

LOCK THE GATE ALLIANCE  
MARCH 2016

# FREE-LOADERS

## AIR AND WATER POLLUTION FROM NSW COAL MINES



**Lock the Gate  
Alliance**

We are grateful to Dr. Ian Wright, Lecturer, Environmental Science at Western Sydney University for reviewing and providing feedback on this report.



Mt Thorley Warkworth: Dean Sewel

Cover: Mangoola coal mine: Dean Sewell

# EXECUTIVE SUMMARY

In 2013/2014, the coal mining industry in NSW dumped 26,894 kg of heavy metals and other pollutants into our streams and rivers. This included dangerous substances including arsenic, lead, and mercury.

In that same year, coal mines also emitted 122,819 tonnes of coarse and fine particle pollution and 77,570 tonnes of other airborne pollutants, including arsenic, volatile organic compounds, polycyclic aromatic hydrocarbons, and formaldehyde.

Under the NSW load-based licensing scheme, other industries are required to pay to discharge many of the key pollutants that the coal mining industry discharges for free. Due to the fact that the coal mining industry is not covered by the load-based licensing scheme, it is the environment and community who are bearing the cost of that industry's polluting ways.

For example, industries such as steel-making, power generation, and even coal seam gas mining, are required to pay to discharge many of the same pollutants. There are ten different substances (known as 'assessable pollutants') which are discharged into water from coal mines that other industries are required to pay to discharge under the NSW load-based licensing scheme. There are also eleven of these assessable pollutants emitted by coal mines into the air. However, the coal industry pays for none of those discharges to either air or water.

This report has analyzed data from the National Pollutant Inventory to assess the volume of pollutants discharged into air and water from coal mines in NSW, and to determine their contribution to the total reported pollutant load.

The results of the analysis reveal that coal mines are responsible for:

- 60% of all reported arsenic discharges into water sources in NSW
- 23% of all reported lead discharges into water sources in NSW
- 77% of all reported Chromium III discharges into water sources in NSW
- 71% of all reported discharges of selenium and associated compounds into water sources in NSW

For air pollution, coal mines are responsible for:

- 25.9% of all reported arsenic pollution in NSW
- 32.8% of all reported volatile organic compounds (VOCs) pollution in NSW
- 77.3% of all reported PM10 particle emissions
- 53% of all reported PM2.5 particle emissions

In addition to these assessable pollutants, there are a number of other pollutants that are not covered by the load-based licensing scheme yet that are also discharged by the coal mining industry into streams and rivers. For example, the coal mining industry is responsible for over 80% of all reported discharges of nickel and cobalt to water sources in NSW.

The underground mines of southern Sydney and the Blue Mountains are particularly notable for the quantity of heavy metal pollution they release into surface water, some of it into tributaries that feed Sydney's drinking water catchment. For air pollution, it is the large open cut coal mines of the Hunter Valley that are the worst offenders. Many Hunter residents are familiar with the visible PM10 pollution that cloaks the valley on hot days, but many other potentially harmful air pollutants, such as arsenic and cobalt, are released by several large mines in close proximity to each other, raising the possibility that cumulative impacts are being experienced by nearby populations.

The load-based licensing scheme was designed to reduce pollution in NSW, and is touted by the NSW Environment Protection Authority as an important incentive-based mechanism to encourage major industries to reduce their pollution. The failure to apply the load-based licensing scheme to coal mining in NSW means that a vital opportunity to reduce a major source of pollution is being missed and that a wealthy, profit-making industry is permitted to pollute air and water resources for free.

Preliminary analysis indicates that the amount of money NSW ought to be charging the coal industry for all of this free pollution is at least \$14 million per annum. This bill is not evenly spread across the industry. The most polluting mines - Wilpinjong, Ravensworth, Mt Arthur and Hunter Valley Operations - should all have, according to our calculations, at least a million dollars on the bill for the pollutants they release.

The NSW EPA is currently undertaking a review of the load-based licensing system and its application. This represents an immediate opportunity that can be used to force coal polluters to pay for their own air and water emissions, and to create urgent pressure for them to reduce pollutant loads into our water and air. But the load-based licencing scheme alone cannot prevent damaging environmental impacts where there are fundamental inadequacies in NSW's approach to air and water pollution from coal mines.

Therefore, we recommend that:

1. The NSW EPA should utilise the current review of the load-based licensing system to:
  - Extend the coverage of the load-based licencing system to the coal mining industry, to introduce proper accountability and transparency into the management of mining pollution in NSW.
  - Extend the scope of chemicals considered as assessable pollutants to include other heavy metals like nickel and cobalt
  - Set fees at a level that are substantial enough to represent a significant incentive for the coal mining industry to reduce pollution
  - Calculate allowable loads for pollutants at a catchment and air shed level
2. The NSW Government should undertake broader reform to NSW planning and mining policy to prevent damaging air and water pollution from mining and to put strict standards in place to protect human health and the environment.

# INTRODUCTION

## The load-based licensing scheme

Fundamentally, New South Wales' load based licensing scheme adopts the "polluters pays" principle and approach to pollution control. That polluting companies should bear the cost of measures to reduce and control that pollution is one of the long-established principles of ecologically sustainable development, and is enshrined in NSW law, in the Protection of the Environment Operations Act 1997.

That Act makes pollution of the water and air an offence in NSW, but provides for the EPA to issue Environment Protection Licences to the operators of polluting facilities, like coal mines. EPLs regulate the concentrations of air and water pollution that can be released into the environment, and where and how companies release that pollution, as well as pollution reduction programs, and monitoring and reporting regimes. It's illegal to pollute the environment without an EPL, but once you have one, there is no incentive to reduce your pollution levels if you are within the limits it specifies, and many do not specify limits.

Load-based licensing serves a different purpose. It imposes dollar values on every gram of polluting substances that are emitted by industry, be it particle pollution into the air or heavy metals into the water. Load-based licensing requires companies to annually pay a fee calculated on the volume of assessable pollutants (those listed in the load-based licensing schedule) they have emitted in the previous year. Different pollutants have different weightings, according to the harm they do to the environment. The purpose of the scheme is to create an inducement to the company to reduce their pollution levels, in order to reduce their bill.

The load-based licensing scheme does not cover all pollutants. A schedule in the Protection of the Environment Operations Regulation 2009 lists "assessable pollutants" for different activities, and many activities that require Environment Protection Licences don't have any assessable pollutants listed, including coal mining. In order for the load-based licensing scheme to apply to coal mining, Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009 will need to be changed to list some or all of the pollutants reviewed in this report, as well as, potentially, pollutants like carbon dioxide, methane and salt, which are not addressed in this report.

The load based licensing scheme is reported to bring over \$30 million in revenue to New South Wales annually. The EPA is currently conducting a review of the scheme, which has been in operation since 1999. This review should address a key gap in the scheme's application: some of the biggest source points of air and water pollution in the state, our coal mines, are not currently covered by it.

## National Pollution Inventory Data

The analysis conducted in this report was based on a compilation of reports from the National Pollutant Inventory (NPI) for 2013 to 2014. This means that our work is limited to the pollutants reported to the NPI, which notably does not include salt, carbon dioxide or methane, all of which are emitted in large quantities from NSW coal mines.

Firstly, information was collected from the NPI on all water and air-borne pollution data discharged

from coal mines in NSW. From this, a full list of water and air pollutants discharged from coal mines was compiled. The discharges and emissions from individual coal mines were ranked in order of scale and were also added together to derive a total volume of each pollutant discharged from coal mines in NSW. A further analysis was conducted of assessable pollutants for comparison purposes. Assessable pollutants are defined as all pollutants covered by the NSW load-based licensing scheme for at least one industry. Many of the pollutants that coal mines release into the rivers of NSW and into the air are assessable pollutants for other industries.

NPI data was reviewed for other facilities covered by the load-based licensing scheme, including the volume of assessable pollutants discharged in total by facilities and industries. This enabled a comparison of the volume of assessable pollutants released by industries covered by the load-based licensing scheme with the coal mining industry, which is not.

Similarly, the total NPI data on all pollutant discharges was analysed to identify pollutants which do not qualify as assessable pollutants but for which coal mining is a major or significant contributor to the overall load.

## Method

A list was created of all reported pollutants emitted in any amount by any NSW coal mine in 2013-2014. A database was created showing NPI waterborne and airborne pollution data for all industries that reported any 2013-2014 emissions of any of those pollutants.

This database was further developed to identify which pollution sources were coal mines, and which were industries exposed to the NSW Load-Based Licensing (LBL) regime. The pollution data for LBL industries was then further refined to show which individual pollutants were listed Assessable Pollutants (AP) for each industry under the LBL regime (each industry covered by the NSW LBL regime is only covered for certain AP, not all of them.)

Coal mines release large volumes of salt pollution into NSW waterways. We have not included salt pollution in this analysis because in the Hunter Valley, where salinity from mines is a significant problem that exacerbates the natural salinity of the river system, a scheme called the Hunter River Salinity Trading Scheme already requires coal mines to pay for their salt pollution.

**Table 1: Summary of pollutants and sources in the NPI**

	<b>Waterborne</b>	<b>Airborne</b>
Number of NPI pollutants emitted by NSW coal mines.	17	38
NPI pollutants emitted by NSW coal mines that are also assessable pollutants under the LBL (for other industries)	10 Arsenic & compounds Cadmium & compounds Chromium (III) compounds Copper & compounds Lead & compounds Mercury & compounds Selenium & compounds Total Nitrogen Total Phosphorus Zinc and compounds	11 Arsenic & compounds Benzene Fluoride compounds Hydrogen sulfide Lead & compounds Mercury & compounds Oxides of Nitrogen Particulate Matter 10.0 um Particulate Matter 2.5 um Sulfur dioxide Total Volatile Organic Compounds
Amount of NSW businesses reporting emissions of any of the above pollutants.	114	757
Number of above businesses that are exposed to LBL.	76	227
NSW coal mines that report pollution to the NPI	23 Angus Place Colliery Appin Mine Austar Coal Mine Bloomfield Colliery Bulga Coal Surface and UG Operations Charbon Colliery Clarence Colliery Dendrobium Mine Hunter Valley Operations Lidsdale Coal Loading Facility Macquarie Coal Preparation Plant Mandalong Mine Metropolitan Collieries Pty Ltd Mount Thorley Warkworth Operations Myuna Colliery Narrabri Coal Mine - Baan Baa Newstan Colliery Russell Vale Colliery	55 Abel Mine Angus Place Colliery Appin Mine Ashton Coal Mine Camberwell Austar Coal Mine Bengalla Operations Bloomfield Colliery Boggabri Coal Mine Bulga Surface and UG Operations Charbon Colliery Clarence Colliery Dendrobium Mine Donaldson Mine Drayton Mine Duralie Mine Glendell and Ravensworth East Glennies Creek Gujarat - NRE Wongawilli Hunter Valley Operations Integra Coal Open Cut Mine Integra Coal Underground Mine Liddell Coal Operations Lidsdale Coal Loading Facility

	<b>Waterborne</b>	<b>Airborne</b>
NSW coal mines that report pollution to the NPI	Springvale Colliery Tahmoor Coal Mine Ulan Coal Mine West Cliff Colliery West Wallsend Colliery	Macquarie Coal Preparation Plant Mandalong Mine Mangoola Coal Maules Creek Coal Pty Ltd Metropolitan Collieries Pty Ltd Moolarben Coal Operations Mount Thorley Coal Loader Mount Thorley Warkworth Mt Arthur Coal Mt Owen Mine Muswellbrook Coal 1 & 2 mines Myuna Colliery Narrabri Coal Mine - Baan Baa Newstan Colliery Pine Dale Mine Ravensworth Mine Complex Rix's Creek Pty Limited Rocglen Coal Mine Russell Vale Colliery Springvale Colliery Stratford Mine Sunnyside Open Cut Coal Mine Tahmoor Coal Mine Tarrawonga Coal Mine Tasman Mine Ulan Coal Mine United Colliery Wambo Mine Werris Creek No 2 Coal Mine West Cliff Colliery West Wallsend Colliery Wilpinjong Coal Mine

# RESULTS

## Water

**Note: many coal mines don't have reported water pollution, because they store it in onsite tailings dams or onsite/offsite landfill and report it to the NPI as "transfers" instead of "emissions." These "transfers" are not included in this assessment.**



Water outfall: Dean Sewell

Our results indicate that for some water-based pollutants, NSW coal mines are significant point sources, and contribute significant proportions of the volume overall. There is considerable variation among NSW coal mines in the quantity of water pollution they create. In general, the underground mines in the Blue Mountains, Lake Macquarie and southern Sydney are significant sources of some water pollutants.

The contribution of coal mines to the NSW reported emissions of selected NPI pollutants is summarised in Table 2.

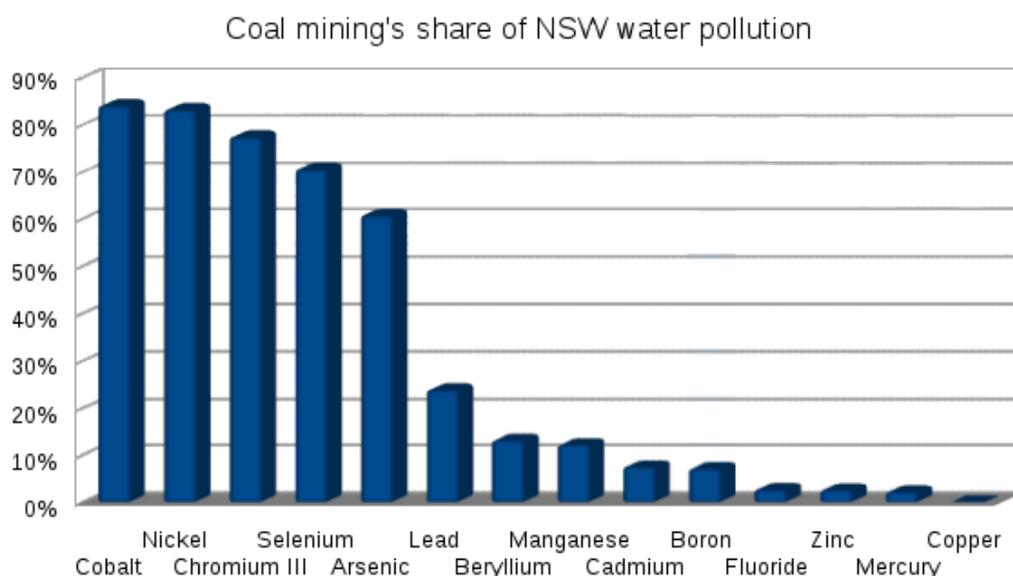
**Table 2: NSW NPI reported emissions for selected water pollutants**

Pollutants	Facilities reporting	Total reported (kg)	Number of coal mines reporting	Volume of pollution from coal mines (kg)	Coal mines % of total
Cobalt and compounds*	16	66	11	55	84.08%
Nickel and compounds*	29	587	20	489	83.27%
Chromium III	29	320	16	248	77.47%
Selenium and compounds	9	22	5	16	70.62%
Arsenic and compounds	27	482	14	294	60.88%
Lead and compounds	34	112	20	27	23.87%
Beryllium and compounds*	13	14	7	2	13.23%
Manganese and compounds*	31	19,184	22	2,357	12.28%
Cadmium and compounds	14	4	6	0.31	7.62%
Boron and compounds*	27	48,670	19	3,518	7.23
Fluoride and compounds*	32	465,203	13	12,831	2.76%
Zinc and compounds	36	35,450	22	946	2.67%
Mercury and compounds	23	41	13	1	2.33%
Copper and compounds	34	28,804	20	50	0.17%

\* These pollutants are not currently assessable pollutants for any industry in NSW

For two pollutants that are already listed for other activities in the load based licensing schedule, selenium and chromium III (trivalent chromium), coal mining is actually the biggest source in New South Wales, contributing 70.6% and 77.5% of the total reported in NSW respectively. For arsenic and compounds it is a massive contributor – amounting to over 60% of the total arsenic discharge load in NSW. For lead and compounds, it is also a significant proportion, contributing 23.9% of the total water-based lead pollution in NSW.

Two other significant pollutants released into waterways in New South Wales by coal mines, cobalt and nickel, are not currently assessable pollutants for any activity under the load based licensing scheme. Coal mines contribute 84% of the cobalt water pollution in NSW and 83% of the nickel pollution, so both of these would be candidates for listing as assessable pollutants for coal mining under the load based licensing scheme.



## Key pollutants

Information about key pollutants is drawn from the World Health Organization, unless another source is cited.

### Cobalt & compounds

Coal mines produce 84% of the water-based pollution by cobalt and compounds in NSW. Cobalt is a listed Group 2B (possible) carcinogen, but is not listed as an assessable pollutant for any activities in NSW. Just two mines, Springvale and Tahmoor, make up over half of all NSW emissions of this pollutant.

### Nickel & compounds

Nickel is a listed Group 2B (possible) carcinogen, and is not listed as an assessable pollutant for any activity in NSW. Coal mines are the main source, followed by aluminum smelting and coal-fired power stations. The top three sources are Dendrobium, West Cliff and Tahmoor mines, with Bloomfield, Newstan, and Mandalong Springvale in the top ten.

### Chromium III

Unlike its cousin, hexavalent chromium, trivalent chromium is not carcinogenic. The two biggest sources in the state are coal mines, Dendrobium and Springvale, both in Sydney's drinking water catchment.

Power stations, the Orica ammonium nitrate plant at Kooragang Island and the Tomago aluminium smelter are also in the top ten sources of this pollutant in NSW.

### **Selenium & compounds**

Two coal mines create most of the water-based selenium pollution in New South Wales, Bloomfield and Hunter Valley Operations. Only one NSW facility has water-based selenium listed as an assessable pollutant, Wallerawang power station, which is now in care and maintenance. Selenium is bioaccumulative in aquatic food chains and “can cause developmental abnormalities and reproductive failure in fish and wildlife.”<sup>1</sup>

### **Arsenic & compounds**

Arsenic is a listed Group 1 (known) carcinogen. Two coal mines account for over half of all emissions, in the state: Tahmoor and Dendrobium, both in the southern coalfields between Sydney and Wollongong. Vales Point and Eraring coal fired power stations are also significant sources of waterborne arsenic pollution, but it is not listed as an assessable pollutant for electricity generation.

### **Lead & compounds**

Lead is a listed Group 2B (possible) carcinogen, and inorganic lead compounds are listed Group 2A (probable) carcinogens. Lead is highly toxic and is associated with developmental delay in children. The biggest source in the state, Bluescope Steel, is the only LBL-exposed facility with reported emissions, but accounts for over half of all pollution. Coal mines are the most common pollution sources including 5 of the top 10 polluters. Power stations other big emitters, but lead is not an AP for them.

### **Beryllium & compounds**

Beryllium is a listed Group 1 (known) carcinogen, but is not listed as an assessable pollutant for any activities in NSW. Bayswater power station is responsible for most of the beryllium released into water in NSW, but three coal mines, Bloomfield, Hunter Valley Operations and Springvale, are significant sources.

### **Manganese & compounds**

Coal mines are the most numerous source of water-based pollution of Manganese in NSW, particularly Myuna, Clarence, Tahmoor and Newstan, but the leading emitter is Malabar sewage plant, an order of magnitude higher than other emitters.

### **Cadmium & compounds**

Cadmium is a listed Group 1 (known) carcinogen. It is listed as an assessable pollutant for non-aluminium metal smelting and sewage treatment, but not for the activities that are the top ten sources of this pollutant in water. The top five pollution sources account for 90% of the cadmium released into water in NSW: coal fired power stations (Vales Point, Bayswater and Eraring), aluminium smelting at Tomago, and oil refining at Kurnell. Coal mines make up 7% of the total reported release of cadmium into water in NSW.

### **Boron & compounds**

The World Health Organisation advises that “Findings from human experiments show that boron is a dynamic trace element that can affect the metabolism or utilization of numerous substances involved in life processes.”<sup>2</sup> Coal mines are the most numerous source of boron water pollution in NSW, but the vast majority, 92% of the volume of this pollution comes from Malabar sewage plant, North Head

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1. Lemly, November 2013. “Biological Assessment to Determine Impacts of Selenium Pollution From Coal Ash Wastewater Discharges on Fish Populations in Lake Sutton, NC.” Report prepared for Southern Environmental Law Center, North Carolina.

sewage plant and Bayswater power station.

### **Fluoride compounds**

The sewage plants and Tomago aluminium smelter are the largest sources of this pollution in NSW, though one coal mine, Springvale, is in the top ten.

### **Zinc & compounds**

The top three emitters of water-based pollution of zinc in the state have their zinc pollution covered by the load based licencing scheme and account for almost all the zinc released reported as released into NSW water. Coal mines are the most numerous source of this pollutant, but the volume is much smaller.

### **Mercury & compounds**

Extremely toxic, but not a listed carcinogen. North Head and Malabar sewage plants are the two biggest sources of aqueous mercury pollution, by orders of magnitude. Bluescope Steel is the only other mercury-emitting source for which it is an AP. Coal mines are the most common source of pollution, although the amounts are low.

### **Copper**

The three biggest sources of aqueous copper pollution in the state are also the only sources for which it is an assessable pollutant. Malabar sewage plant, North Head sewage plant and Bluescope Port Kembla produce volumes three orders of magnitude higher than other sources and account for over 99% of reported pollution. Coal mines account for only a small percentage of copper pollution, but are the majority of pollution sources (20 of 34).

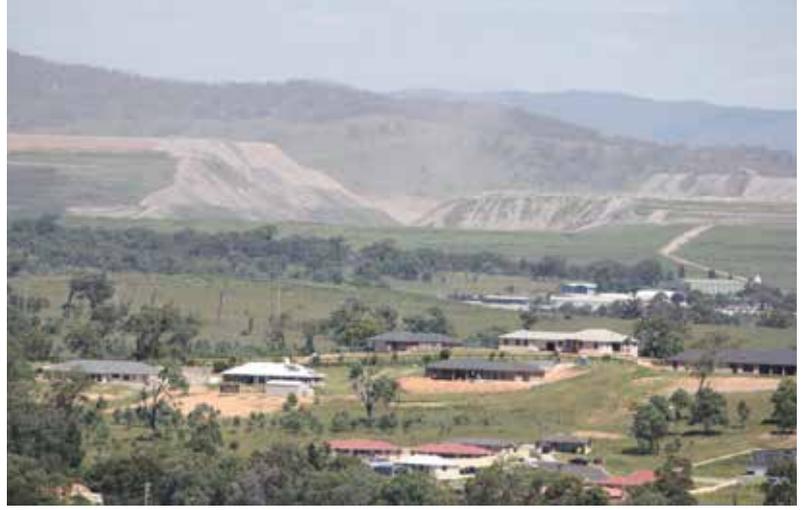
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2. World Health Organisation. 2003. "Boron in Drinking Water: Background document for developing WHO Guidelines for Drinking Water Quality." [http://www.who.int/water\\_sanitation\\_health/dwq/boron.pdf](http://www.who.int/water_sanitation_health/dwq/boron.pdf)

# RESULTS

## Air

As for water pollution, there are significant volumes of air pollutants being released by NSW coal mines. For several major pollutants, coal mines are the biggest polluters in the state. Many of the pollutants listed below should be considered for inclusion as assessable pollutants for coal mining under the load based licencing scheme to encourage mining companies to clean up their operations. The most polluting coal mines for air pollution are the open cut mines of the Hunter Valley, including the mines in the Goulburn River catchment, close to Mudgee.



Muswellbrook with mine dust: Dean Sewell

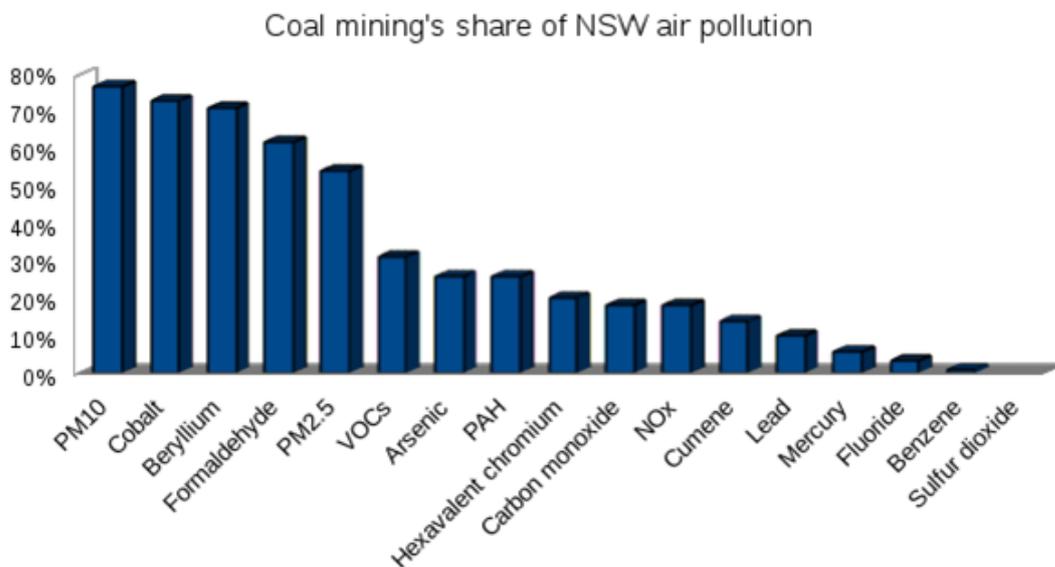
**Table 3: NSW NPI reported emissions for selected air pollutants**

Pollutants	Facilities reporting	Total reported (kg)	Number of coal mines reporting	Volume of pollution from coal mines (kg)	Coal mines % of total
PM10 - large particles	394	155,109,022	48	119,899,194	77.3
Cobalt and compounds*	115	2,876	41	2,095	72.8
Beryllium & compounds*	194	542	34	383	70.6
Formaldehyde (methyl aldehyde)*	68	430,374	11	267,681	62.2
PM2.5 - fine particles	384	5,426,019	48	2,919,898	53.8
VOCs – Volatile Organic Compounds	601	11,666,197	50	3,828,108	32.8
Arsenic and compounds	216	3,994	42	1,036	25.9
Polycyclic aromatic hydrocarbons*	354	3,716	48	956	25.7
Chromium VI (hexavalent chromium) compounds*	71	183	3	36	19.7
Carbon monoxide*	400	208,987,372	48	37,436,508	17.9
NOx	396	203,114,361	48	35,890,529	17.7
Cumene (isopropylbenzene; 1-methylethylbenzene)*	122	3,143	34	425	13.5
Lead and compounds	235	43,787	49	4,273	9.8
Mercury and compounds	249	664	48	38	5.8
Fluoride and compounds	154	2,592,561	42	79,093	3.1
Benzene	125	78,499	14	813	1.0
Sulfur dioxide	390	215,734,860	48	58,890	0.03

\* These pollutants are not currently assessable pollutants for any industry in NSW

For coarse particles (PM10), fine particles (PM2.5), cobalt and formaldehyde, coal mines produce more than half the airborne pollution reported to the NPI in NSW. Coal mines are also responsible for a significant proportion of reported arsenic, VOCs and PAHs.

Some of the Hunter Valley’s open cuts are particularly concerning, given how many of the mines that are tightly clustered around Singleton and Muswellbrook are among the top 10 or 20 pollution sources for pollutants that are damaging to people’s health. It is no surprise that Mount Arthur, Ravensworth, HVO and Mount Thorley Warkworth top the lists of pollution sources, given their size, by their proximity to each other, and to the Bayswater and Liddell power stations raises serious concerns about the cumulative impact this load, not just of particles but of toxic pollutants, might have on nearby populations.



## Key pollutants

### Large particles – PM<sub>10</sub>

Coal mining is responsible for 77% of the coarse particle pollution reported to the NPI in NSW. Particle pollution causes respiratory illness. The top fifty emitters of coarse particle pollution in NSW include 28 coal mines, 11 other mines and only eight other facilities that actually have PM10 listed as an assessable pollutant. Nine of the top ten worst reported sources are open cut coal mines: Wilpinjong, Ravensworth, HVO, Mt Arthur, Mount Thorley Warkworth, Ulan, Liddell, Wambo and Mangoola.

### Cobalt and compounds

Coal mining produces 72% of air-borne cobalt pollution reported to the NPI in NSW. Every one of the top 34 emitters is a mine (coal and metal), emitting between 11 and 427kg. Eight of the top ten point sources of air-borne cobalt pollution are open cut coal mines in the Hunter Valley: Wilpinjong, Wambo, Ravensworth Liddell, HVO, Mangoola, Ulan and Moolarben.

### Beryllium and compounds

Beryllium is listed as a Class 1 (known) carcinogen. Mining and especially coal mining is the major source of beryllium pollution in NSW, with coal mines accounting for 13 of the top 20 emitters, including Wilpinjong, HVO, Ravensworth, Wambo, Liddell and Moolarben. Coal mining contributes 70% of reported air-borne Beryllium pollution in NSW.

## **Formaldehyde**

Formaldehyde is a class 1 (known) carcinogen. After the two nuclear reactors in Sydney's Lucas Heights, coal mines are the primary pollution source in NSW for this pollutant, accounting for 8 of the top 10 sources. The biggest emitters are Mt Arthur, Mount Thorley-Warkworth, HVO and Drayton.

## **Fine particles – PM<sub>2.5</sub>**

Fine particles are particularly bad for health. They are known to increase respiratory illness and mortality<sup>3</sup>. Coal mines create more than half of the fine particle pollution reported to the NPI in NSW. The top 50 emitters include 25 coal mines, 3 other mines and 11 facilities, mostly power stations and Bluescope Steel, that actually have PM2.5 listed as an assessable pollutant. Wallerawang power station is the biggest single source but Wilpinjong, Liddell and Ravensworth open cut coal mines are in the top five. Bulga open cut, Mt Arthur, Wambo, Mt Owen, Glendell & Ravensworth East, Mount Thorley Warkworth and HVO are all in the top 20.

## **VOCs – Volatile Organic Compounds**

VOCs are a group of organic chemicals that include some listed individually under the NPI, like formaldehyde and benzene. Many are hazardous to health. Overall, coal mines contribute 32% of the total VOCs reported to the NPI. Among the worst polluters are Bulga open cut, Ravensworth, Wilpinjong, Mt Arthur and Liddell, all in the top ten worst emitters.

## **Arsenic and compounds**

Arsenic is a listed Class 1 (known) carcinogen. Forty-two coal mines in NSW produce a quarter of the airborne arsenic pollution reported to the NPI from NSW. In the top ten point sources are Wilpinjong, Ravensworth, Mangoola and HVO.

## **Polycyclic Aromatic Hydrocarbons (PAHs)**

PAHs are a group of organic chemicals, including several carcinogens. A quarter of the PAH pollution in NSW is produced by coal mines. Wilpinjong is the worst of the coal mines and the fifth largest overall.

## **Hexavalent chromium**

Hexavalent chromium is a class 1 (known) carcinogen. It is not a problem for most mines, but Moolarben coal mine is the biggest source of it in NSW and Bengalla and Mount Arthur are also significant sources.

## **Carbon monoxide**

Carbon monoxide is toxic to humans in concentrations over 35ppm. Nine of the top 15 emission sources of carbon monoxide in NSW are coal mines, with the worst being Wilpinjong, Ravensworth, Bulga and Mount Thorley Warkworth.

## **NOx – oxides of nitrogen**

Acutely toxic in high doses, the ominous orange cloud that warns of the arrival of NOx after blasting is a familiar sight for those that live near the open cut coal mines of the Hunter. Ravensworth, Wilpinjong and Bulga open cut are all in the top ten emitters of NOx reported in NSW, with Mt Arthur, Mount Thorley Warkworth, HVO, Wambo and Mount Owen all in the top 20. The top five NOx emitters in the state are the coal fired power stations Bayswater, Mt Piper, Vales Point, Liddell, and Eraring, all of which have NOx listed as an assessable pollutant.

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3. See for example, this summary of health effects of particle pollution from the US EPA: <http://www3.epa.gov/pm/health.html>

### **Cumene (isopropylbenzene or 1-methylethylbenzene)**

Cumene is the common name for isopropylbenzene, an organic compound found in crude oil. 34 coal mines are responsible for 13.5% of the reported cumene pollution in NSW. Mount Arthur, Mount Thorley Warkworth and HVO are all in the top ten biggest NSW emitters of this pollutant.

### **Lead and compounds**

Lead is a listed Group 2B (possible) carcinogen and a neuro-toxin. Inorganic lead compounds are listed Group 2A (probable) carcinogens. Unsurprisingly, the two biggest sources of air-borne lead in the state are lead mines at Broken Hill and Cobar. 24 of the top 50 emitters are coal mines, with every Hunter Valley open cut on the list.

### **Mercury and compounds**

The top five emitters of air-borne mercury in NSW according to the NPI data are Bayswater power station, Bluescope Steel, Mt Piper power station, Eraring power station and Berrima cement works, all of which have air-borne mercury as an assessable pollutant under the load based licencing scheme. The four huge open cut mining complexes that dominate the central part of the Hunter Valley, Mount Thorley-Warkworth, HVO, Ravensworth and Mount Arthur, are among the top 20 worst sources.

### **Fluoride and compounds**

While there are no coal mines in the top ten sources of fluoride, and while coal mines are overall a minor contributor to the total pollution loading, they are nevertheless significant contributors, and there are 19 coal mines in top-fifty polluters list, most of them in the Hunter Valley.

### **Benzene**

Benzene is a listed Class 1 (known) carcinogen. Coal mining makes overall a small contribution, but three Hunter Valley open cut mines, Mount Arthur, Bengalla and HVO are in the top 20 largest sources reporting to the NPI in NSW.

### **Sulfur dioxide**

Coal mines are not large contributors to the overall load of sulfur dioxide in NSW, but the concentration of sources in the central Hunter Valley makes it a cause for concern. The six biggest sources are coal-fired power stations.

# HOW MUCH SHOULD THEY BE PAYING?

All of the pollution released by the coal mining industries into the air and water ways of NSW imposes a cost on the public and on other users of the water, including natural ecosystems. The polluter pays principle, enshrined in law in NSW says this cost ought not to be borne by the community, or tax-payers, but by the industries that make money creating pollution.

The method for calculating pollution fees under the LBL is not simple, and depends on both the commercial productivity of the polluter (how much it produces, whatever that product is), and the “threshold factor” for each pollutant and industry (as listed under the regulation which governs the scheme). There are two different equations that can be used to calculate a pollution fee, and the interplay of the threshold factor and the commercial production amount will determine which equation each polluter must use to calculate its fee.

While these two factors (production amount and threshold factor) are used to determine which equation must be used, the factors themselves feature in only one of the two equations. Therefore, even though coal mines are not currently covered by the LBL scheme, and so does not have “threshold factors” listed in the regulations, it is possible to calculate a “ball-park” figure for how much each mine would be paying if it were covered. The actual fee would be heavily influenced by the threshold factors applied to coal mining if it were brought into the scheme.

The simpler equation, and the one that we have used to make our calculations, is shown Division 3, section 19(3) of the Protection of the Environment Operations (General) Regulation 2009, and is as follows.

$$\text{Fee} = \frac{\text{AL} \times \text{PFU} \times \text{PW} \times \text{CZ}}{10,000}$$

Where:

AL = assessable load (amount of pollution)

PFU = pollution fee unit, shown in s19(7) of the regulation and for our purposes has a value of \$42.62

PW = pollutant weighting, listed in Sch. 2 of the regulation, and different for each pollutant.

CZ = critical zone factor, listed in Sch. 2 of the regulation. In most circumstances it has a value of 1

Lock the Gate has applied this equation to the NSW coal industry. The very minimum the coal industry should be paying for the 20,834 kg of heavy metals and other pollutants they released in 2014 into our streams and rivers, and the 122,819 tonnes of coarse and fine particle pollution and 77,570 tonnes of other airborne pollutants they released into the air, **is at least \$14 million.**

This bill is not evenly spread across the industry. The most polluting mines, Wilpinjong, Ravensworth, Mt Arthur and Hunter Valley Operations, should all have, according to our calculations, at least a million dollars in fees for the pollutants they release.

The concentration of air polluting mines in the Hunter and water-polluting mines in Sydney's drinking water catchment and the Lake Macquarie catchment indicates that coal mine waste discharges should be examined at the catchment and air shed level to calculate allowable loads, in a manner similar to the Hunter Valley's Salinity Trading Scheme. This way, individual polluting mines pay the bill, but the total pollution level experienced by the public and in the environment is managed cumulatively.

## What needs to be done?

Immediate changes are needed to force coal polluters to pay for their own emissions, and to create urgent pressure for them to reduce pollutant loads into our water and air. But the load-based licencing scheme alone cannot prevent damaging environmental impacts where there are fundamental inadequacies in NSW's approach to air and water pollution from coal mines.

The adoption in December 2015 of the National Clean Air Agreement creates a deadline on amendment of the National Environmental Protection Measure for Air Quality and adoption of stricter standards for particle pollution<sup>4</sup>. It is time for NSW to fix its poor air quality regulation and clean up air in the Hunter, before the middle of 2016.

Similarly, a court case challenging the approval of expanded mining at the Springvale mine in Sydney's drinking water catchment is a timely prompt to address the gap in allowing unlicensed discharge of heavy metals and other pollutants by coal mines in our waterways.

Therefore, we recommend that:

1. The NSW EPA should utilise the current review of the load-based licensing system to:
  - Extend the coverage of the load-based licencing system to the coal mining industry, to introduce proper accountability and transparency into the management of mining pollution in NSW.
  - Extend the scope of chemicals considered as assessable pollutants to include other heavy metals like nickel and cobalt
  - Set fees at a level that are substantial enough to represent a significant incentive for the coal mining industry to reduce pollution
  - Calculate allowable loads for pollutants at a catchment and air shed level
2. The NSW Government should undertake broader reform to NSW planning and mining policy to prevent damaging air and water pollution from mining and to put strict standards in place to protect human health and the environment.

4. See the National Clean Air Agreement and Work Plan, December 2015.  
<http://www.environment.gov.au/protection/air-quality/publications/national-clean-air-agreement>

# INDIVIDUAL MINE PROFILES

Some individual coal mines which reported the high volumes of air and water pollution to the NPI are profiled below. We reviewed the Environment Protection Licences for the profiled mines to identify discharge points, any limits or monitoring requirements imposed in their licences and significant non-compliance history. Where available, we have also referred to the mines' annual environmental reports.



Hunter Valley Operations dragline: Dean Sewell

## Hunter Valley Operations

Hunter Valley Operations (HVO) is a multi-pit mining complex, with five pits spanning north and south banks of the Hunter River, owned by Rio Tinto. HVO is among the worst coal mines for airborne arsenic, NOX, benzene, and lead compounds, the second worst coal mine for mercury airborne beryllium in the state. The mine is not required by its EPL to monitor or limit any specific air pollutants, though like many open cut Hunter mines, it is required to implement pollution reduction programs to limit dust and coarse particle pollution.

HVO North has two licensed water discharge points to Farrell's Creek and Parnell's Creek, which flow into the Hunter River upstream of the Glennies Creek confluence. The mine is also licensed to discharge directly onto alluvial land, but on 9 November 2014, a ruptured pipeline between two dams caused an unknown volume of water to travel along an unnamed tributary. HVO has had several other non-compliance incidents relating to surface water pollution recorded against its Environment Protection Licence, including discharging outside authorised time, storm water runoff, leakage of mine water directly into the Hunter River, and failures in monitoring in Farrell's Creek. HVO reported the second highest volume of selenium pollution into water to the NPI, contributing 21% of NPI reported Selenium water pollution in that year. Given that other mines in the region, including Bloomfield and Mount Thorley Warkworth are also in the top ten emitters for this pollutant, action is warranted to put a price on this pollution and encourage the mines to reduce the load. HVO also reports releasing Arsenic, Zinc, Copper and Lead into water and is ranked fifth for Mercury released into water. The Mercury amount is small compared to the two biggest polluters, the sewage plants at Malabar and North Head. HVO is not required by the EPA to monitor or limit their discharge of these pollutants, or of Selenium.

## Springvale

Springvale is an underground mine 15km north-west of Lithgow in the Blue Mountains. It undermines Newnes State Forest, on the edge of the Blue Mountains World Heritage Area. Springvale is licensed to discharge mine-affected water from seven discharge points, some of which are licensed for pollution by metals and some are not. The discharge points release water into waterways feeding two rivers - the Wolgan River, which flows north to the Capertee Valley and Wollemi, and the Cox's River, which forms part of the Hawkesbury-Nepean and flows through the Blue Mountains World Heritage Area eventually into Warragamba dam. The Cox's River also receives polluted waste water from nearby coal fired power stations. Testing carried out by researchers from the Blue Mountains Conservation Society showed that this part of the river had high levels of heavy metals including zinc, copper and manganese, 125

times more sulphate than surrounding streams and only 5% of the oxygen that fish need. The mine transfers up to 30ML per day of water from the mine workings to the Wallerawang Power Station for use in cooling towers, but if more than this volume needs to be disposed of, it is discharged into the Coxs River. Springvale was the largest single reported water polluter of cobalt and compounds, producing 44% of the total reported in 2014. Springvale reported the second largest level of chromium III pollution into water in the NPI, producing a quarter of the total amount reported that year. It was the third largest polluter of mercury, the fourth largest polluter of lead and the fifth largest water polluter of copper. It also reported polluting water with zinc, beryllium, boron, fluoride and nickel.

The EPA has required Springvale to undertake monitoring for toxic metal pollutants at upstream and downstream locations and undertake an assessment of the pollutants detected in water discharged in accordance with ANZECC water quality guidelines, providing this assessment to the EPA by February 2014. The EPA has stated that it intends to place water quality limits for these pollutants on discharges at this point based on the results of this assessment. They have also been tasked by the EPA to assess “the acute and chronic toxicity of the mine water being discharged from Licensed Discharge Point 9” by August 2014. They have repeatedly been found by the EPA to be in breach of their licence for exceeding limits on arsenic and other pollution from one discharge point, and for failing to monitor properly from another. After several non-compliance findings when Centennial breached the volume limit for water discharges, EPA responded by varying the licence to remove the volume discharge limit. The Planning and Assessment Commission recently approved an expansion of this mine, despite the company not yet complying with work programs requested by the EPA to assess and control water pollution. The expansion will mean an increase in the volume of water the mine discharges into the Coxs River.

## **Wilpinjong**

The results of this analysis for the Wilpinjong coal mine near Ulan and Wollar are particularly significant. Wilpinjong is the worst coal mine emitter of lead and PAHs, second worst coal mine source of NOX and among the worst coal mines for mercury, sulfur dioxide and VOCs. It is the third largest point source of carbon monoxide, the second largest reported source of PM2.5, and the worst point source in the entire state for PM10, beryllium and cobalt. Wilpinjong suffers from spontaneous combustion of coal stockpiles and waste piles, and this burning results in the kinds of pollutants that Wilpinjong is reporting. In reviewing the airborne pollution data, Wilpinjong mine recurs as one of the worst point sources for a number of harmful toxins. Wilpinjong have three pollution reduction programs in place for control of particulate pollution, including requirements that they cease using equipment on their overburden during adverse weather conditions. In 2013, one of their recorded non-compliance incidences was for a power failure in the weather monitoring. Continuous weather monitoring on site did not occur for up to 6% of the reporting period. However, there are no pollution limits specified in Wilpinjong’s EPL for any air pollutants. Partly in response to odour complaints in the nearby town of Wollar, complaining of sulfurous smells, the EPA imposed pollution reduction programs on the mine requiring Wilpinjong to keep dust down on haul roads, to control PM10, and to continuously monitor in Wollar for NOX, sulfur dioxide, hydrogen sulfide, volatile organic compounds (VOCs) including, benzene, toluene and xylene and polycyclic aromatic hydrocarbons (PAHs). During monitoring in 2013-14, Wilpinjong got an odour complaint every ten days.

## **Clarence**

The Clarence colliery has one major water pollution discharge point, into the near pristine headwaters of the Wollangambe River which flows into the Blue Mountains World Heritage Area. Two other discharge points release leachate water during high rainfall events. Unlike many other mines,

Clarence treats the water before discharging, for metals, but it still has significant water pollution problems. Clarence was penalised by the EPA for exceeding manganese discharge limits in 2012. According to the NPI reports, it is the fifth largest water polluter of zinc and the third largest for manganese. During 2012, exceedance of limits on pH, total suspended solids, cadmium, manganese and zinc were recorded at one of the high rainfall discharges. Similarly, in 2013, there were exceedances of Manganese limits at one discharge point, and various metals at another.



Tailings Dam: Dean Sewell

The EPA reviewed the Environment Protection Licence for this mine in 2015 and found it was introducing high volume point source pollution into an area that has generally excellent water quality. The EPA found that there was very little dilution of the discharge once it joined the river, because of its high volume and headwaters location and that compared to the river upstream of the discharge, and other waterways on the Newnes Plateau, the discharged waters had elevated levels of cobalt, magnesium, nickel, strontium, sulphur and zinc, among other pollutants. Some contaminants were at levels toxic to some aquatic invertebrates and algae. A few months after this investigation was completed, a coal fines reject pile at Clarence colliery collapsed into the Wollangambe River, polluting it with coal fines for several kilometres. It took the EPA and Centennial Coal five months to remove 163 tonnes of material from the river.

## Dendrobium

South 32's Dendrobium mine is located to the west of Lake Cordeaux and east of Lake Avon. The mine's surface facilities are located within the catchment of American Creek and Water and Brandy Creek which flows to Allans Creek and then into the Inner Harbour at Port Kembla. The mine is licensed to discharge arsenic, copper, nickel and zinc into Allan's Creek, a tidal creek flowing into Port Kembla harbour. Dendrobium coal mine is the largest reported polluter of nickel and Chromium III into water in NSW, and the second largest reported for arsenic pollution, releasing 81kg into the local creek. The mine is also a significant polluter of zinc and lead. The area being mined is destroying a cluster of four upland swamps classified as being of special significance by the Office of Environment and Heritage, as well as three smaller swamps. These swamps filter and release clean water into Sydney's drinking water catchment, in this case, Avon Dam, and Pheasant's Nest Weir.

## Mount Arthur

Mount Arthur is the biggest coal mine in New South Wales and is owned by BHP Billiton. In its last reporting period, the mine produced 24 million tonnes of run of mine coal. Mount Arthur is the second biggest reported source of airborne formaldehyde in NSW. It is the worst ranked coal mine for airborne benzene and fourth worst ranked coal mine for oxides of nitrogen. It is the fifth largest site source in the state for PM10 coarse particles, after Wilpinjong, Ravensworth and HVO, and the fifth largest coal mine emitter of PM2.5 (ranked eighth overall in the state), creating 15% of the total reported emissions of that substance in NSW. Mount Arthur also reports significant emissions of PAHs, hexavalent chromium, and volatile organic compounds. Under the terms of its Environmental Protection Licence, Mount Arthur is required to monitor for PM10 pollution and deposited dust, but no other monitoring for

air quality is required of them, nor are their air pollution limits imposed for any substance.

Last year, the mine recorded nine exceedances of the 24 hour PM10 standard of 50µg per cubic metre. On nearby Roxburgh Road, the peak measurement for PM10 during the last reporting period for Mount Arthur was 89µg per cubic metre. Roxburgh Road lies between Mount Arthur, Bengalla and Mangoola mines, however, and Mount Arthur's environmental report for that year claims that they "investigated" and concluded that "Mt Arthur Coal's contribution to these results was less than 50µg/m<sup>3</sup> on all occasions." Shepherd Avenue, on the southern outskirts of Muswellbrook less than 2km from Mount Arthu, recorded six exceedances of the 24 hour PM10 standard and also exceeded the annual average standard for PM10. In this case, too, BHP used modelling to calculate its responsibility for the pollution and determined it was less than the standard. Exceedances of the PM10 standard were also measured at other residential locations near the mine, including South Muswellbrook. In all but one case, BHP found that it was not solely responsible for the exceedance, and, therefore, not responsible at all.

## **Mandalong**

Mandalong mine in Lake Macquarie is the fifth worst offender in polluting water with cobalt and compounds, and is also a significant polluter of nickel and arsenic. Mandalong mine is ranked 13th in the state for pollution of water by arsenic, according to the NPI data, and reported dumping 1.13kg of arsenic and compounds in water in 2014. An expert analysis by Dr. Ian Wright of the surface water pollution impacts of an expansion of the Mandalong mine, which was approved in October, found that the current mine operation is not meeting its Environment Protection Licence requirements with regard to water pollution<sup>5</sup>. Dr. Wright found that nickel concentrations of 59 to 61µg/L are at levels higher than ANZECC guidelines and noted other elevated metals of concern as boron, barium, lithium, molybdenum, and zinc. Despite this, the mine has just been given development consent to expand its operations, and Centennial coal will be dumping significantly more water that is polluted with heavy metals into the creeks that feed Lake Macquarie. Centennial Coal is required by its Environment Protection Licence to collect monthly samples and analysis of a number of pollutants, including arsenic, nickel, cobalt and other metals. The company was supposed to assess the environmental effects of this pollution load after two years of monitoring, but four years on, they are planning to increase their pollution rate. Mandalong is a perfect candidate for a load-based licencing approach to ensure that the company is working to reduce pollution into Lake Macquarie, especially given that the total amount of water pollution they will produce is about to significantly increase.

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5. Wright, Ian A. December 2013. <http://www.mandalong.net.au/index.php/mining-in-mandalong/impact-of-the-mandalong-southern-extension-eis-on-surface-water-quality-and-aquatic-ecosystems>