LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Part 3 - Pollution and Prevention

Environmental Essentials WA

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Overview

Environmental Essentials WA

OUTCOMES

You will gain a general overview of pollution, their impacts and how they can be controlled and managed. In particular:

- What is Pollution?
- What is Pollution Prevention?
- Types, sources, control and mitigation of:
  - Air Pollution
  - Water Pollution
  - Noise Pollution
  - Light Pollution
- What is waste?
- Understand why waste should be managed.

RELEVANCE TO WA INDUSTRIES

- *Environmental Protection Regulations 1987*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*
- Includes discharges to: Soil, surface water, groundwater, air, stormwater drains, vessels or receptacles which are connected to the environment, any other place that has direct connectivity to the environment (for example road surfaces, forecourts, carparks or hardstands).
- Materials burning (causing visible smoke)

ENVIRONMENTAL PROTECTION REGULATIONS 1987

- *Clean Air (Determination of Air Impurities in Gases Discharged to the Atmosphere) Regulations 1983*
- *Environmental Protection (Abattoirs) Regulations 2001*
- *Environmental Protection (Abrasive Blasting) Regulations 1998*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- *Environmental Protection (Concrete Batching and Cement Product Manufacturing) Regulations 1998*
- *Environmental Protection (Controlled Waste) Regulations 2004*
- *Environmental Protection (Domestic Solid Fuel Burning Appliances and Firewood Supply) Regulations 1998*
- *Environmental Protection (Fibre Reinforced Plastics) Regulations 1998*
- *Environmental Protection Goldfields Residential Areas Sulfur Dioxide Policy and Regulations 2003*
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992*
- *Environmental Protection (Metal Coating) Regulations 2001*
- *Environmental Protection (NEPM-NPI) Regulations 1998*
- *Environmental Protection (Noise) Regulations 1997*
- *Environmental Protection (Packaged Fertiliser) Regulations 2010*
- *Environmental Protection (Petrol) Regulations 1999*
- *Environmental Protection (Recovery of Vapours from the Transfer of Organic Liquids) Regulations 1995*
- *Environmental Protection (Rural Landfill) Regulations 2002*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*
- *Noise Abatement (Noise Labelling of Equipment) Regulations (No. 2) 1985*

WHAT IS POLLUTION?

- The introduction of contaminants into the natural environment that cause adverse change.
- Direct or indirect alteration of the environment
- Can take the form of chemical substances, or energy, such as noise, heat, light or electromagnetic radiation.
- The components of pollution, can be either foreign substances/energies or naturally occurring contaminants
- Can be point source (from a single source) or non-point source pollution (multiple sources).

POLLUTION PREVENTION

- Practice that reduces, eliminates, or prevents pollution at its source - "source reduction"
- Not the same as recycling, treatment and disposal

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Air pollution

Environmental Essentials WA

Chemical additions to the atmosphere by natural events or human activities in high enough concentrations to be harmful

Two categories

- Primary Air Pollutant
  - Harmful substance that is emitted directly into the atmosphere
- Secondary Air Pollutant
  - Harmful substance formed in the atmosphere when a primary air pollutant reacts with substances normally found in the atmosphere or with other air pollutants

CHARACTERISTICS OF MAIN AIR POLLUTANTS

Pollutant	Composition	Primary or Secondary	Characteristics
Particulate matter			
Dust	Variable	Primary	Solid particles
Lead	Pb	Primary	Solid particles
Sulfuric acid	H_2SO_4	Secondary	Liquid droplets
Nitrogen oxides			
Nitrogen dioxide	NO_2	Primary	Reddish-brown gas
Sulfur oxides			
Sulfur dioxide	SO_2	Primary	Colorless gas with strong odor
Carbon oxides			
Carbon monoxide	CO	Primary	Colorless, odorless gas
Carbon dioxide*	CO_2	Primary	Colorless, odorless gas
Hydrocarbons			
Methane	CH_4	Primary	Colorless, odorless gas
Benzene	C_6H_6	Primary	Liquid with sweet smell
Ozone	O_3	Secondary	Pale blue gas with acrid odor
Air toxics			
Chlorine	Cl_2	Primary	Yellow-green gas

Some standards

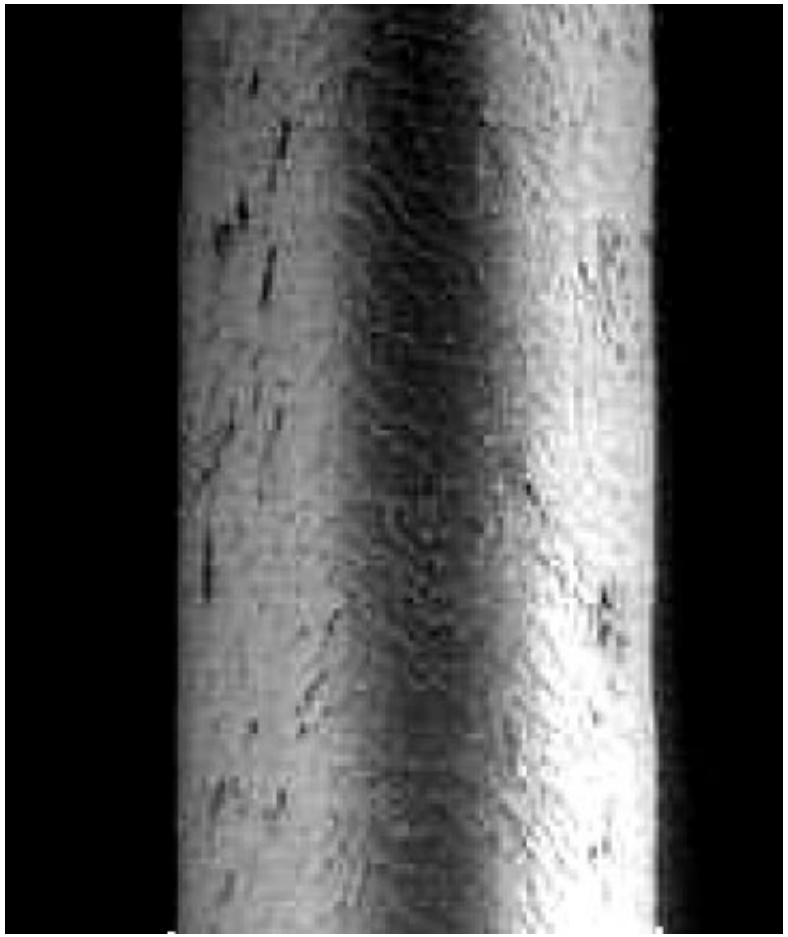
Pollutant	Averaging period	maximum concentration standard	Exceedance
Carbon monoxide	8 hours	9.0 ppm	None allowed
Nitrogen dioxide	1 hour 1 year	0.08 ppm 0.015 ppm	None allowed
Photochemical Oxidants (ozone)	8 hours	0.065 ppm	exceptional events
Sulphur dioxide	1 hour 1 year	0.10 ppm 0.02 ppm	None allowed
Lead	1 year	0.50 μg m^{-3}	None allowed
Particles as PM_{10}	1 day 1 year	50 μg m^{-3} 25 μg m^{-3}	exceptional events
Particles as $PM_{2.5}$	1 day 1 year	25 μg m^{-3} 8 μg m^{-3}	exceptional events

SOURCES AND EFFECTS OF AIR POLLUTION

Pollutant	Source	Effects
Particulate	Industries, electric power plants, motor vehicles, construction, agriculture	Aggravates respiratory illnesses; long-term exposure may cause increased incidence of chronic conditions such as bronchitis; linked to heart disease; suppresses immune system; some particles, such as heavy metals and organic chemicals, may cause cancer or other tissue damage
Nitrogen oxides	Motor vehicles, industries, heavily fertilized farmland	Irritate respiratory tract; aggravate respiratory conditions such as asthma and chronic bronchitis
Sulfur oxides	Electric power plants and other industries	Irritate respiratory tract; same effects as particulates
Carbon monoxide	Motor vehicles, industries, fireplaces	Reduces blood's ability to transport oxygen; headache and fatigue at lower levels; mental impairment or death at high levels
Ozone	Formed in atmosphere (secondary air pollutant)	Irritates eyes; irritates respiratory tract; produces chest discomfort; aggravates respiratory conditions such as asthma and chronic bronchitis

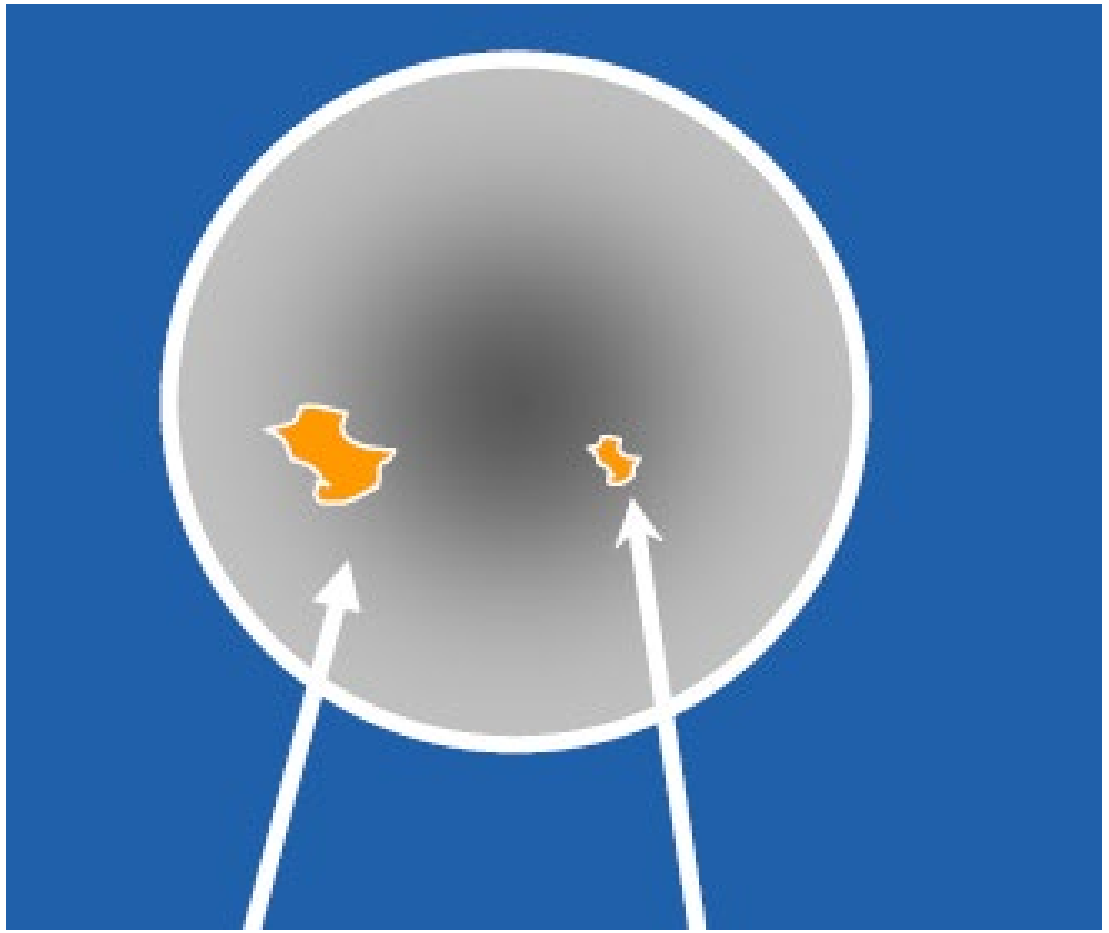
- CO_2 and hydrocarbons contribute to climate change

Particulate Matter



Human hair

(70 µm diameter)



PM 10

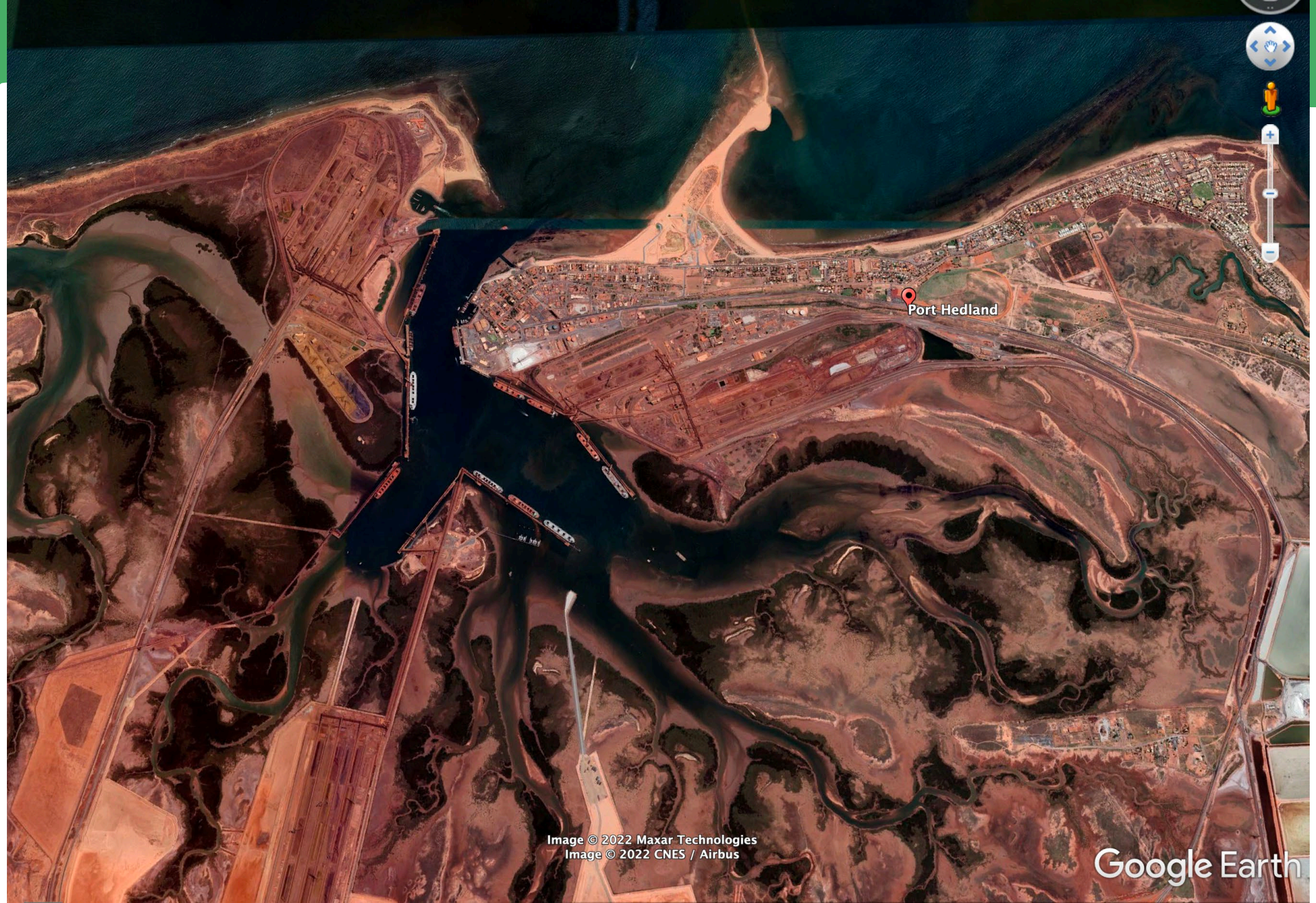
(10 µm)

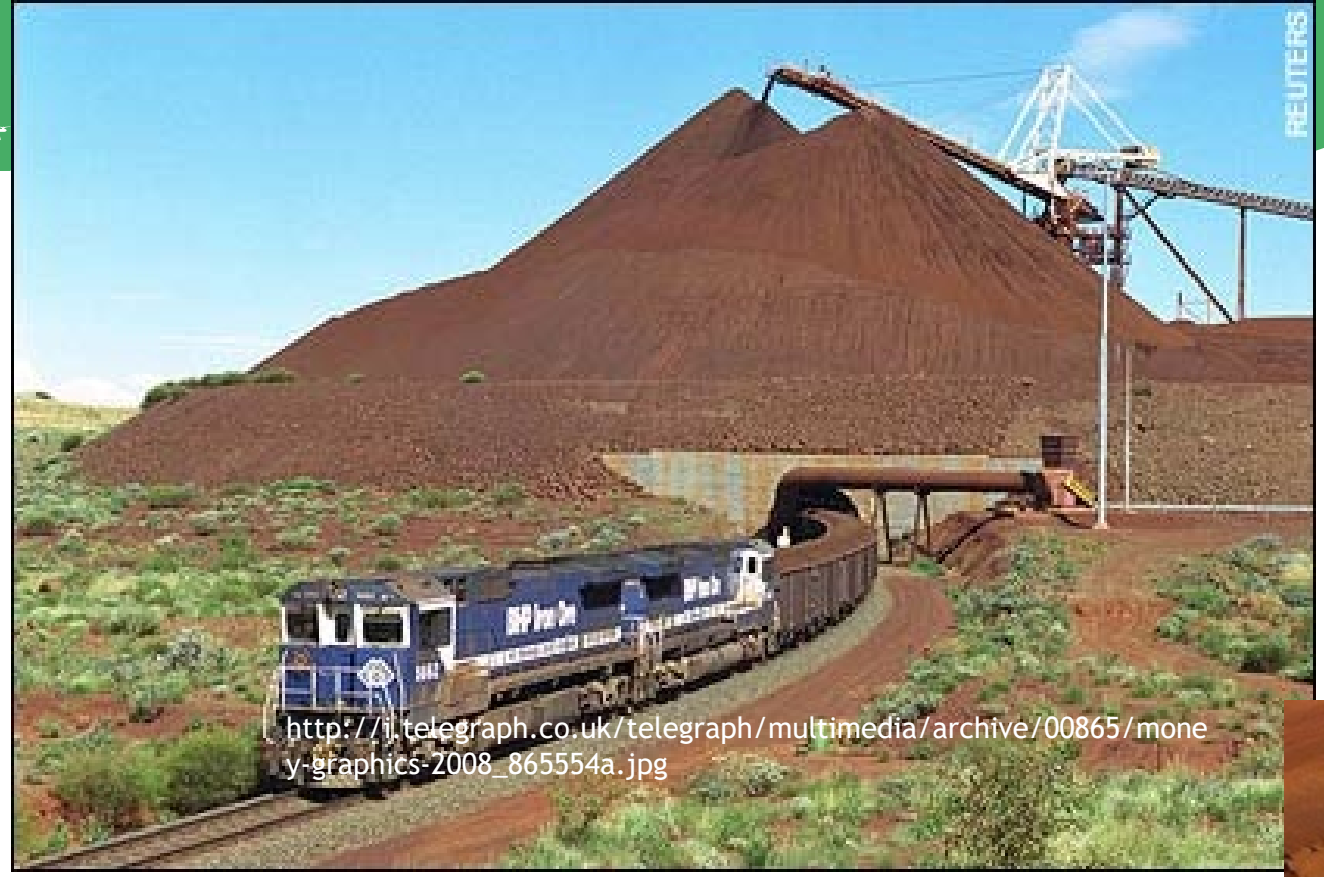
PM 2.5

(2,5 µm)

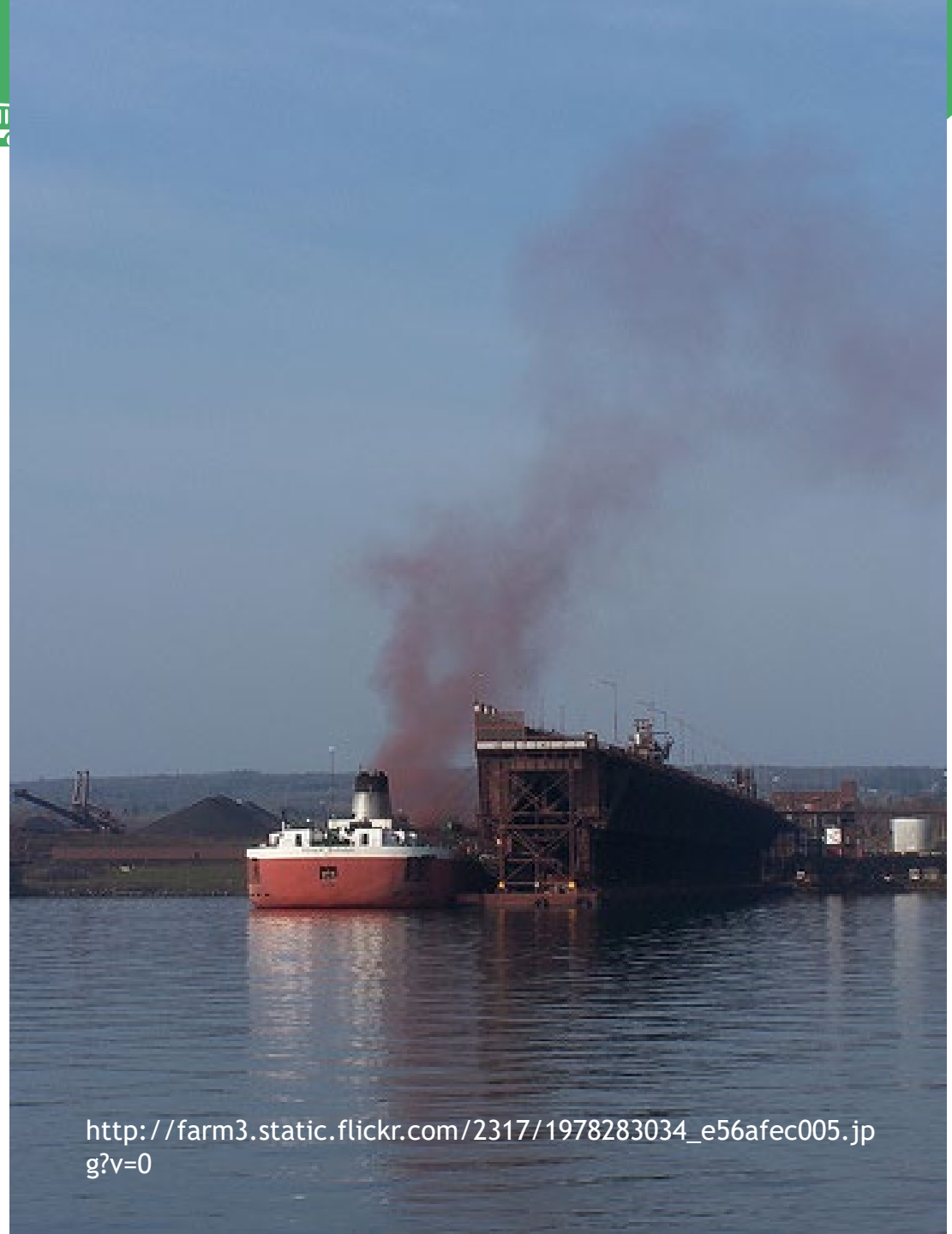
Port Hedland and dust

- Sources
  - Natural – dust storms
  - Iron ore handling


Port Hedland
Image © 2022 Maxar Technologies
Image © 2022 CNES / Airbus
Google Earth



http://i.telegraph.co.uk/telegraph/multimedia/archive/00865/money-graphics-2008_865554a.jpg



http://farm3.static.flickr.com/2317/1978283034_e56afec005.jpg?v=0

Dust

- Particulates
- Size is an issue
- Concentration of particulates
- PM_{10} and more recently $PM_{2.5}$
  - Particulate matter (PM)
  - Size – e.g. 10 micrometers or less in diameter

Health impacts

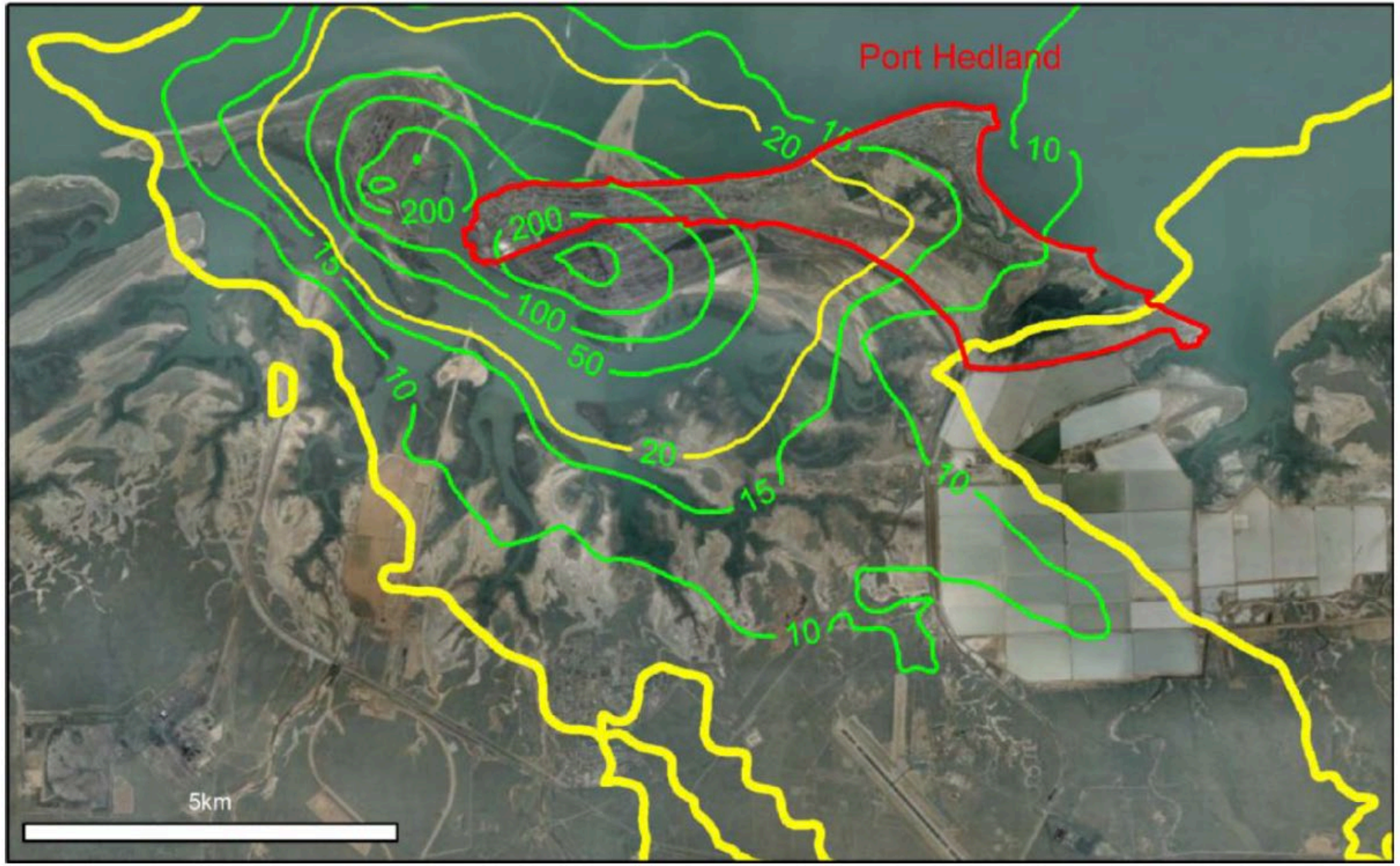
- Toxic effects by absorption into the blood (e.g. lead, cadmium, zinc)
- Allergic or hypersensitivity effects (e.g. some woods, flour grains, chemicals)
- Bacterial and fungal infections (from live organisms)
- Fibrosis and cancer (e.g. asbestos, quartz)
- Irritation of mucous membranes (e.g. acid and alkalis)
- Increased respiratory symptoms, aggravation of asthma and premature death.
- Sensitive groups - elderly and children.

Dust criteria

Table 1: Air NEPM Particle Standards and Goals

Pollutant	Averaging period	Standard (Maximum concentration)	Goal (Maximum allowable exceedences)
Particles (as PM_{10})	1 day	50 µg/m^3	5 days a year
Particles (as $PM_{2.5}$)	1 day	25 µg/m^3	Goal is to gather sufficien data nationally to facilitate review of the Advisory Reporting Standards
	1 year	8 µg/m^3	

Figure 1: Current Number of Exceedences of 50µg/m3




Port Hedland

The ‘values’

- Protecting human health,
- Port the main employer in the Town,
- Export income and Royalties,
- Financial contribution to Town.

Options

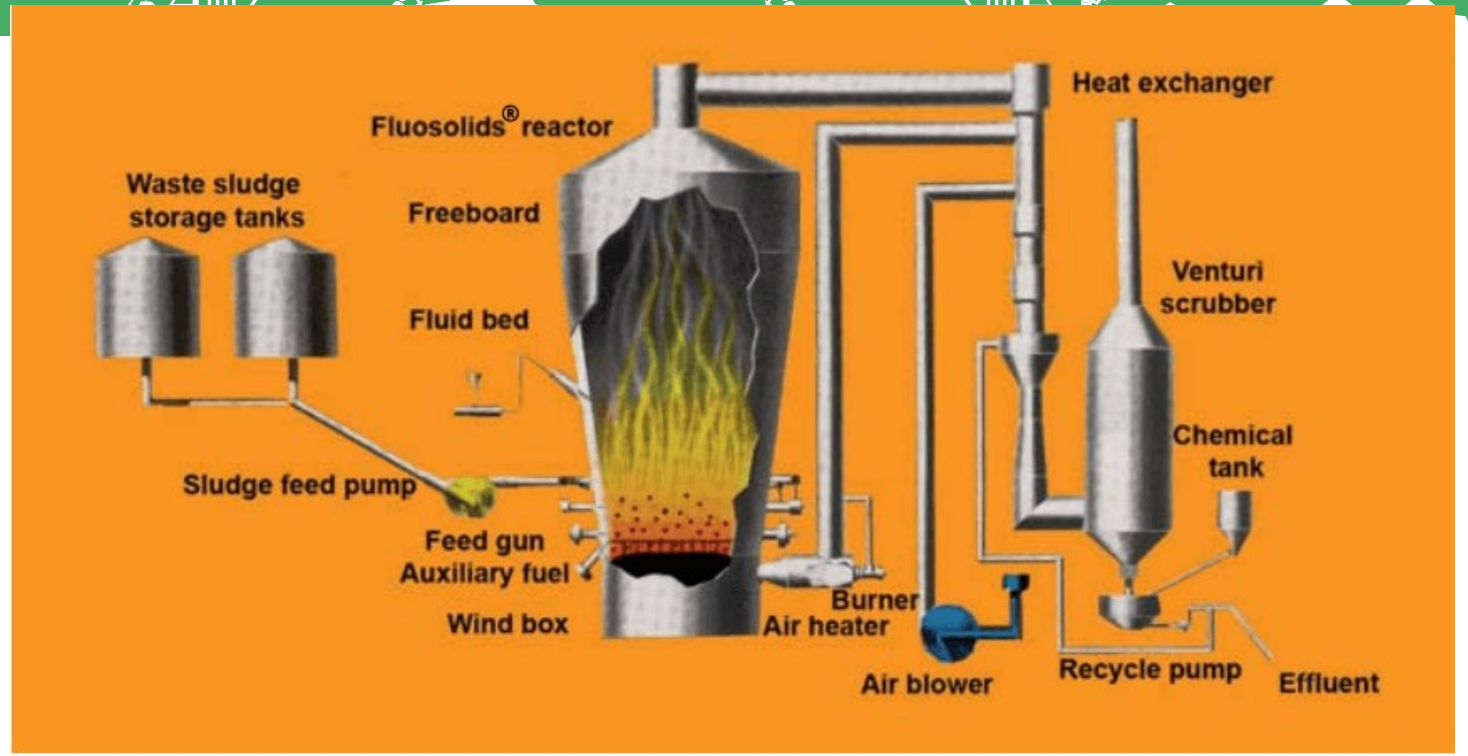
- Accept poor air quality
- Better regulation of the port operators
- Move the Port
- Move the affected people


Port Hedland

Air quality and Kalgoorlie

33% Sulphur

https://www.911metallurgist.com/blog/wp-content/uploads/2016/02/orpiment.png



Combustion system

https://www.911metallurgist.com/blog/wp-content/uploads/2016/07/roaster.png

http://purl.slwa.wa.gov.au/slwa_b1855508_2.jpg`

Kalgoorlie Gold roasting and SO_2

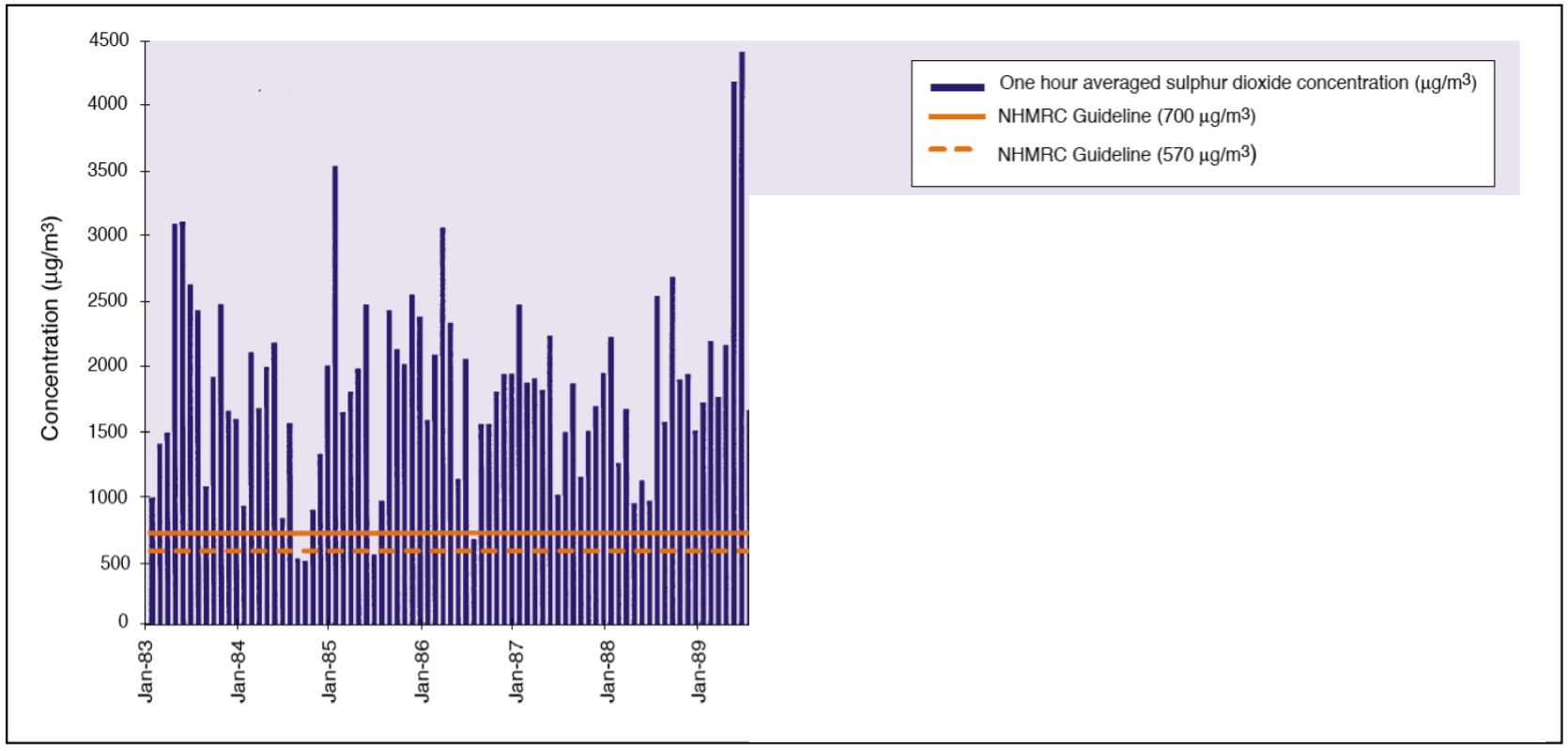


Figure 14. *Maximum average hourly sulphur dioxide levels at Kalgoorlie Hospital with significant events resulting in changes to the ambient sulphur dioxide concentration (Source: Department of Environmental Protection).*

Kalgoorlie – environmental regulation and industry cooperation

What happened

- Several small and old technology roasters in town;
- Then DoE pushed hard to regulate the emissions to improve air quality;
- Push back from industry, but pressure from DoE and EPA meant relocation of roaster to out of town and improved technology

The roasters

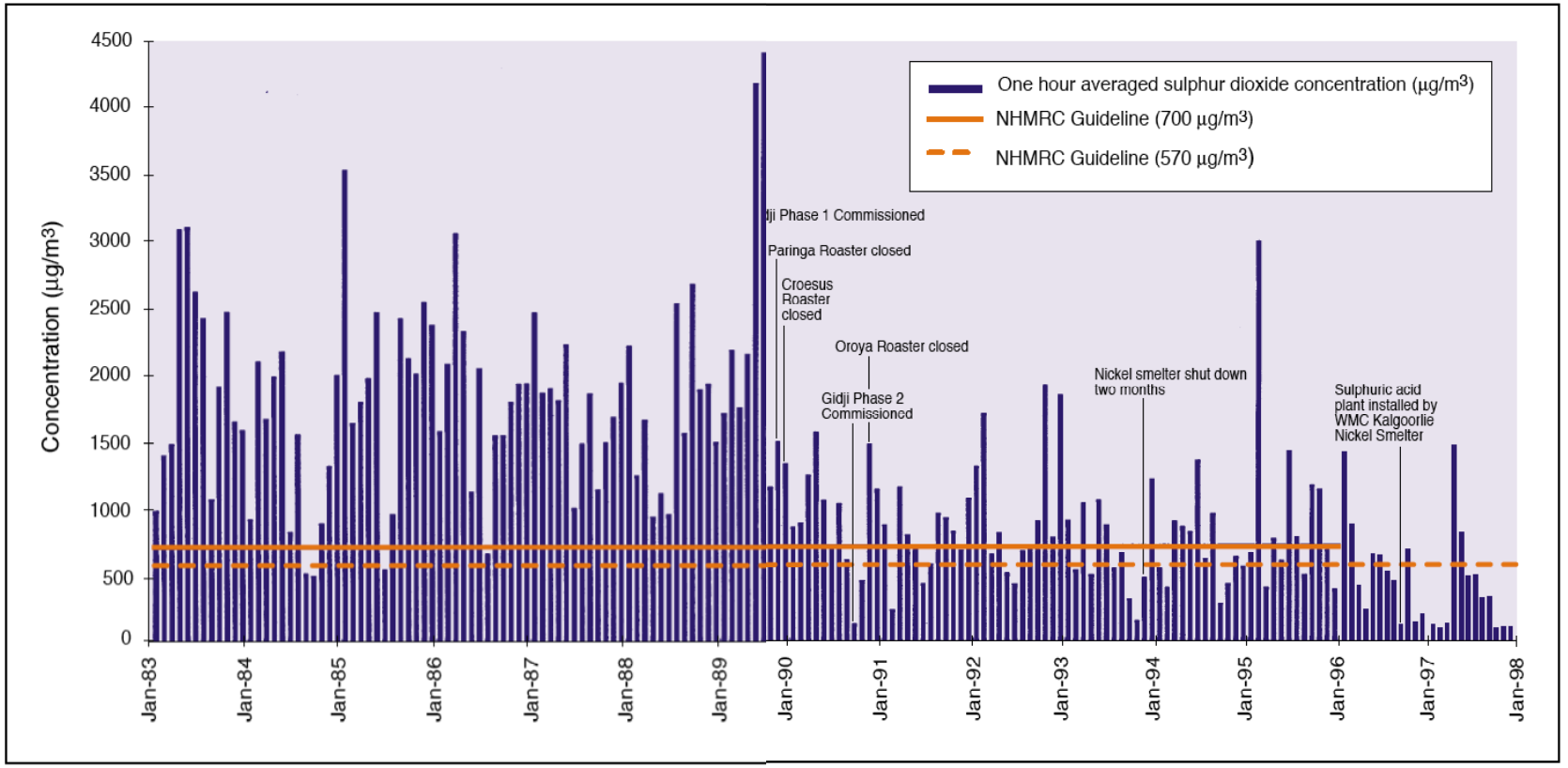


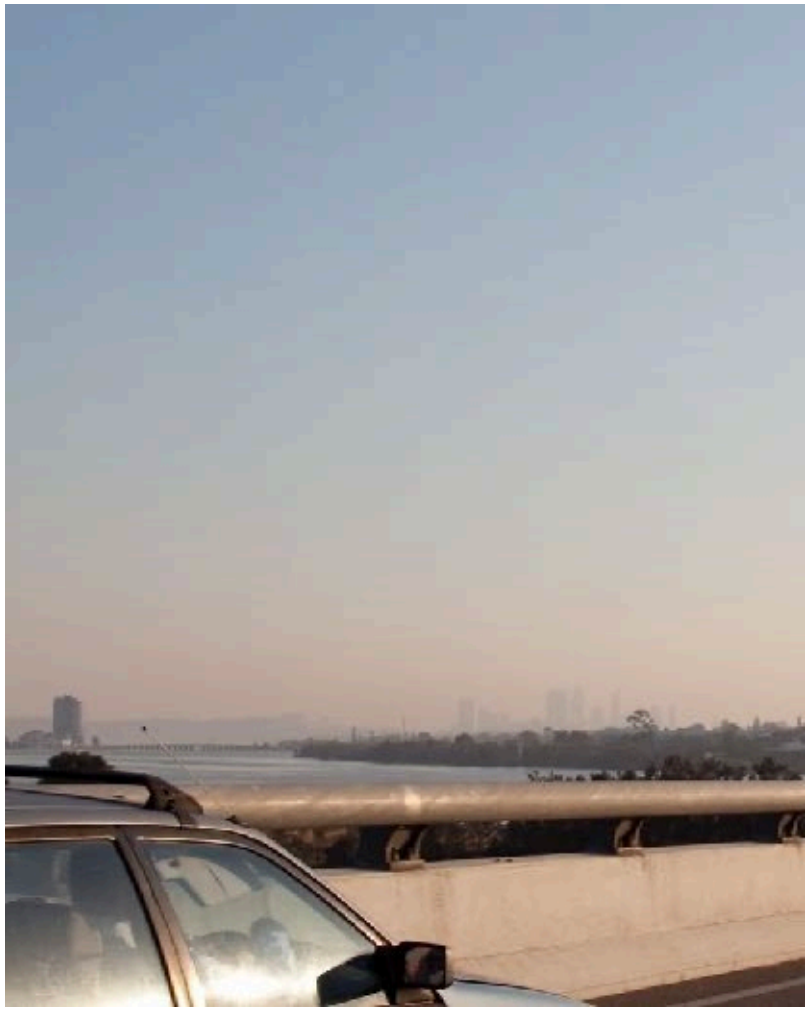
Figure 14. *Maximum average hourly sulphur dioxide levels at Kalgorlie Hospital with significant events resulting in changes to the ambient sulphur dioxide concentration (Source: Department of Environmental Protection).*

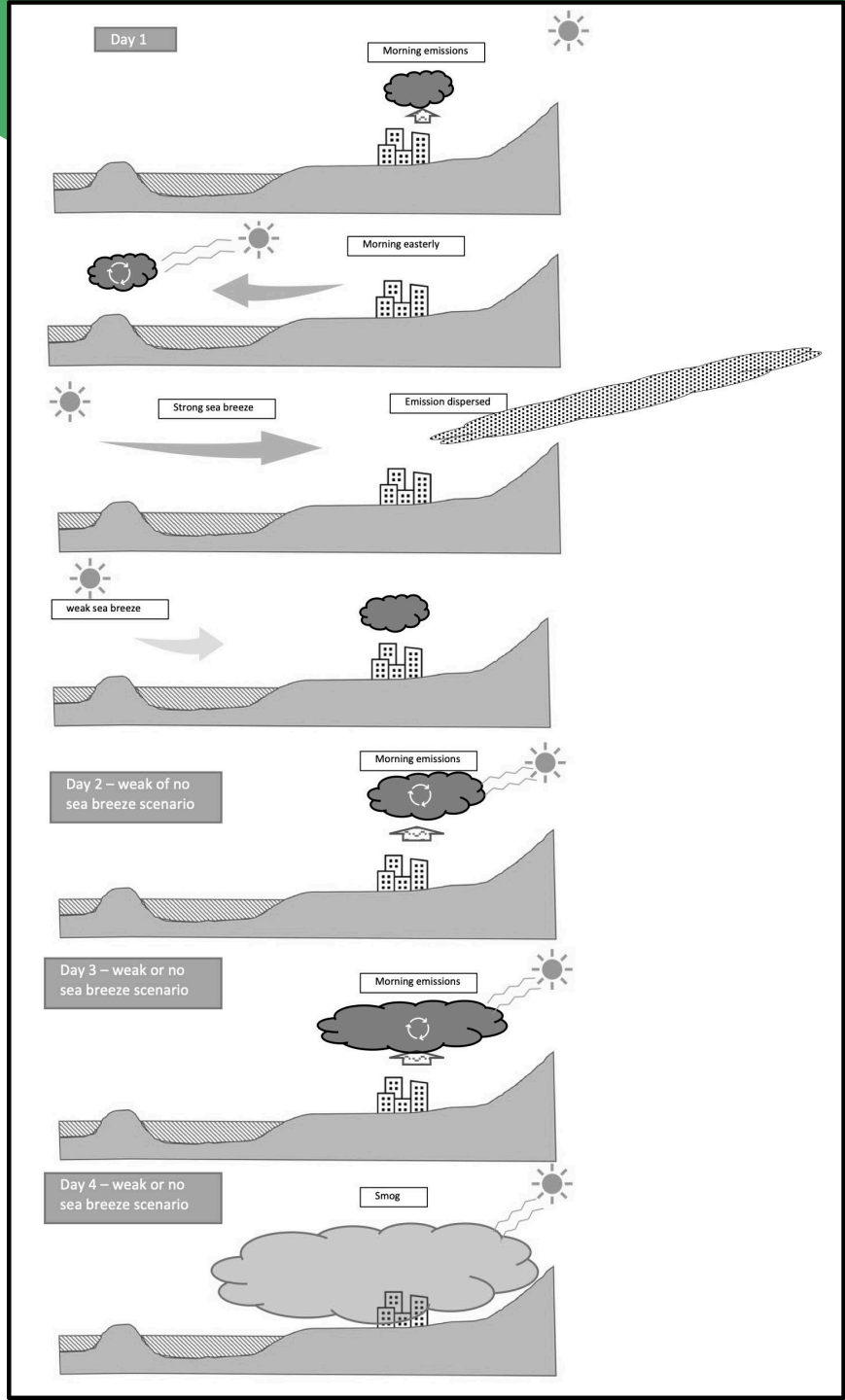
Photochemical smog

a ‘chemical cocktail’ of gases reacts in presence of light to form a visible, often brown, layer in the lower atmosphere

typically has high concentrations of ozone (O_3) at ground level.

Ozone is formed when oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) react





LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Water pollution

Environmental Essentials WA

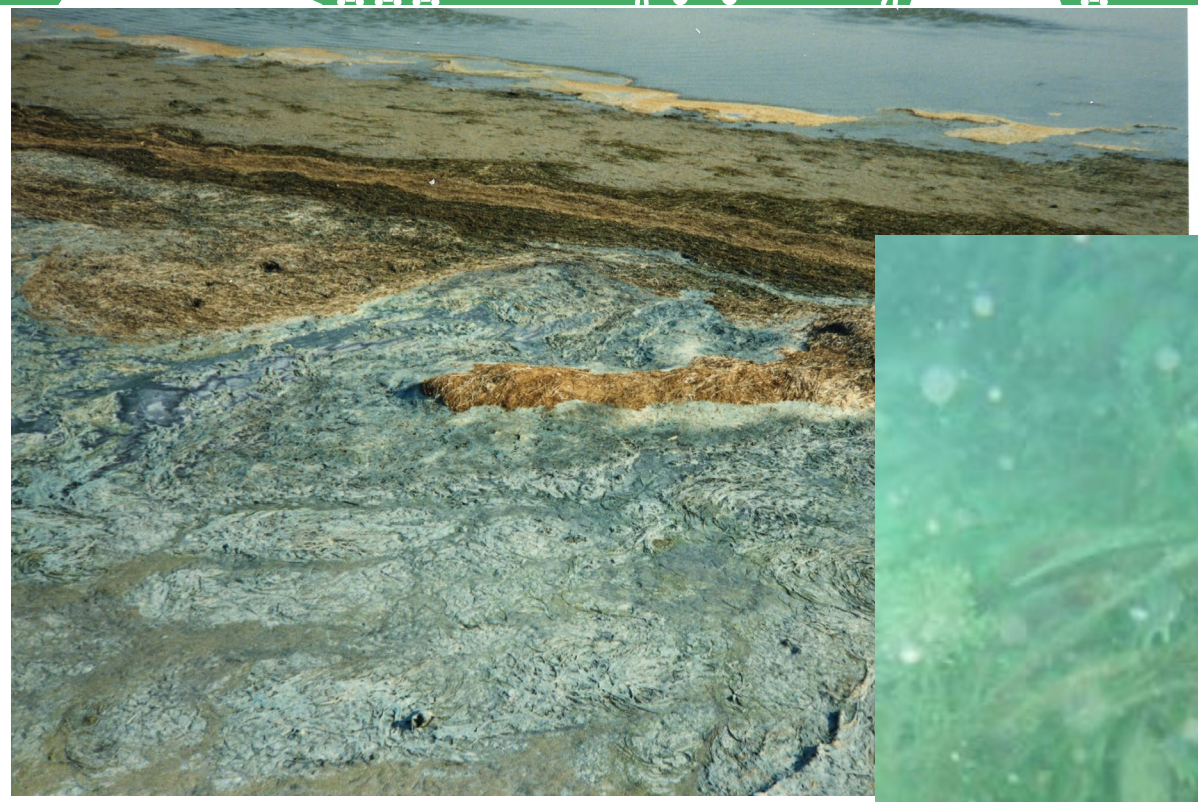
WATER POLLUTION

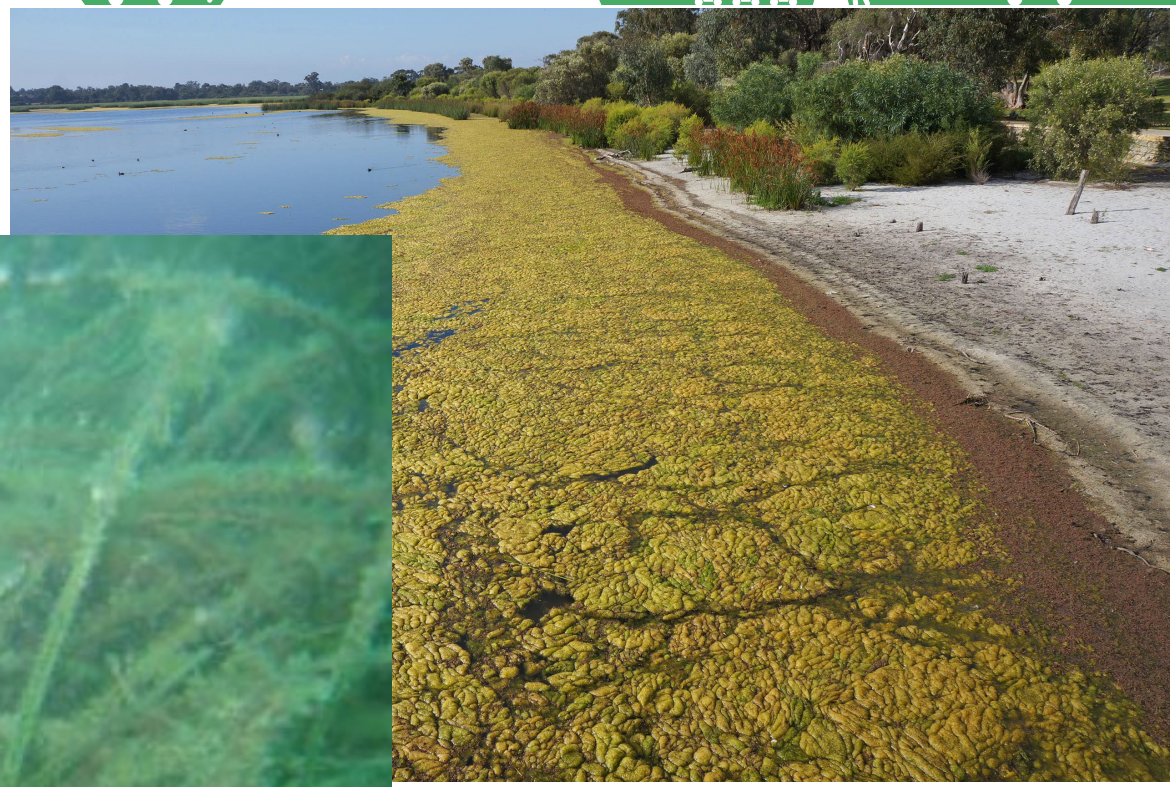
- Any physical or chemical change in water (including lakes, rivers, oceans, aquifers and groundwater) that adversely affects the health of humans and other organisms.
- Water …the universal solvent.

SOURCES AND EFFECTS OF WATER POLLUTION

Pollutant	*Source*	*Effects*
Bacteria and viruses (E. coli)	Sewage; Human and animal waste	Skin issues; illness/death from hepatitis, typhoid, and cholera if water is ingested
Oxygen demanding chemicals (Organic debris & waste + aerobic bacteria)	Sewage, feedlots, paper milling, food processing	Eutrophication; algal blooms; ecosystem degradation
Inorganic Contaminants (Heavy Metals, Ammonia, nitrogen, phosphorous)	Surface runoff, Industrial effluent, household cleansers	Illness; death; ecosystem degradation; Eutrophication; algal blooms
Nitrates, Phosphates	Sewage, manure, agricultural fertilizer and landscaping runoff	Eutrophication; algal blooms
Organic chemicals (Oil, Gasoline, Plastics, Pesticides, Solvents, detergents)	Industrial effluent; household cleansers, runoff from farms and yards	Oil smothering; ecosystem degradation
Sediment	Water (and wind) Erosion	Toxin transport to waterway; turbidity, suffocation, smothering.
Heat/Thermal	Power plants, industrial processes	Ecosystem degradation; Increased algal blooming – reducing oxygen
Solid waste	Anthropogenic (i.e. man)	Human and aquatic organism health; aesthetics

EUTROPHICATION





Nitrogen – sea water
Blue-green algae

Phosphorus hypersaline

Phosphorus - freshwater

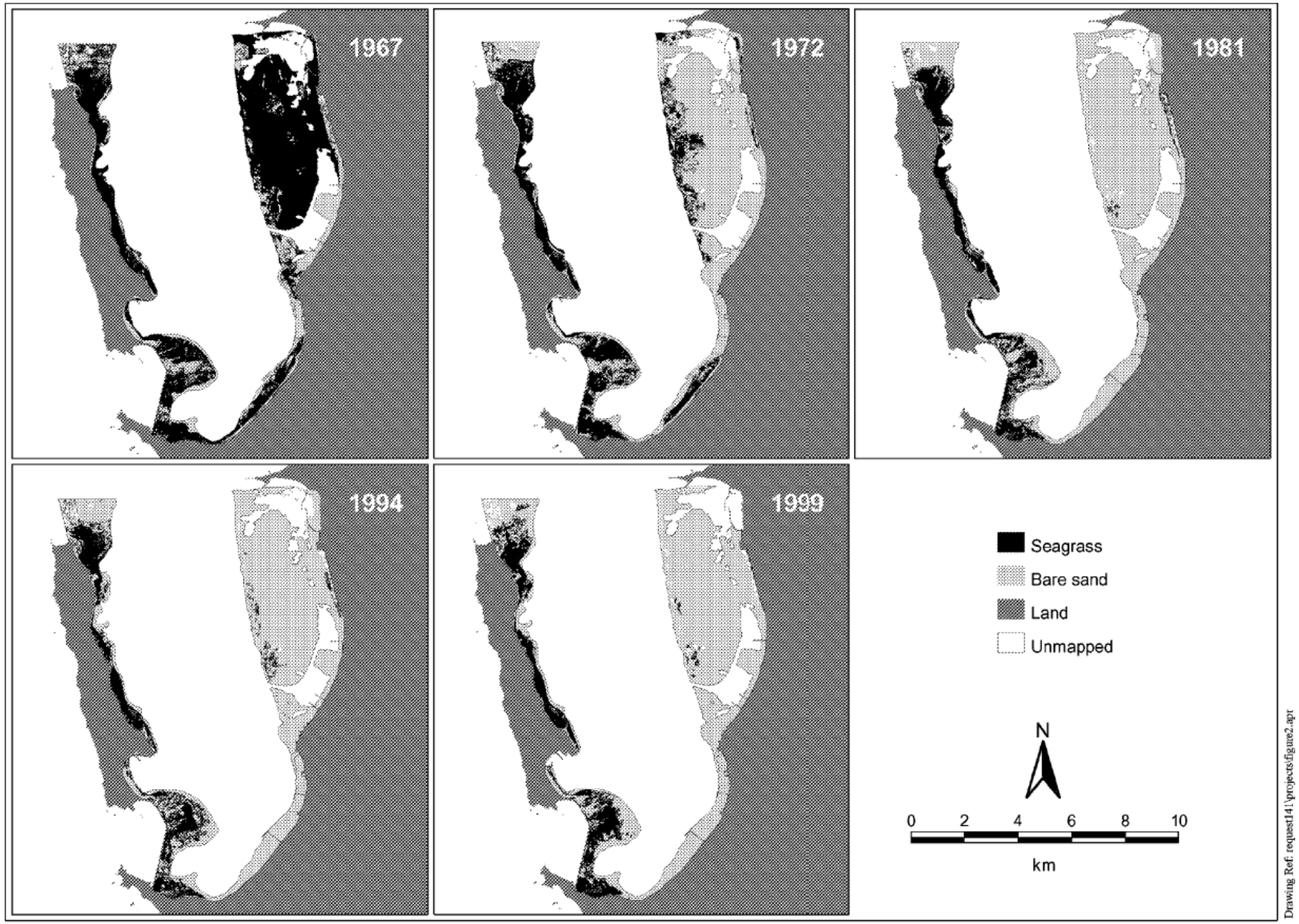
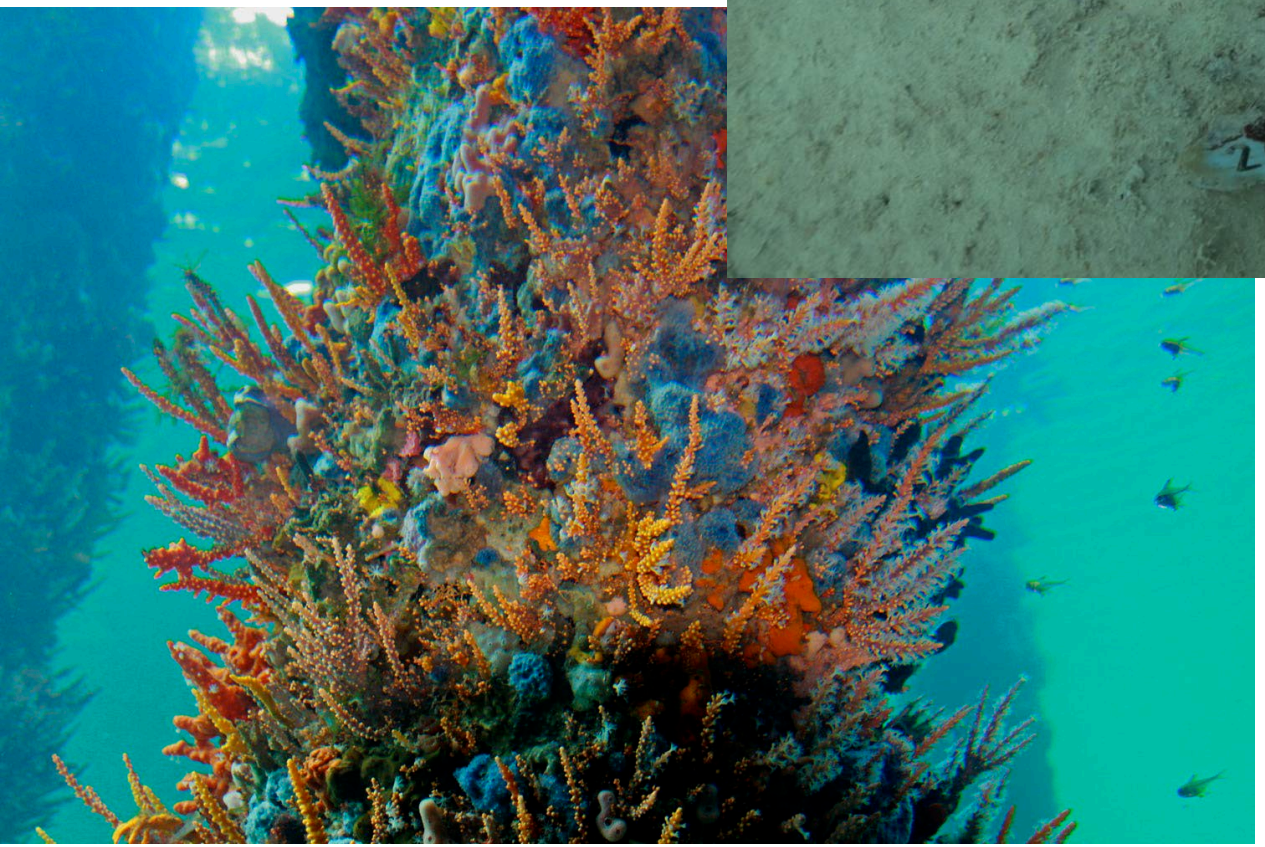


Fig. 2. Distribution of seagrasses in Cockburn Sound in 1967, 1972, 1981, 1994 and 1999.

TURBIDITY



https://mediad.publicbroadcasting.net/p/wlrn/files/styles/x_large/public/201906/buried_coral_dep.jpg

MINE WASTEWATER

- Water is essential for mining operations:
  - Processing — wet grinding, washing, flotation, leaching, etc.
  - Utilities — cooling water, pollution control, etc.
  - Dust suppression
  - Transportation — pumping tailings and products
  - Cleaning equipment, etc.
- In general, the lower the grade of ore, the more water intensive the mining process to extract the ore.

MINE WASTEWATER TREATMENT

Category	Examples	Application
Neutralization	lime or limestone addition	acid rock drainage
Passive treatment	wetland systems	polishing
Metals removal	sulfide precipitation, biological filters, fluidized bed reactor	metal recovery - saleable product
Metals removal	hydroxide precipitation (HDS process), coagulation-flocculation, clarification	metal removal; arsenic removal
Membranes	microfiltration, ion exchange, reverse osmosis	water reuse; metals removal
Biological treatment	Fixed film or suspended	Nitrogen removal, selenium removal, bioleaching
Evaporators and concentrators	brine concentrators, crystallizers	zero liquid discharge
Dewatering	clarifiers, dissolved air flotation	volume reduction of tailings
Filtration and thickening	pressure filters, paste thickeners	volume reduction of tailings
Cyanide treatment	alkaline chlorination, hydrogen peroxide process	gold mine effluent

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Sound and noise

Environmental Essentials WA

SOUND v NOISE

- ‘Noise’ is unwanted sound judged to be unpleasant, loud or disruptive to hearing, or a particular activity.
- Natural sounds like bird noises may well be more acceptable than traffic noise
- noise can cause disturbance to people’s rest or recreational activities, and especially effect the elderly or sick.
- Noise that occurs at night is more likely to cause a disturbance than noise that occurs during the day.
- Unacceptable noise disturb people’s sleep and can lead to significant health issues due to sleep deprivation

Noise types

- Noise can be
  - audible and inaudible (commonly called vibrations)
- Noise can be
  - chronic being constant and forms part of the overall background of noise (i.e. “humming”, “whining” and traffic noise), and can also involve modulation (i.e. regular changes in level or pitch, e.g. a siren
  - acute or impulsiveness (e.g. “hammering”, cars breaking, shouting etc.) – cause most problems

SOURCES OF NOISE

- Road traffic e.g. moving trucks, automobiles, buses, especially those with modified silencer system
- Industrial (power plants, stone crushing, metal workshops, cabinet making)
- Machinery (generator sets, compressors, air conditioning units, boilers, pumps, motors)
- Construction and roadworks
- Aircrafts and ship engines
- Community noise e.g. radio/TV, loudspeakers, pool houses and alarms
- Animals (birds)
- Places of entertainment, including night clubs, loud speaker, amplifier, musical instrument

NOISE EFFECTS

- Hearing Loss (Including Occupational Hearing Loss)
- Stress
- High Blood Pressure
- Sleep Loss
- Distraction
- Disorientation
- Productivity Loss
- Irritability
- Headache
- Annoyance
- Interference with Communications

Regulating noise

- Noise that is fixed in one location (industry, concerts etc.) are regulated with set standards through Regulations
- Noise from mobile sources - traffic, trains trucks etc. - are not covered by formal standards, although there are guidelines
- Regulated by DWER and Local Government
- Regulations - *Environmental Protection (Noise) Regulations 1997*
- Regulation 7 requires that noise emitted from any premises must comply with assigned noise levels when received at any other premises and be free of the intrusive characteristics of tonality, modulation and impulsiveness
- The assigned levels are specified under Regulation 8, according to the type of premises receiving the noise, the time of day and the presence of commercial and industrial land use zonings and major roads within a 450 metre radius of the receiver.

Regulating noise

- In general different standards apply at different time during the day as follows:
  - 0700-1900 hours Monday to Saturday;
  - 1900-2200 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays; and
  - 2200-0700 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays.
- Calculation of noise levels is a highly technical process involving on-site measurements, modelling to take into account different weather conditions, and the use of statistics.

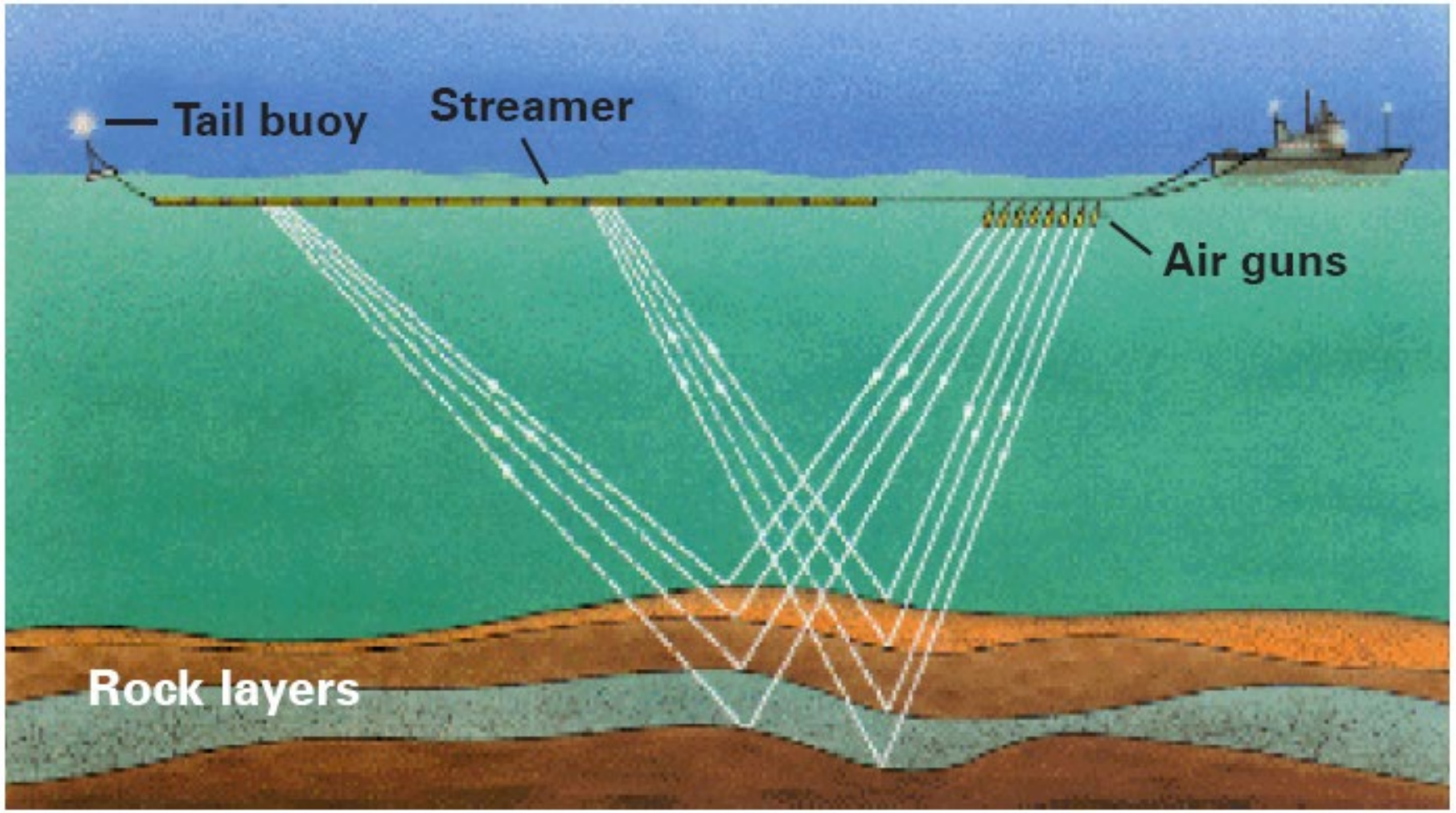
EXEMPTIONS

- Some farm vehicles
- Construction sites, at certain times of the day
- Equipment operated on residential premises (including musical instruments) at certain times of the day
- Bell-ringing and calls to worship at certain times of the day
- Community activities including: - spectators at organised sporting activities
- Public meetings and processions
- Religious activities
- Recreational and educational activities associated with schools and other premises used for educational purposes
- Agricultural shows, fairs, fetes, exhibitions and like events.

Exemptions – Reg 17

- Regulation 17 allows a proponent who believes they “cannot reasonably or practicably comply with a standard prescribed under these regulations” to apply to the Minister for approval to emit noise that exceeds or varies from the standard set in the Regulations
- Regulation 17 is aimed at large industrial premises
- 11 Reg 17 approvals
  - Wagerup Alumina Refinery;
  - Port of Esperance;
  - Fimiston Gold Mine in Kalgoorlie;
  - Australind Pigment Plant;
  - Pinjar Gas Turbine Station;
  - Talison Lithium Australia Greenbushes Operation;
  - Global Advanced Metals Greenbushes Operation;
  - Wesfarmers Premier Coal Mine in Collie;
  - Dardanup Pine Log Sawmill;
  - Western Power Transmission Substations (various locations); and
  - Western Power Electrical Distribution Transformer (various locations)

MARINE ANIMAL RECEPTORS



How seismic works. Source: http://www.glossary.oilfield.slb.com/default.cfm

Sensitive species

- **Table 6-10 Predictable occurrence periods for sensitive marine fauna in the Cape Lambert area**

Receptor	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Turtle nesting	■	▒	▒								▒	■
Emerging hatchlings	■	■	▒	▒								▒
Humpback whales							▒	■	■	▒		
Coral spawning		■	■	■							■	■
Legend	■	*Predicted occurrence*			▒	*Potential occurrence*				*Unlikely to occur*		

NOISE OFFENCE

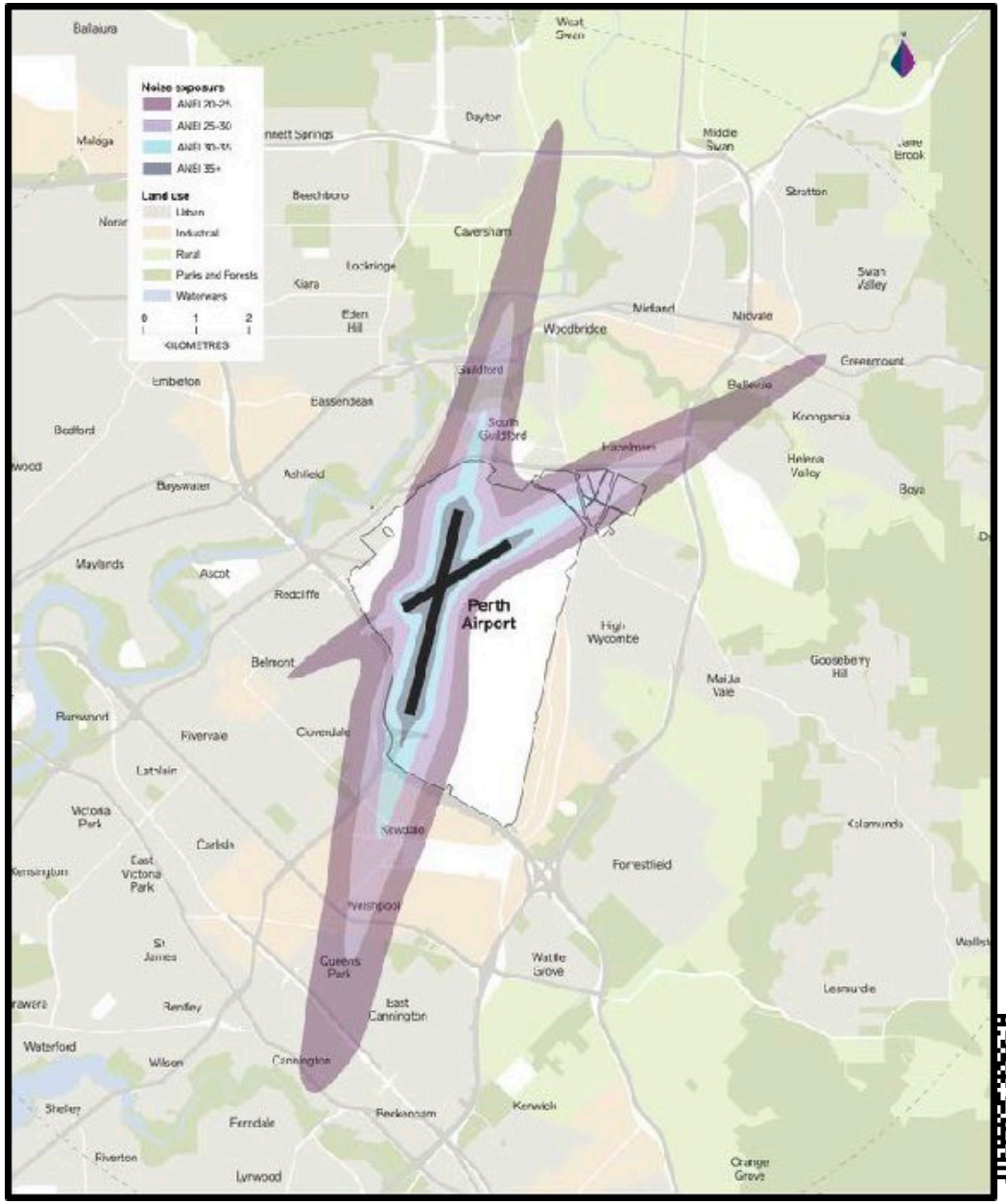
As per the EP Act it is an offence to:

- emit an *unreasonable* emission of noise
- cause pollution (including noise pollution)
- use equipment on any premises in such a way as to emit an unreasonable noise
- own or drive a vehicle or vessel that does not comply with the prescribed noise standard for that class of vehicle
- own or install any equipment that, when operated, can exceed the noise limit
- manufacture, sell, supply, assemble, distribute or store any equipment or vehicle which, when operated under prescribed test conditions, exceeds the relevant noise limit for that equipment or vehicle.

Aircraft noise

ANEFs

- Detailed computer modelling is carried out taking into account the number of flights, types of aircraft and meteorological conditions to produce these noise contours, called Australian Noise Exposure Forecast – or ANEFs.
- Four categories of ANEF that related to land use planning:
  - Less than 20 ANEF;
  - Between 20 and 25 ANEF
  - Between 25 and 30 ANEF; and
  - 30 to 35 ANEF.

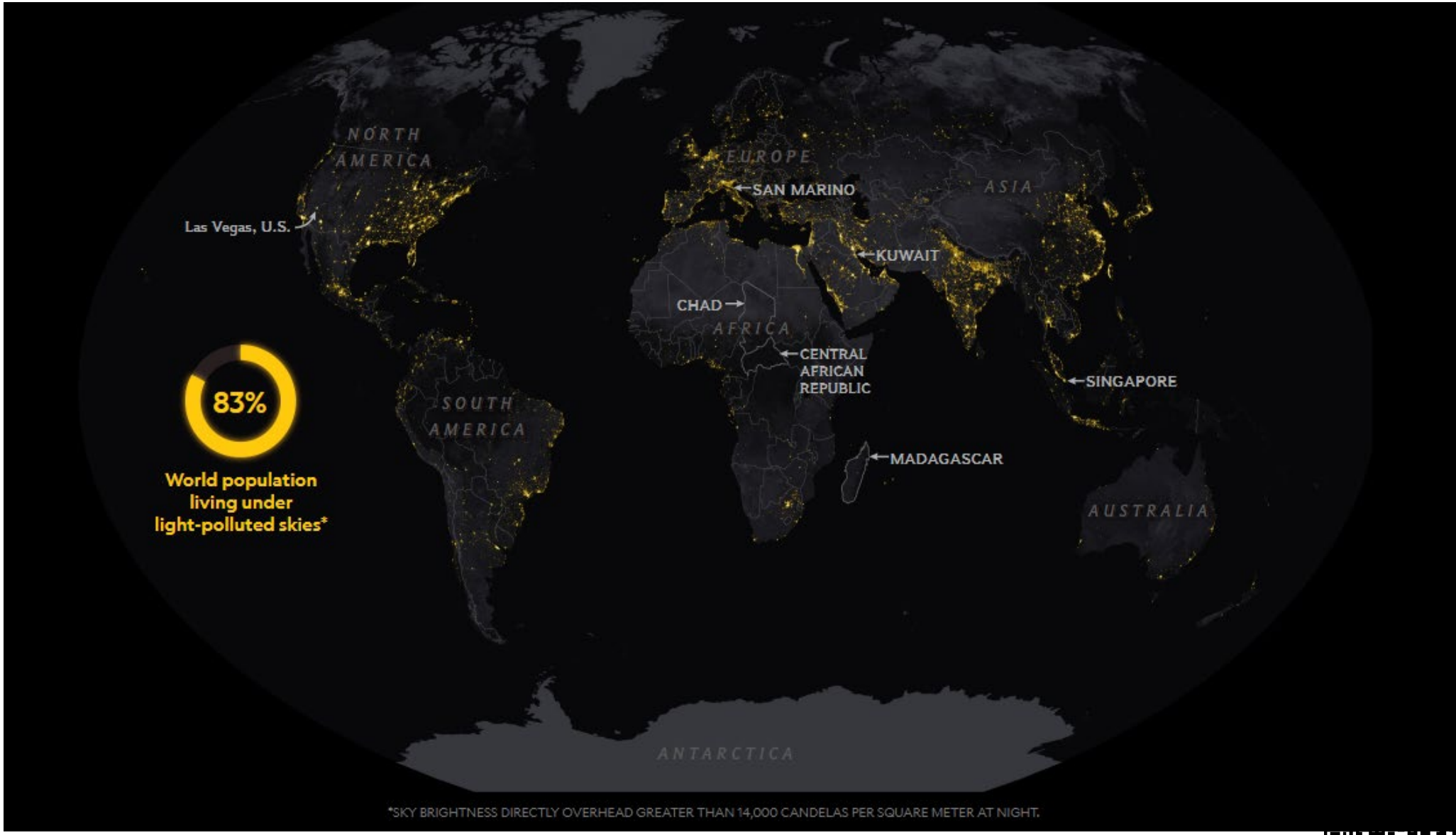


Building type	Forecast noise exposure level (ANEF)			
	less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	25 to 30 ANEF	30 to 35 ANEF
House, home unit, flat, caravan park	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
School, university	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
Hospital, nursing home	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
Hotel, motel, hostel	Acceptable	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)
Public building	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)
Commercial building	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable
Light Industrial	Acceptable	Acceptable	Acceptable	Conditionally Acceptable
Other industrial	Acceptable	Acceptable	Acceptable	Acceptable

LIGHT POLLUTION

Definition

Light pollution is excessive, misdirected, or obtrusive artificial (usually outdoor) light.



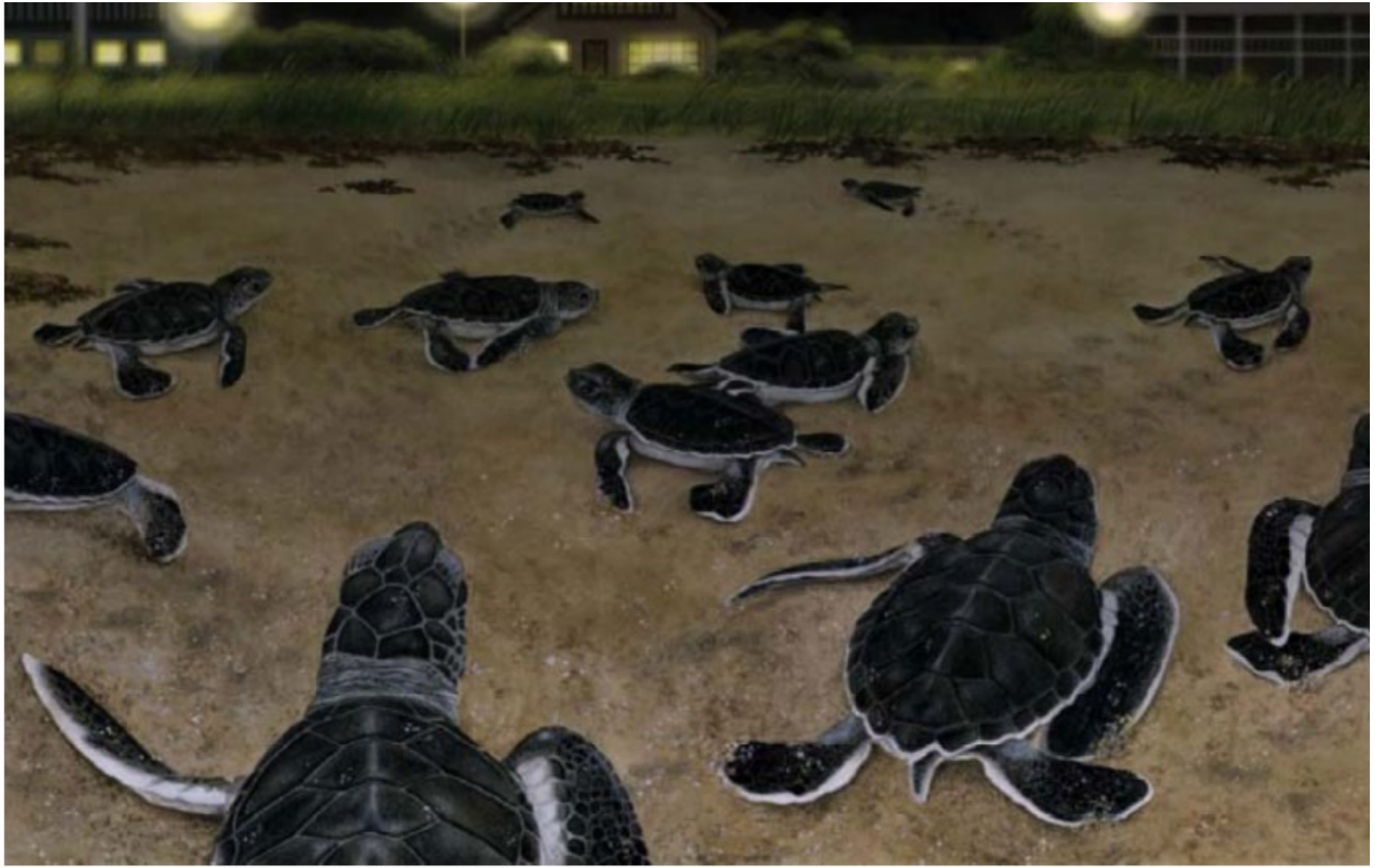
LIGHT POLLUTION EFFECTS

- Affects ecosystems
- Alteration of circadian rhythm
- Aesthetics of the night sky

LIGHT POLLUTION EFFECTS

- Researchers have already identified harmful impacts on an array of non-urban species including bats, insects, plants, fish, turtles, marine invertebrates including corals, and even primates
- The damaging effects of coastal light on threatened turtle species are perhaps the most commonly known
- *Commonwealth Government Light Pollution Guidelines for Marine Turtles, Seabirds and Migratory Shorebirds*

LIGHT IMPACTS ON TURTLES



credit: Dawn Witherington

Light pollution - DCCEEW

LIGHT POLLUTION MITIGATION AND MANAGEMENT

Light Emission Monitoring

- Demonstrate your lighting has not significantly increased ambient light levels over and above levels existing prior to development.
- Manage installed lighting to mitigate light spill on projects located in close proximity to species or ecosystems sensitive to ambient lighting.

Lighting Audit or Mitigation

- Demonstrate that installed lighting is appropriate and compliant with lighting commitments.
- Reduce lighting output and associated cost on your project effectively and without compromising stringent HES standards and employee safety.

Potential Light Emission Modelling

- Assess the ecological risk posed by project lighting in areas containing sensitive receptors.
- Assess the environmental risk posed by additional project lighting for existing projects which plan to expand, or add infrastructure, in areas containing sensitive receptors.

LIGHT POLLUTION MITIGATION AND MANAGEMENT

- Position Statement - Dark Sky and Astrotourism (www.wa.gov.au)

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Western Australian Planning Commission

Position Statement:

Dark sky and astrotourism

January 2022

Published by the
Western Australian Planning Commission
Gordon Stephenson House
140 William Street
Perth WA 6000

Locked Bag 2506
Perth WA 6001

Published January 2022

website: www.dplh.wa.gov.au
email: info@dplh.wa.gov.au

tel: 08 6551 8002
fax: 08 6551 9001
National Relay Service: 13 36 77
This document is available in alternative formats on application to the Communications Branch.

5.6 Development

Development approval

In considering applications for development approval, decision-makers should ensure lighting and dust management is consistent with the dark sky principles. These measures may be demonstrated through a lighting management plan and dust/construction management plan approved as part of the application by the decision-maker, or as a condition of approval. For most proposals, a basic lighting management plan and/or dust/construction management plan will be sufficient. Lighting and dust management plans should be consistent with this policy, Australian standards, DWER Guidelines and include:

- a map/plan
- lighting selection, location and illuminance values
- potential light emission recipients, including the possible impact on any protected wildlife species
- mitigation measures
- maintenance/monitoring/reporting.

In considering lighting management for a proposal with light pollution that may adversely impact a listed species under the EPBC Act or State legislation, the Australian Government's *National Light Pollution Guidelines* should be followed.

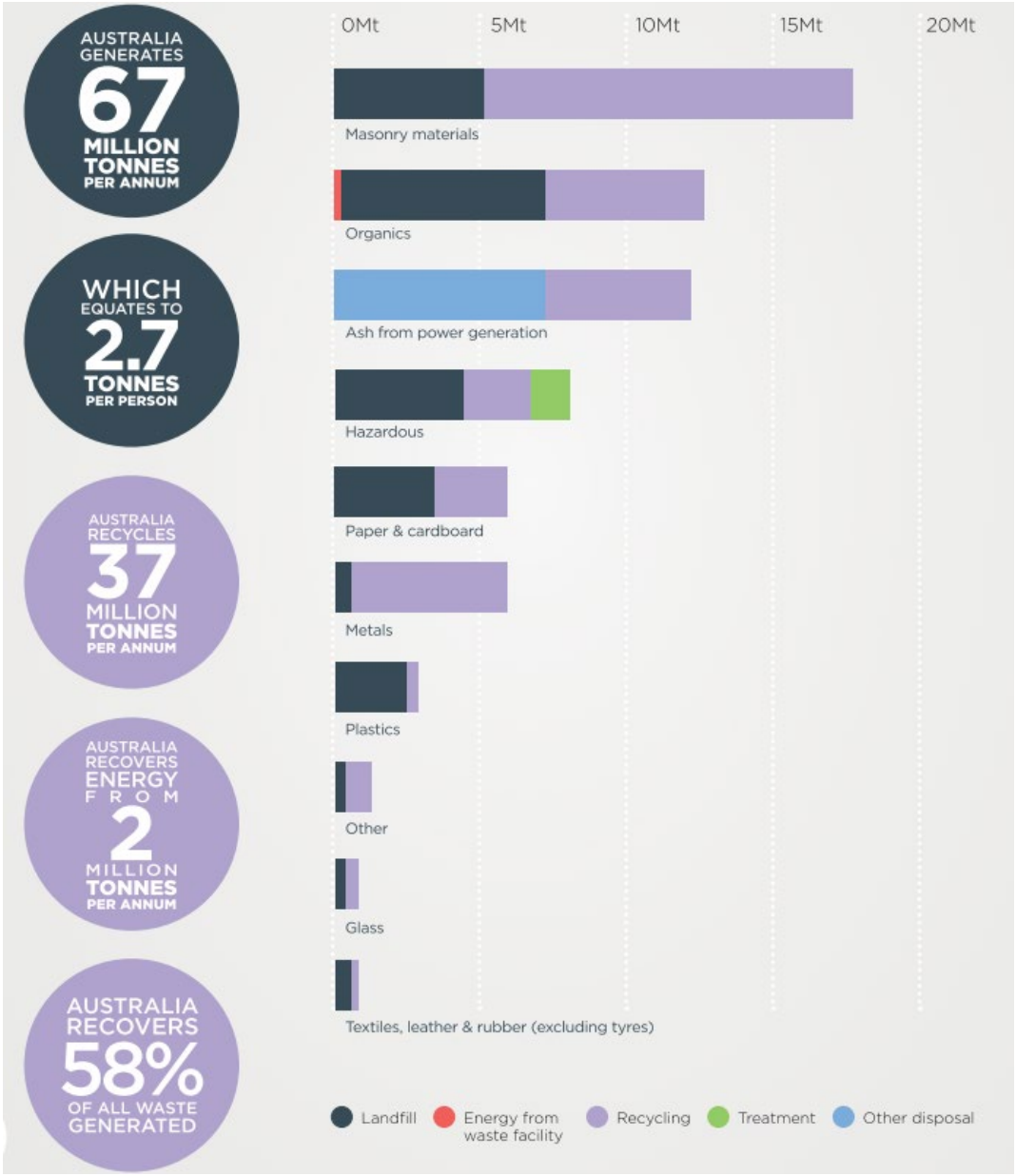
WHAT IS WASTE?

- Residual product that is not the primary goal of production
- A material, substance, or by-product) eliminated or discarded as no longer useful or required after the completion of a process
- Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities.
- If the residual product is reused or recycled or recovered in some way, the process will no longer be considered as waste.

WHY MANAGE WASTE?

- Conserves resources & energy
- Reduces water & air pollution
- Saves landfill space
- Waste = resource inputs

WASTE IN AUSTRALIA



WASTE CLASSIFICATION (origin and type)

Municipal Solid Wastes

- Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by any municipality.

Bio-Medical Wastes

- Solid or liquid wastes including containers, intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.

Industrial Wastes

- Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.

Agricultural Wastes

- Wastes generated from farming activities. These substances are mostly biodegradable.

WASTE CLASSIFICATION (origin and type)

Fishery Wastes

- Wastes generated due to fishery activities. These are extensively found in coastal & estuarine areas.

Radioactive Wastes

- Waste containing radioactive materials. Usually these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.

E-Wastes

- Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, may contain contaminants such as Pb, Cd, Be or brominated flame retardants.

An Act to –

- provide for waste avoidance and resource recovery; and
- establish the Waste Authority; and
- establish a container deposit scheme; and
- provide for waste services by local governments; and
- provide for levies on waste; and
- repeal the *Environmental Protection (Landfill) Levy Act 1998*
- provide for related and consequential matters.

Object of this Act

1) The primary objects of this Act are to contribute to sustainability, and the protection of human health and the environment, in Western Australia and the move towards a waste-free society by –
   a) promoting the most efficient use of resources, including resource recovery and waste avoidance; and
   b) reducing environmental harm, including pollution through waste; and
   c) the consideration of resource management options against the following hierarchy –
      i. avoidance of unnecessary resource consumption
      ii. resource recovery (including reuse, reprocessing, recycling and energy recovery);
      iii. disposal.

LANDFILL CLASSES

The *Waste Avoidance and Resource Recovery Act 2007* defines waste as matter whether useful or useless, which is discharged into the environment; or matter which is prescribed by the regulations to be waste.
Below are the criteria to be applied in determining classification of wastes for acceptance to landfills licensed or registered in Western Australia in accordance with Part V of the *Environmental Protection Act 1986*.

Landfill classes and waste types

Class I— Inert landfill

- Clean Fill
- Type 1 Inert Waste
- Contaminated solid wastes meeting waste acceptance criteria specified for Class I landfills
- Type 2 Inert Waste
- Type 3 Inert Waste
- Type 1 Special Waste

Class II— Putrescible landfill

- Clean Fill
- Type 1 Inert Waste
- Putrescible Wastes
- Contaminated solid wastes meeting waste acceptance criteria specified for Class II landfills
- Type 2 Inert Waste
- Type 1 and Type 2 Special Wastes

Class III— Putrescible landfill

- Clean Fill
- Type 1 Inert Waste
- Putrescible Wastes
- Contaminated solid wastes meeting waste acceptance criteria specified for Class II or Class III landfills
- Type 2 Inert Waste
- Type 1 and Type 2 Special Wastes

Class IV— Secure landfill

- Clean Fill
- Type 1 Inert Waste
- Putrescible Wastes
- Contaminated solid wastes meeting waste acceptance criteria specified for Class II, Class III or Class IV landfills
- Type 2 Inert Waste
- Type 1 and Type 2 Special Wastes

Class V— Intractable landfill

- Intractable and other wastes in accordance with the approvals for the site

TREATMENT - INCINERATION

- Works by burning wastes under heat
- Reduces waste substantially
- Waste must be segregated – what goes in comes out (Dioxins and furans)
- Ash is hazardous in most cases
- Emissions must be controlled
- Medical wastes are commonly incinerated

TREATMENT

- Composting
- Settling ponds
- Wastewater Treatment Facilities
- Resource Recovery (AKA Waste-to-Energy): Waste is burned to produce energy. Preferred to landfilling – reduces bulk of municipal waste to ash and provides energy. Strict regulatory restrictions and high economic costs and stringent environmental regulations:

WASTE LEGISLATION

- Waste Avoidance and Resource Recovery Act 2007
- Environmental Protection (Controlled Waste) Regulations 2004
- EP Act Part V Licence

BEST PRACTICE WASTE MANAGEMENT IN MINING

- Waste Management Plan:
  - Waste types and where waste is generated, stored, handled, treated or disposed
  - How will success be measured and monitored
- Ascertain the nature of the waste – and the correct classification
- Waste segregation
- Responsible disposal
- Sustainable procurement (recycled and recyclable materials)
- Recovering solvents, metals or oil and re-using them for a secondary purpose
- Recyclable construction wastes will be collected separately and reused or recycled
- Reverse logistics
- Vegetation wastes stockpiled safely to be used in on-site landscaping. Topsoil from disturbed areas will be stored for use in future rehabilitation activities on-site.

Summary

- What is pollution
- Regulations
- Types of pollution
  - Air
  - Particulates
  - Water pollution
    - Mine and wastewater
  - Sound and noise
  - Light
- Waste and management