, Port Augusta experienced severe storms that dumped some 60mm of rain on the ash dump. This severely compromised the chemical dust suppressant which thinned and dried up, removing the suppressant's ability to contain the underlying ash.

In early January 2017, strong winds carried a thick plume of ash dust to nearby residents at Port Augusta. Despite these weather events being forecast, and despite assurances made to the community that it would protect their health, Flinders Power appeared unprepared for the events. No dust suppressant or means for aerial re-application were on standby and no warning was given to the community to prepare for potentially hazardous conditions.

For several days people in Port Augusta reported breathing difficulties, coughing, and significant increases in asthma incidents including the hospitalisation of children with asthma. Pharmacies ran out of asthma medication.¹⁶⁸ The South Australian EPA issued a \$2,200 fine to Flinders Power for not taking adequate steps to prevent the dust escaping.¹⁶⁹

The South Australian EPA did not approve the Flinders power station ash dump rehabilitation plan until March 2017, nearly 12 months after closure. Although the ash dump has been covered and sown with grass seeds, the dust events haven't stopped, with the most recent occurring in January 2019.¹⁷⁰ Alinta CEO Jeff Dimery has stated that the cost of remediation of the Flinders power station is in between \$200 and \$300 million.¹⁷¹

'It is a sad indictment indeed that governments and corporations can so easily turn their backs and leave one community to bear the legacy and impacts, potentially for generations yet to come.'¹⁷²

The problems with remediation of the Flinders power station highlight the urgent need for a national approach to ash dump management and closure. Without adequate closure plans prepared well before the closure of power stations, communities living close to power stations will be in danger of being exposed to toxic coal ash and polluted waterways.

'It is a sad indictment indeed that governments and corporations can so easily turn their backs and leave one community to bear the legacy and impacts, potentially for generations yet to come.'



7

Closure/post-closure of coal ash dumps

Coal ash dumps must be comprehensively rehabilitated and require on-going management to protect surrounding communities well into the future. Protecting water sources is an absolute priority. It is vital that contaminated groundwater and land is cleaned up so that communities who live near coal ash dumps do not have to continue to bear the burden of pollution from coal-fired power stations.

Australian regulators do not require the development of closure and post-closure plans until after the closure of a power station is announced. As described in the Port Augusta case study above, this significantly impacts on surrounding communities. It is imperative that Australian power station operators be required to prepare detailed closure and post-closure rehabilitation plans, in consultation with the surrounding communities, well in advance before the closure of the power stations.

Closure plans that adhere to best practice standards will not necessarily prevent continued leaching of hazardous contaminants from coal ash into groundwater and surface water. Often the floor of ash dumps are in contact with underlying groundwater. Therefore the groundwater will continue to pass through the buried ash after closure and will continue to indefinitely leach toxic chemicals from the ash. It often takes decades for coal ash to reach its highest leaching potential.

The best way to prevent ongoing contamination is to remove the ash from the original dump to a purpose-built dump that adheres to the conditions outlined above. That way the community can be assured that both operator and regulator are taking a best practice approach to rehabilitation and closure, and are serious about mitigating the likelihood the community will inherit a toxic legacy.

Community participation is fundamental to the development of rehabilitation and closure plans of ash dumps. People have a right to know exactly how companies propose to clean up this toxic waste, the conditions imposed on the companies by regulators, and be able to hold both companies and regulators accountable for plans that do not adhere to best practice.

“They’re as big as a suburb. They’re unlined. They’re leaching continuously into the lake. We don’t know what’s happening to the aquifers underneath or around the place. But certainly we know it’s leaching into the waterways. The government needs to get real about this. It needs to engage with the community - bring the community on board. It needs to have a full inquiry – but an independent inquiry. Not a government controlled inquiry.”



Mike Campbell, OAM,
Community Environment
Network

General principles for safe closure

The following section provides a checklist for ash dump rehabilitation that communities should demand when closure and post-closure plans for ash dumps are being developed.

1. A comprehensive corrective action plan is developed in partnership with the community that includes:
 - ☑ detailed descriptions of the ash dump and surrounding area (site characterisation);
 - ☑ extensive detail of the remedial action to prevent ongoing contamination of groundwater, surface water, air and land;
 - ☑ requirements for quarterly community reports and feedback on process;
 - ☑ assessment of the contamination levels and composition of contaminants;
 - ☑ detailed chemical analysis of the ash;
 - ☑ hydrogeological reports and maps;
 - ☑ groundwater and surface water monitoring data for the previous 10 years;
 - ☑ triggers for remedial action in the event of exceedances identified at monitoring points including groundwater, surface water, air and structural integrity monitoring points; and
 - ☑ requirement for timely public safety announcements.
2. Comprehensive water quality modelling is available that estimates:
 - ☑ how quickly groundwater/surface water contamination will improve;
 - ☑ how much contamination is expected to continue to leak into water sources; and
 - ☑ a prediction for the effect of pollution control measures including removal of contaminated materials.
3. A strict time limit is set within which closure and post-closure plans must be prepared and implemented.
4. A closure plan is agreed that is enforceable by both the environmental regulator and the community including the following elements:
 - ☑ conditions of compliance are clear and have time frames for compliance;
 - ☑ community enforcement actions are available to ensure the plan is followed strictly.
 - ☑ mechanisms that allow companies to bypass their obligations without thorough explanation, allow time to lapse without having implemented rehabilitation within a strict time period, and/or waive rehabilitation requirements by deferring to reports such as third-party engineering reports, must be removed.
5. The operator is required to maintain a financial assurance before rehabilitation takes place. Financial assurance details, including amount, must be publicly available.
6. The impact of ash dump contaminants in water, surface water, air and land are detailed, as are the environmental and human health impacts of these contaminants.
7. There are detailed descriptions of long-term monitoring program (at least 30 years) funded by the operator that include:
 - ☑ groundwater monitoring systems;
 - ☑ remedial actions to restore groundwater to original conditions where contamination continues or in the event that contamination is discovered post-closure; and
 - ☑ ash dump cap inspection and cap maintenance.

8. All documents related to ash dump rehabilitation are publicly available, preferably on a publicly accessible website, including:

- ☑ monitoring data;
- ☑ reports used to develop the corrective action plan;
- ☑ the final corrective action plan;
- ☑ communications between the ash dump operator and regulators overseeing the rehabilitation and closure plan;
- ☑ any penalty infringement notices or court orders issued for non-compliance; and
- ☑ all community update reports.

“My home in Mannering Park has always been my sanctuary because it brings to me serenity, peace and being one with nature. But unfortunately the downside is living right next to a coal-fired power station and ash dump.

One day this power station will go. I hope it will be within my lifetime within the next 10 years or so. I want to make sure the legacy will not hurt any other living creature or thing. We need to make sure that it is completely rehabilitated. I don't know enough about the science of that. And I don't know the cost of that. But I do know the cost of it if we don't.”



Sue Wynn,
Mannering Park Progress
Association, NSW

8

Conclusion

Coal ash dumps are one of the many hidden costs of coal and are a looming toxic legacy in Australia. As this report shows, these dumps are already causing water contamination, polluting aquatic ecosystems, and blowing toxic ash over communities who live near them.

The regulators who oversee these toxic dumps overwhelmingly do not require financial assurances to financially protect communities or best practice management to stop contamination. Most ash dumps don't have thorough and strict rehabilitation or post-closure plans. Very little information about ash dumps is available to the public without engaging in lengthy and expensive Freedom of Information processes.

Most people have no idea how badly regulated and how risky these toxic dumps are. Because of the dangerous heavy metals and other pollutants in coal ash and other materials dumped in ash dumps these sites will be toxic in perpetuity. This stymies future land use planning, threatens water supplies, and poses an enormous and expensive human and environmental health risk.

There are actions that regulators and power stations can take now to minimise the risk of these toxic dumps. These actions must be undertaken as a priority to ensure that environmental and human health and safety are protected well into the future. These actions include the need for operators to redesign and relocate toxic sites in accordance with rigorous engineering and construction standards to protect groundwater and land from contamination, keep ash dry, ensure that dust suppression measures are strict to prevent ash blowing onto communities and into waterways and prepare thorough rehabilitation and closure plans in consultation with the communities that live near ash dumps. Regulators must ensure that every step of the process is enforceable with strict legal penalties for non-compliance.

Until then, toxic ash dumps continue to be yet another toxic legacy left by the coal industry and lax regulators.

By acknowledging the extent of contamination and risk to environmental and human health, Australian governments have the power to impose best practice measures for coal ash dump management, rehabilitation and closure.

The following recommendations aim to ensure this happens.

“We need those answers. Not only just for our community. Everyone in Australia needs those answers because this is a problem at every coal-fired power station around Australia.”



Sue Wynn,
Mannering Park Progress
Association, NSW

Recommendations

1. **All states initiate inquiries into coal ash dumps.** Australian Parliaments need to initiate inquiries into coal ash dumps to understand the full extent of the toxic threat and make strong recommendations to protect human and environmental health.
2. **Rehabilitation plans:** Australian governments should impose an immediate obligation on ash dump owners and operators to prepare best practice rehabilitation, closure plans and post-closure plans in consultation with the communities who live near these toxic sites.
3. **Tougher groundwater regulation:** Australian regulators who oversee ash dumps should immediately develop and implement actions to clean up and manage ash dumps causing groundwater contamination, including re-siting operational ash dumps to thoroughly rehabilitate existing sources of contamination to best practice standards.
4. **Safe containment of existing ash dumps:** Australian governments should impose immediate obligations on ash dump owners and operators to convert wet dumps to dry ash emplacements.
5. **Bond payments to protect communities:** Australian governments should immediately impose a bond or financial assurance on ash dumps to protect Australian communities from bearing the cost burden of poorly managed or poorly rehabilitated ash dumps.
6. **National guidelines:** Australian governments should develop and ensure the implementation of enforceable national best practice guidelines for ash dump management, rehabilitation, and closure and post-closure management (as outlined in this report) to mitigate as far as practicable the future threat of contamination of land, groundwater, and surface water and prevent harm to human health.
7. **Transparency and availability of information:** Australian governments should make access to information about ash dumps transparent and available to the Australian community, including all existing management plans, details of financial assurance, rehabilitation plans, pollution incidents, fines and other enforcement actions taken by regulators, monitoring data, hydrogeological assessment, predictions for future contamination, and predictions for future land-use planning.

Mt Piper Power Station. Source: Zephyr L'Green



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