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Clean TeQ Sunrise

CCC meeting

15 February 2018

AGENDA

- General update
- Modification 4
  - Overview / update
  - Transport assessment
  - Clean TeQ’s submission
- Modification 6
- Working with and investing in our community
- Air quality
- Q&A

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SINCE THE CCC LAST MET, WE HAVE:

- Placed Modification 4 on public exhibition (closed 13 December)
- Approval of Modification 5
- Placed Modification 6 on public exhibition (closed 7 February)
- Completed an independent pedestrian safety review - Trundle
- Transported two autoclaves to Port Pirie
- Secured accommodation facility for Clean TeQ Sunrise construction
- Listed on the Toronto Stock Exchange (TSX)
- Appointed Clean TeQ's Chief Technical Development Officer, Stephen Grocott
- Commenced a short-term drilling program at Clean TeQ Sunrise
- Signed a lease for an office space in Parkes
- Reached 'in-principle agreement' with all three Councils for our Voluntary Planning Agreement (VPA)
- Announced scandium partnership agreement with Chinalco and Chongqing University
- Appointed Project Operations Director, Tim Kindred (commencing in April)

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Modification 4 (MOD4)

MOD 4 OVERVIEW

MOD 4 details the proposed changes:

- Addition of a water treatment plant
- Mine Site – Modified Layout
- Tailings Storage Facility (increased extent and height)
- Evaporation Ponds and Water Storage Dam (reduced extent)
- Access surface water from the Lachlan River
- Other mine infrastructure area components (reconfigured)
- Addition of blasting at the mine site

There are NO changes to:

- Approved surface development area
- Life of mine
- Mining method and rate
- Open cut pits
- Waste emplacements
- Processing rate
- Workforce

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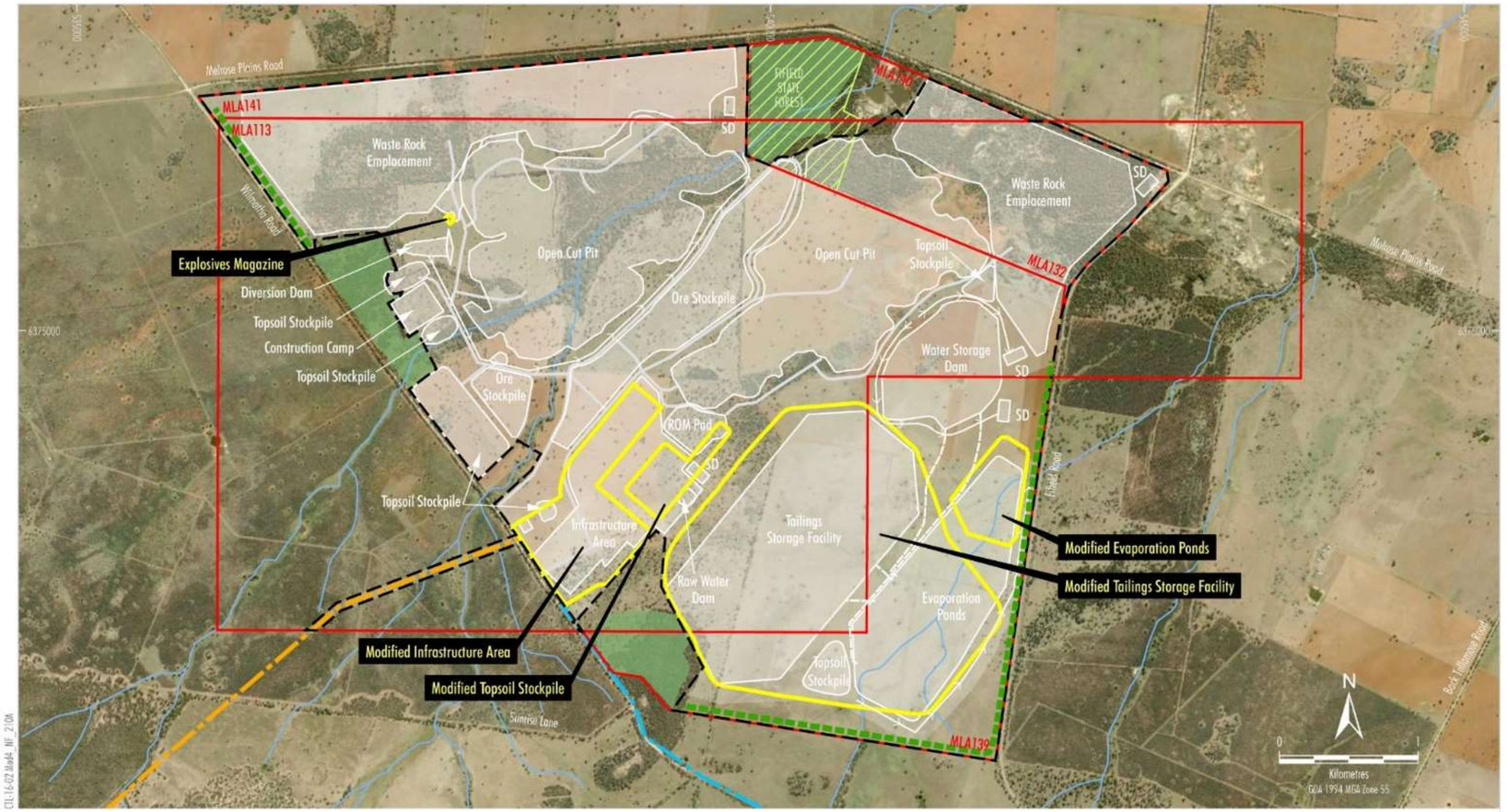
MOD 4 OVERVIEW



LEGEND

- State Forest
- Mining Lease Application Boundary
- Approved Surface Development Area
- Approved Mine Footprint
- Diversion Structure
- Key Site Water Pipeline
- Approved Gas Pipeline
- Approved Water Pipeline
- Vegetation Screening
- Existing Open Woodland
- Modified Layout

Source: Black Range Minerals (2005); NSW Department of Industry (2017); NSW Land and Property Information (2017)
NSW Imagery: © Department of Finance, Services & Innovation (2017)

CLEAN TEQ SUNRISE PROJECT

Indicative Modified Mine and Processing Facility General Arrangement

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MOD 4 ENVIRONMENTAL ASSESSMENT

Environmental Assessment includes the following specialist assessments:

- Noise and Blasting Assessment
- Air Quality Assessment
- Preliminary Hazard Analysis
- Road Transport Assessment
- Water Management Assessment
- Aboriginal Cultural Heritage Assessment
- Biodiversity Surveys

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MOD 4: WHAT WE PROPOSE

Transport – Use and Increases

- Increased sulphur demand
- External limestone supply
- Ammonium sulphate product
- Proposed limited heavy vehicle use of the McGrane Way
- Short-term road transport of water (during construction phase)

Limestone Quarry, Rail Siding and Gas Pipeline

- No changes

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MODIFICATION 4: SUBMISSIONS RECEIVED

Concern raised – Project Traffic in Trundle

- We completed an independent Pedestrian Access Review while MOD4 was on public exhibition
- The Review concluded that:

  …it is considered unlikely that a significant deterioration in the safety of that environment would result with the modified Project…

  As for the existing conditions, some aspects of the pedestrian and vehicular environment could however be improved to mitigate the existing issues …

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LEGEND

Posted Speed Limits

- 100 km/h
- 50 km/h
- 40 km/h School Zone
- School Pedestrian Crossing
- Proposed KerbTreatment
- Proposed Threshold Treatment
- Proposed Speed Reduction Warning Sign

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MODIFICATION 4: SUBMISSIONS RECEIVED

- Concern raised – Project Traffic in Trundle

  In addition to the **Pedestrian Safety Assessment Review,** we:

  - Prepared a supplementary **Road Noise Assessment** (Renzo Tonin & Associates) concluded that the MOD 4 would not lead to any exceedances of the relevant road noise criteria in Trundle.

- Concern raised - Air Emissions

  - Clean TeQ and Ramboll Environ to present a comprehensive response at today's CCC meeting including description of control measures to be implemented; details of emissions to be released; dispersion mechanisms; modelling process; and predicted impacts (including context of health/odour limits).

WE HAVE REDUCED OUR TRAFFIC NUMBERS

Our proposed traffic movements through Trundle will be 20% below the approved Project

As promised, we have committed to a number of initiatives:

- Running employee shuttle buses from Condobolin, Parkes and Forbes
- We have obtained heavy vehicle authorisation permit to allow higher capacity vehicles from Parkes
- We are considering employing around a third of our operational workforce (i.e. approximately 100 personnel) in a Regional Operations Centre in Parkes. This would further reduce number of light vehicles.

As a result, over a 24 hour period, it is proposed that:

- 70 heavy vehicles, 70 light vehicles and six buses will pass through Trundle
- An average of approximately three heavy vehicles per hour on Forbes Street, Trundle

	Light Vehicles	Heavy Vehicles	Shuttle Buses	Total Vehicles
Modified Project – With Higher Capacity Vehicles	**70**	**70**	**6**	**146**
Employees	50	-	-	50
Employee Shuttle Buses	-	-	6	6
Limestone (with higher capacity trucks)	-	52	-	52
Lime	-	8	-	8
Other	20	10	-	30

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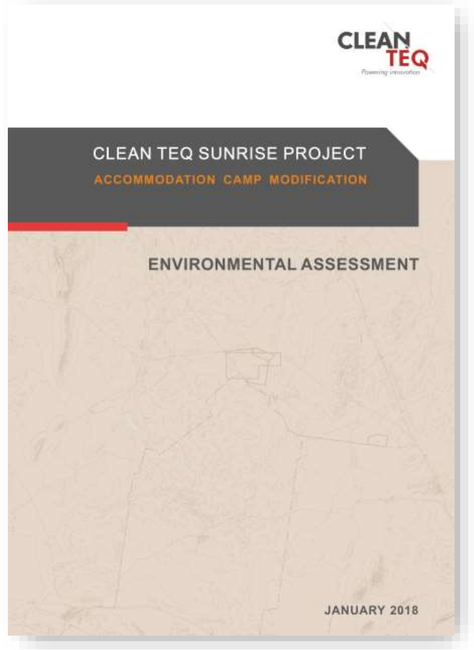
Modification 6 (MOD6) Accommodation Camp

MODIFICATION 6

Status Update

- EA lodged in December 2017 and public exhibition ended on 7 February 2018
- Draft Responses to Submissions Report to be prepared by 5 March 2018



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Working with our community

COMMUNITY ENGAGEMENT

1. Hold community drop-in sessions in Trundle and Fifield on Monday and Tuesday, 26 and 27 February respectively (to be advertised)

2. Meet with ‘near neighbours’ in Fifield in the coming weeks

3. Publish and distribute the second edition of our community newsletter (print and electronic)

4. Launch online forms for people to register for employment or procurement opportunities

WELCOME YOUR IDEAS, INPUT AND PARTICIPATION

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INVESTING IN OUR COMMUNITY

Voluntary Planning Agreement

- ‘In-principle’ agreement for Voluntary Planning Agreement with Forbes, Lachlan and Parkes Shire Councils for our Voluntary Planning Agreement
- $400,000 per annum community contribution (50 % Lachlan Shire Council, 25% Forbes Shire Council and 25% Parkes Shire Council)
- Additional $340,000 in road maintenance contributions per annum
- Total spend of $740,00 per year

Community Investment Program

- To be launched later this year

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OUR VALUES – WHAT'S IMPORTANT TO US

Respect	Care	Togetherness	Simplicity	Ambition
We act with integrity, honesty and respect	*We care for each other, our communities, partners, and environment*	*We work together and build trusting relationships*	*Our approach is simple, focused and drives value*	*We bring courage and ambition to everything we do*





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Air quality & emissions

Ramboll Environment
Stephen Grocott

AIR EMISSIONS – SULFUR DIOXIDE

- Sulfur (by-product from natural gas production and oil refining)

- Imported sulfur is burnt in an acid plant to make sulfur dioxide (SO_2).
- 99.7 – 99.9% of the SO_2 is captured and oxidised to make sulfuric acid (H_2SO_4), electricity and steam
- 0.1 – 0.3% of sulfur is exits with stack gas as SO_2

- The acid is stored in tanks and used to dissolve the nickel, cobalt and scandium

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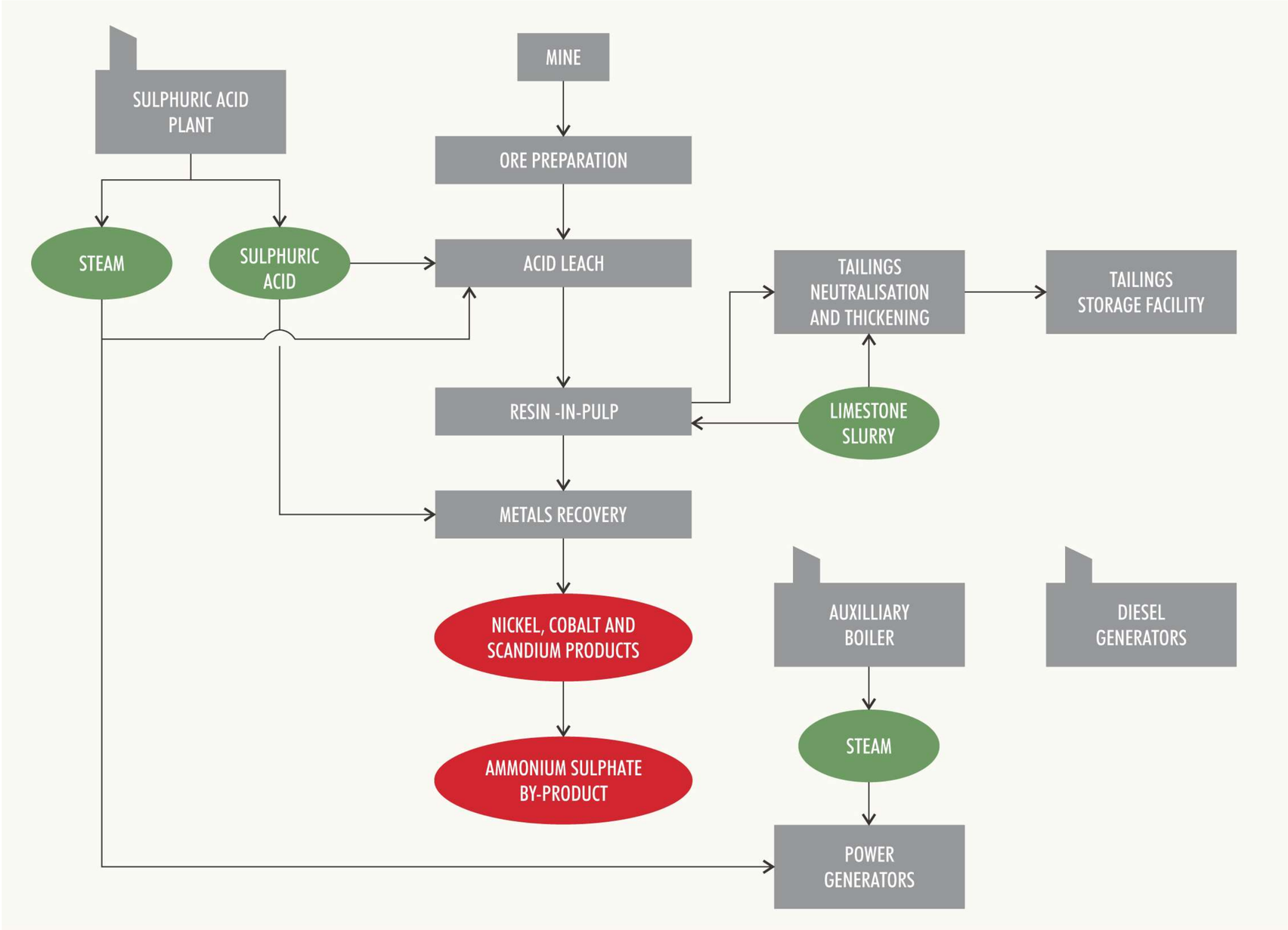
Processing Plant



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SULFUR DIOXIDE

1. High concentrations, for long periods of time, can affect health
2. Maximum acceptable air concentrations are often determined after applying a safety factor to the maximum concentration that doesn't affect an "exercising asthmatic"
3. World-wide health authorities say maximum 1 hr per year at 0.2 ppmv* (same as Australia's NEPM**)
4. Working backwards, the NSW EPA limits our stack emissions to 1,000 mg/m^3 (350 ppm). We target less than 280 ppmv.
5. SO_2 doesn't bio-accumulate. It forms sulfate

*What is ppmv?
ppmv = one part per million by volume (e.g. dessert spoonful in a 20,000 L swimming pool)
0.02 ppmv = 20 ppbv = 58 ug/m^3 = one drop in 5,000 L

**National Environment Protection Measure (NEPM) for sulfur dioxide		
Allowed exceedances (NEPM goal)		
One-hour standard	*0.2 ppm*	*One hour per year*
One-hour standard	*0.08 ppm*	*One day per year*
One-hour standard	*0.02 ppm*	*None*

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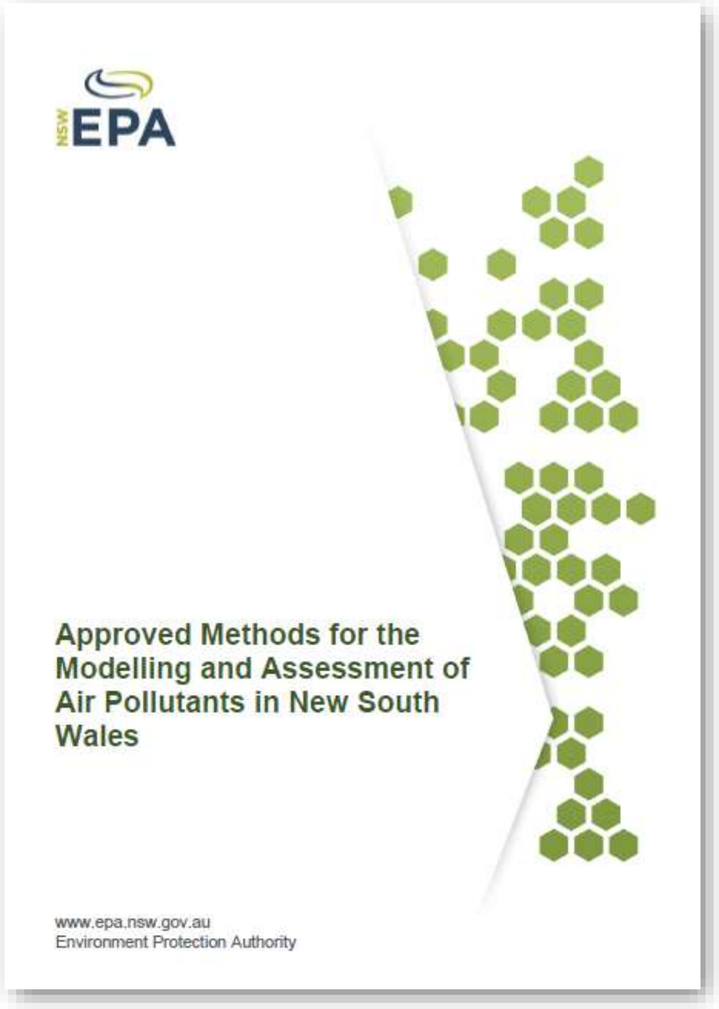
CLEAN TEQ SUNRISE PROJECT
MODIFICATION 4
AIR QUALITY ASSESSMENT

OVERVIEW

- Overview of Air Quality Assessment in NSW – why and how
- Understanding dispersion and how dispersion models work
- Commonly used dispersion models in NSW
- Overview of model inputs
- Interpreting model outputs and results
- Questions

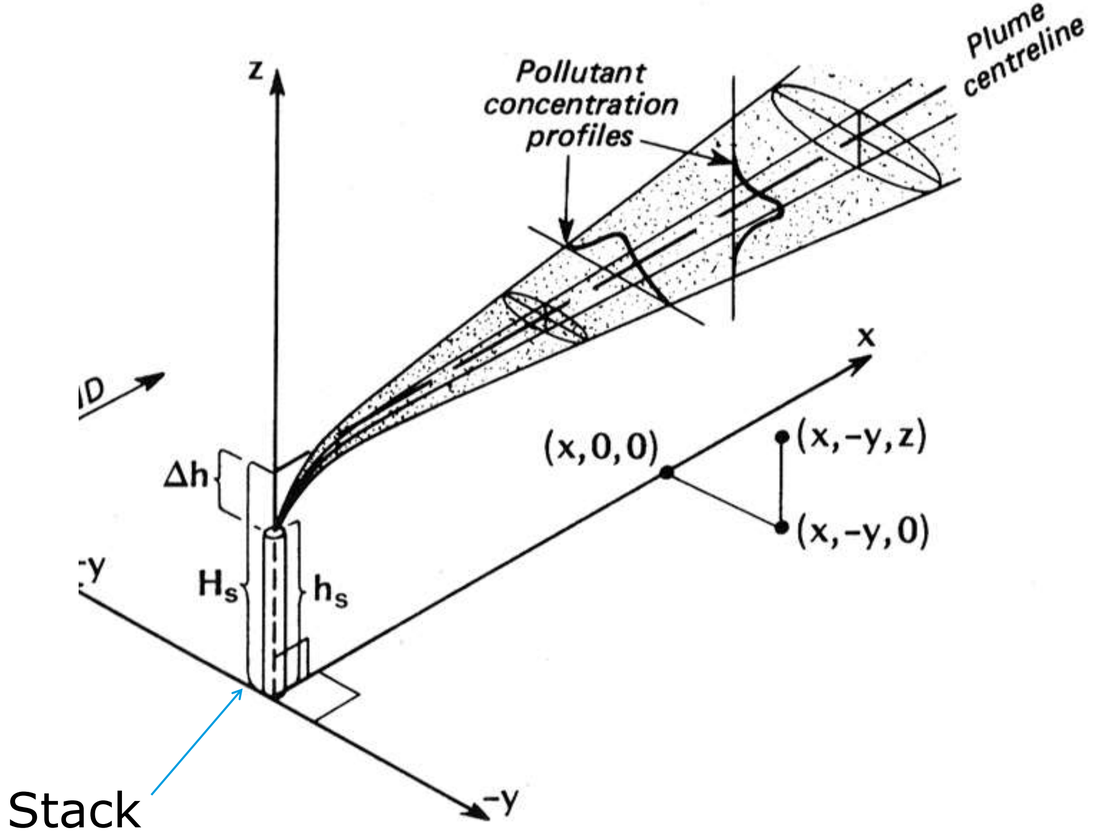
AIR QUALITY ASSESSMENT IN NSW

- NSW EPA provide guidance for air quality assessment in NSW (the Approved Methods) which specifies:
  - How input data are collected and used:
    - Meteorological data;
    - Emissions data;
    - Terrain data; and
    - Building, receptors etc.
  - How dispersion modelling should be performed.
  - How results should be presented and interpreted.
  - What should be included in the air quality assessment report.



WHAT IS A DISPERSION MODEL?

- Set of mathematical equations (algorithms) which are used to characterise the behaviour of an emission source (e.g. a stack).
- Can be used to predict pollutant concentrations at specified distances downwind of an emission source.



EXAMPLE OF DISPERSION EQUATION (GAUSSIAN PLUME)

$$\chi_{(x,y,z)} = \frac{Q}{2\pi\sigma_y\sigma_z U}\exp\left[-\frac{y^2}{2\sigma_y{}^2}\right]\left\{\exp\left[-\frac{(z-H_e)^2}{2\sigma_z{}^2}\right]+\exp\left[-\frac{(z+H_e)^2}{2\sigma_z{}^2}\right]\right\}$$

- In simplified terms:
  - Emission rates determine source strength.
  - Wind direction and wind speed determine where and how far emissions travel.
  - Dispersion parameters determine how well a plume is mixed into surrounding atmosphere.
  - Other more complex parameters include, plume depletion, deposition (wet and dry), building wake effects, terrain effects, chemistry.

where,

$\chi_{(x,y,z)}$	=	concentration (µg/m^3) at distance x downwind, distance y across wind, and at height z above ground
U	=	wind speed (m/s)
σ_y / σ_z	=	standard deviations of lateral and vertical concentrations (i.e. dispersion parameters)
H_e	=	effective stack height (m)
Q	=	source emission rate (g/s)

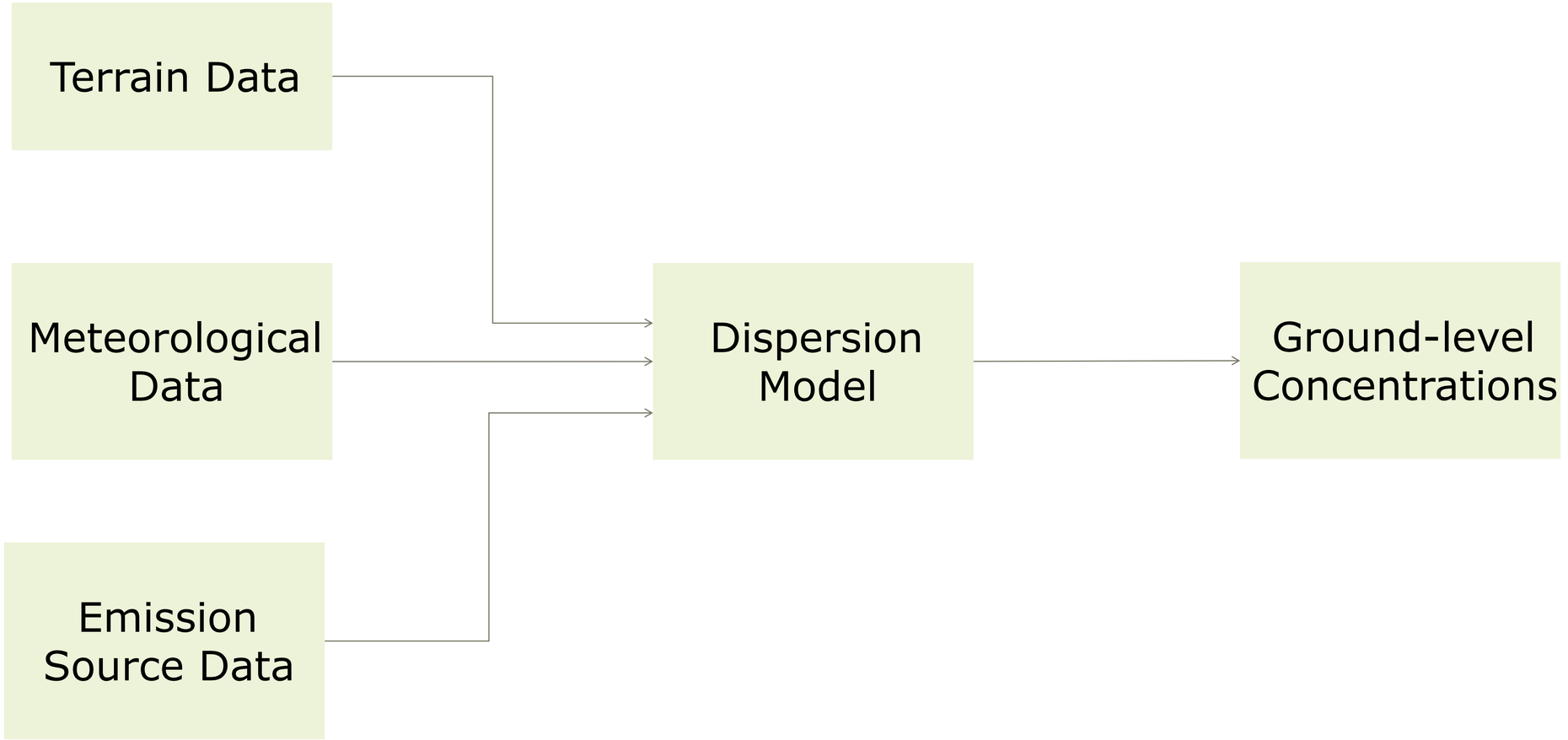
SELECTING THE RIGHT DISPERSION MODEL

- The model selected for an air quality assessment depends on the application:
  - Some models may perform ‘better’ in complex terrain.
  - Some models may perform ‘better’ if low wind speed conditions are important.
  - Some models may model roads/vehicle emissions better.
  - Some models treat chemistry better.
  - Some models are more appropriate for regional airshed modelling.
- General rules
  - Choose an approved ‘regulatory’ model.
  - Use professional judgement to select the best model for the application.
  - Consistency.
  - Apply conservative assumptions (cautious approach).

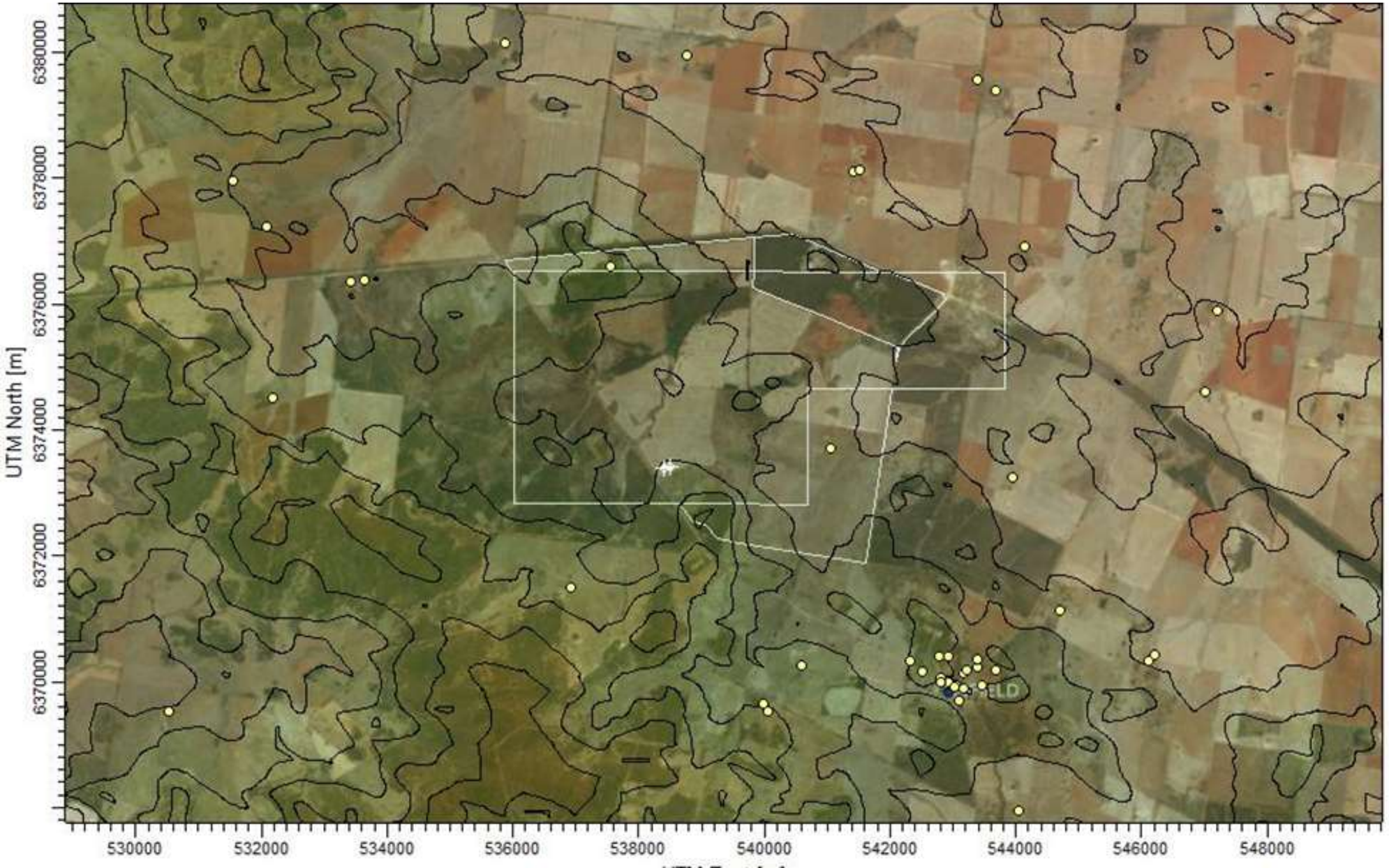
COMMON DISPERSION MODELS USED IN NSW

Model	Notes
AERMOD	• Suitable for the majority of near field applications (<50km). • US EPA and Victorian EPA approved regulatory model and used and accepted in all other states – NSW EPA will include it when they update the Approved Methods.
AUSPLUME	• Previously approved regulatory model for simple near field applications in NSW. • Out of date (2005) and no longer used.
CALPUFF	• Typically used for complex terrain applications and/or odour. • Better suited to regional scale modelling.
TAPM	• Mostly used as a meteorological model to generate input files for other models

WHAT INPUTS ARE REQUIRED FOR DISPERSION MODELLING?

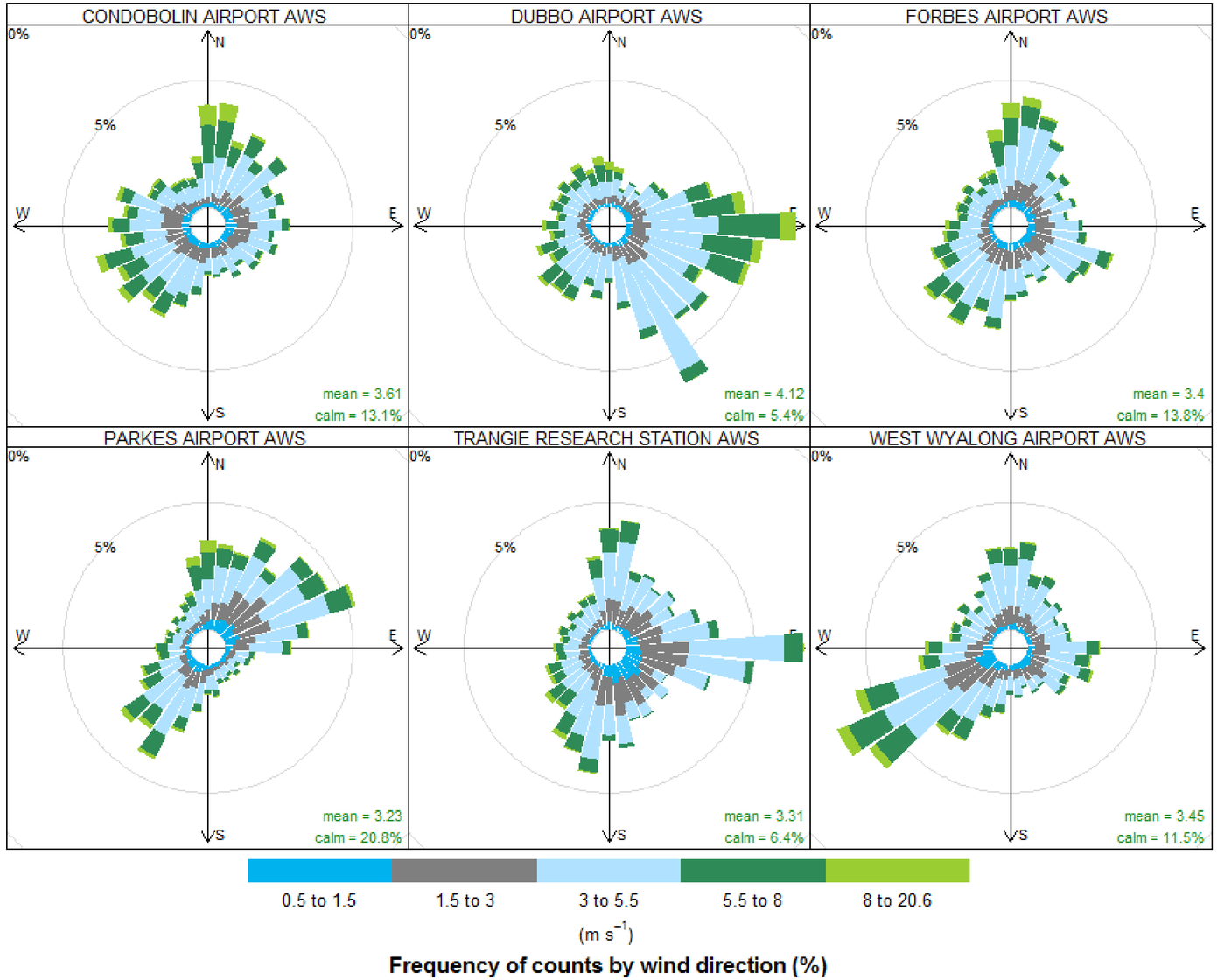


SUNRISE PROJECT – MODEL INPUTS (TERRAIN)



SUNRISE PROJECT – MODEL INPUTS (METEOROLOGY)

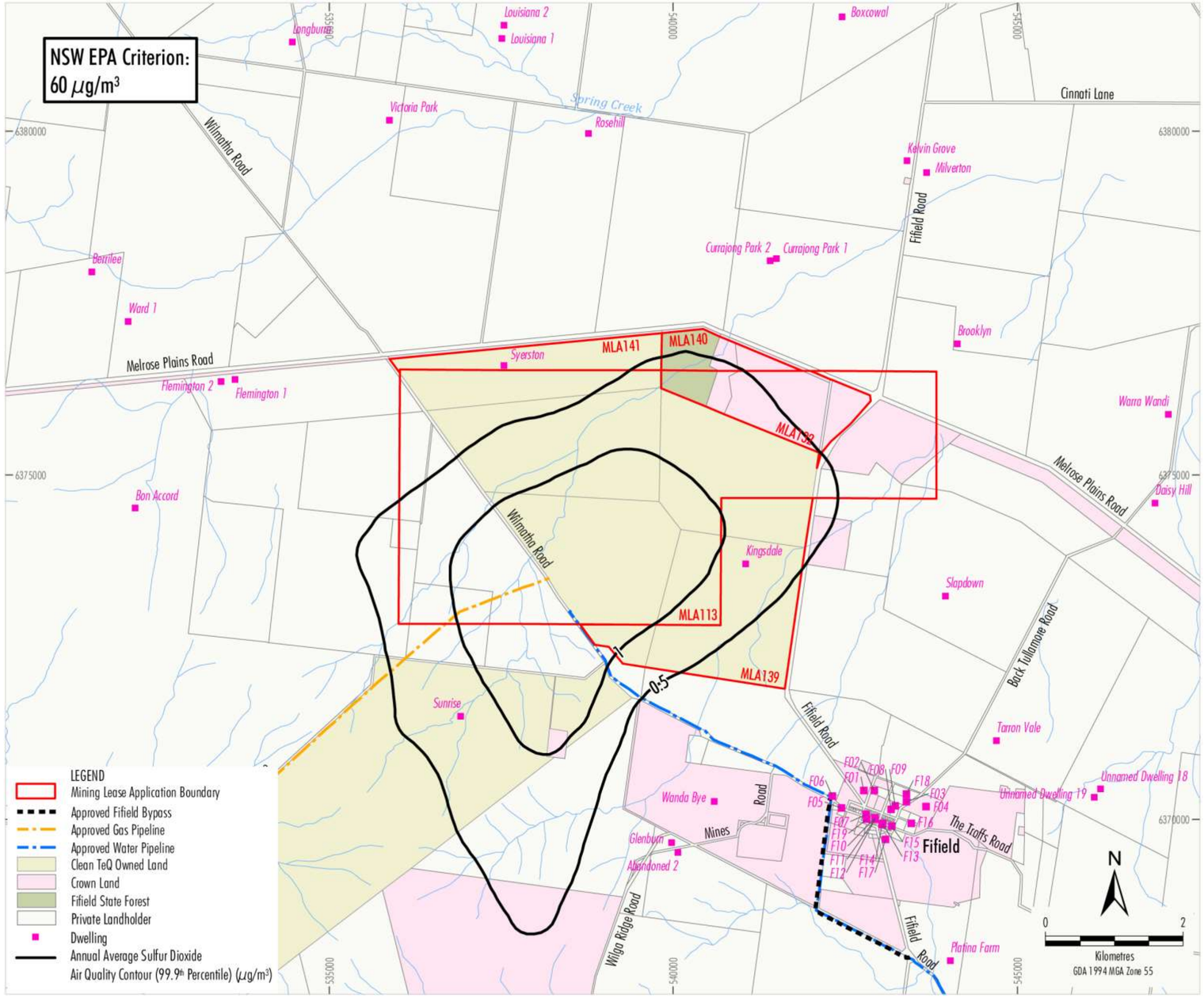
- Available regional data reviewed.
- Nearest site (Condobolin Airport) was comparable to EIS and other data sources (i.e. Northparkes & Cowal Mines).
- Relatively ‘simple’ regional terrain – i.e. no mountains, etc. that would significantly alter weather patterns between Condobolin and the mine.
- Analysis of long term variability to select <u>representative</u> year.



SUNRISE PROJECT – MODEL INPUTS (EMISSION SOURCES)

- Sulphuric acid plant emissions are based on:
  - NSW EPA's allowable in-stack concentration limits (maximum case); and
  - Proposed stack design parameters.
- Power generation emissions are based on:
  - Maximum power demand; and
  - Proposed stack design parameters.
- Fugitive dust from maximum case mining scenarios.

SUNRISE PROJECT – INTERPRETING MODEL OUTPUTS



Annual average SO_2 (µg/m³)

RAMBOLL

SUNRISE PROJECT – NO_X AND SO_X EMISSIONS

- The phenomenon known as acid rain is a process where SOx and NOx emissions react with water in the atmosphere and fall to the ground as wet or dry deposition.
- Acid rain historically occurred in industrialised areas with high emission loads of SOx and NOx (e.g. from coal fired electrical power generation).
- No evidence of 'Acid Rain' occurring in NSW even in concentrated heavy industrial areas
  (i.e. Hunter Valley and Wollongong).
- Predicted SOx and NOx ground level concentrations are well below air quality objectives for ecosystem health, biodiversity and agriculture.

SULFUR DIOXIDE (SO_2) SUMMARY

1. We are selecting from amongst the world's best acid plant manufacturers and designs
2. We are aiming for less than 280 ppm SO_2 vs expected EPA limit of ~350 ppm (1,000 mg/m^3 in POEO Clean Air Regulation standards).
3. We monitor stack emissions and publish online
4. The stack is designed to achieve efficient SO_2 dispersion.
5. We have used state-of-the-art, validated dispersion modelling (Ramboll)
6. Ground level concentrations are far below (better than 10X lower) concentrations that might affect the most sensitive of people (e.g. exercising asthmatic)
7. SO_2 doesn't bio-accumulate
8. SO_2 only affects rain water quality or causes acid rain in air sheds if there is massive, untreated SO_2 emissions from hundreds of untreated sources (e.g. power plants burning high sulfur coal and metal smelters)

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AIR EMISSIONS – SULFUR DIOXIDE

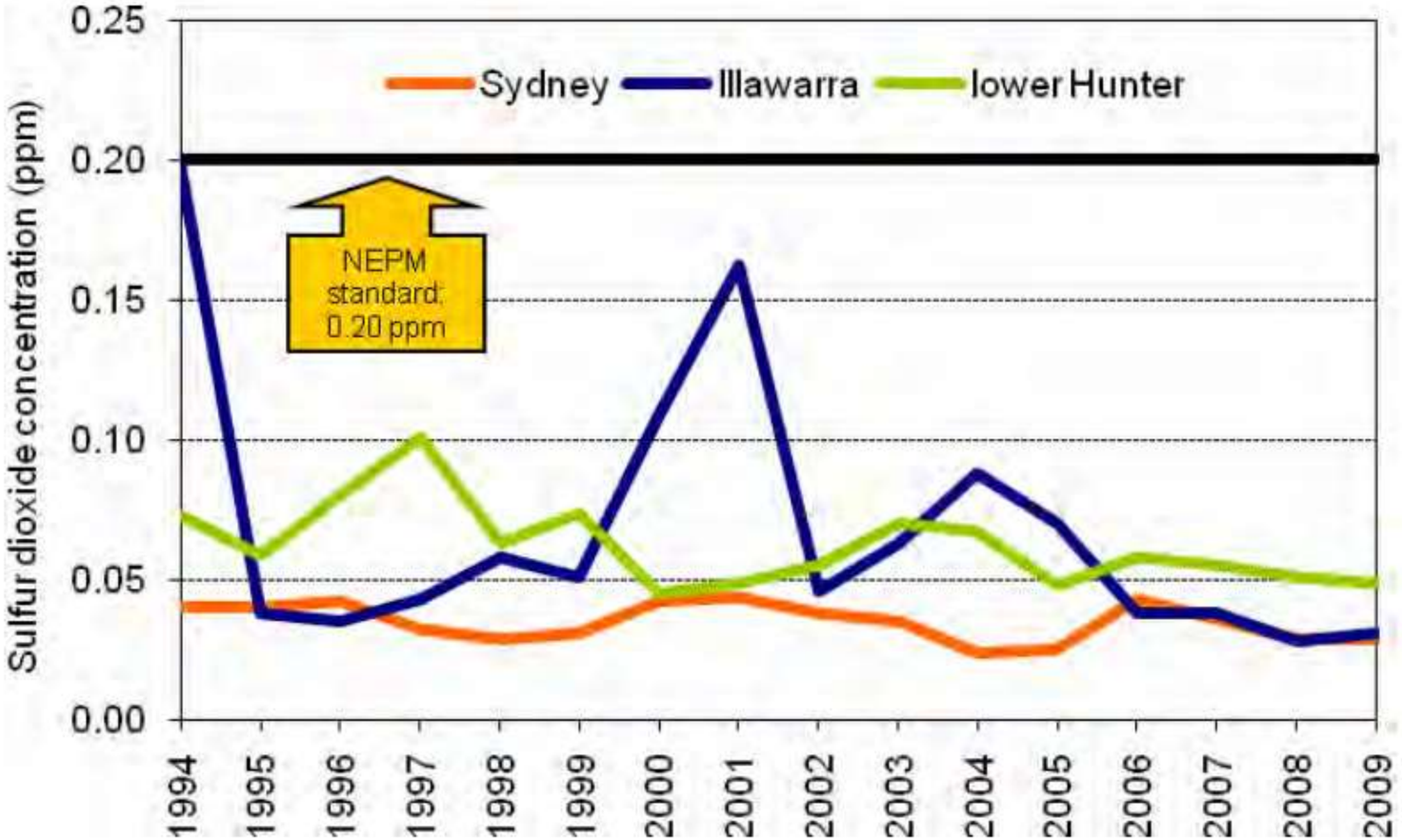

Figure 5.1: Maximum 1-hour average sulfur dioxide concentrations in NSW (1994–2009)

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How will we manage and monitor emissions

- Process control systems to monitor and manage acid plant performance.
- Stack concentration monitoring and reporting in accordance with EPL requirements.

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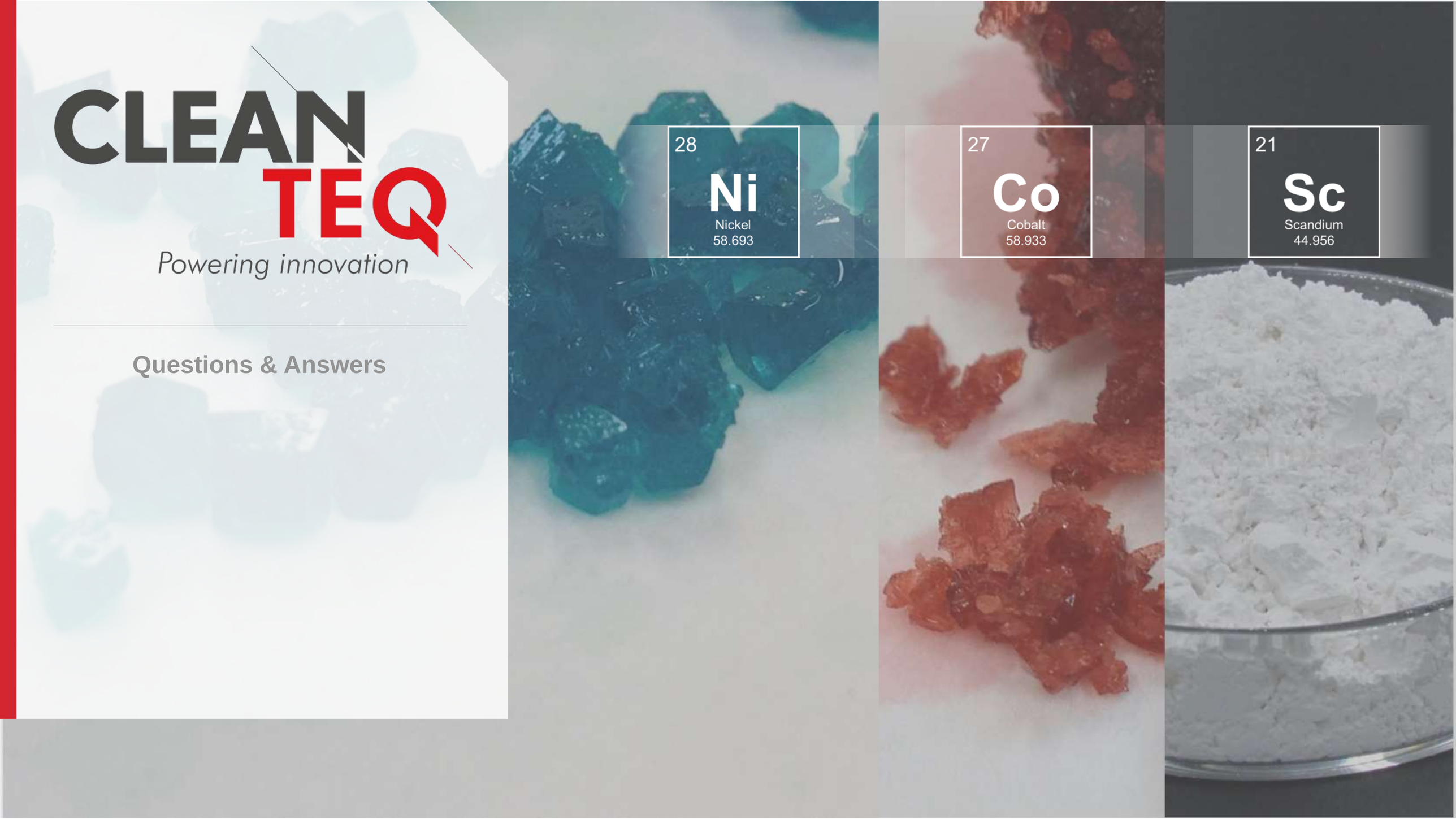
Questions & Answers



Sunrise Project – Model Inputs (Emission Sources)

- Sulphuric acid plant emissions are based on:
  - NSW EPA's allowable in-stack concentration limits (maximum case); and
  - Proposed stack design parameters.
- Power generation emissions are based on:
  - Maximum power demand; and
  - Proposed stack design parameters.
- Fugitive dust from maximum case mining scenarios.

Stack	Height (metres)	Diameter (metres)	Exit velocity (metres/ second)	Flow rate (cubic metres/ second)
Sulphuric acid plant	80	1.8	26.6	53.2
Diesel power plant	10	0.9	18.5	5.6
Diesel fired auxiliary boiler	10	0.9	22.7	8.7

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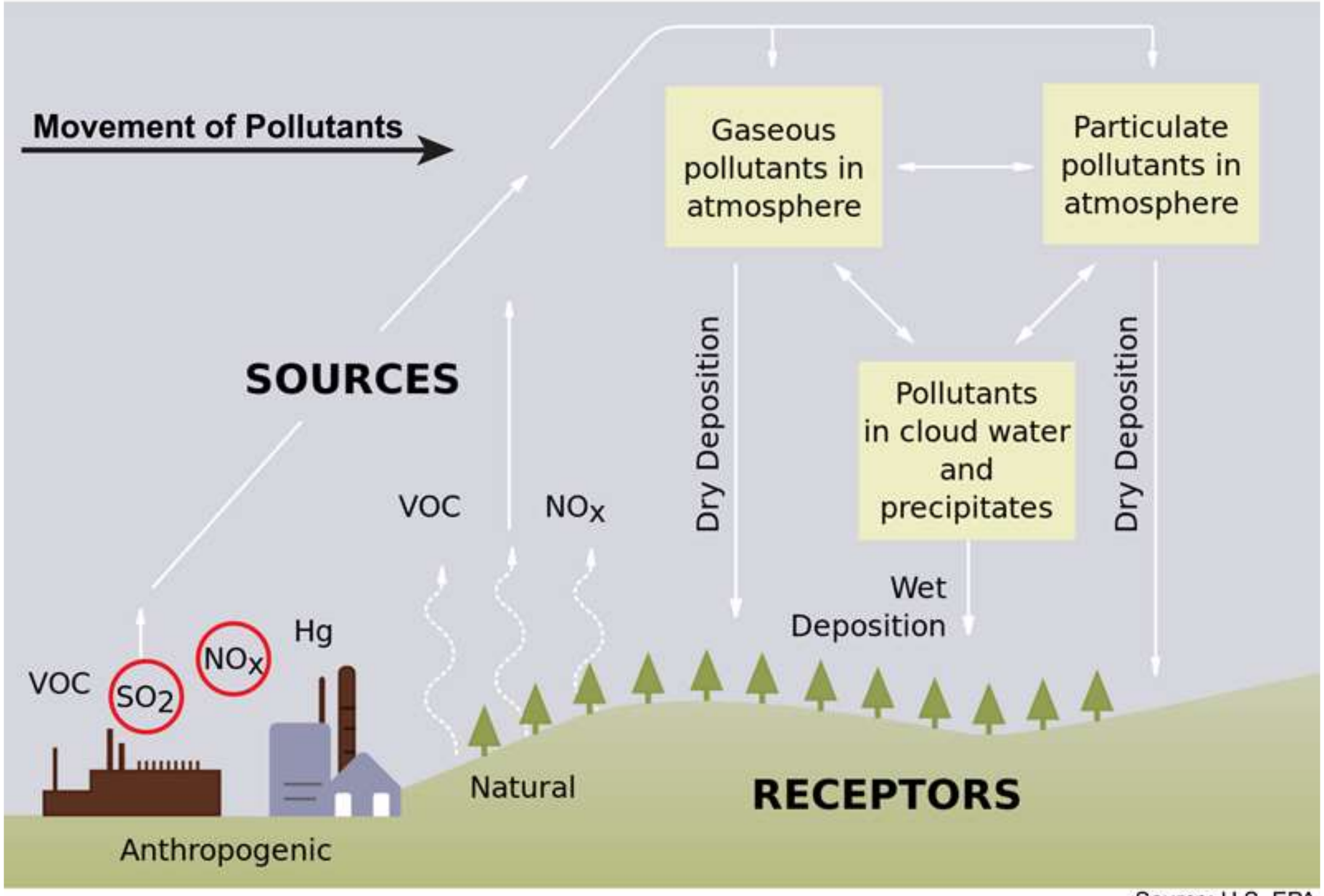
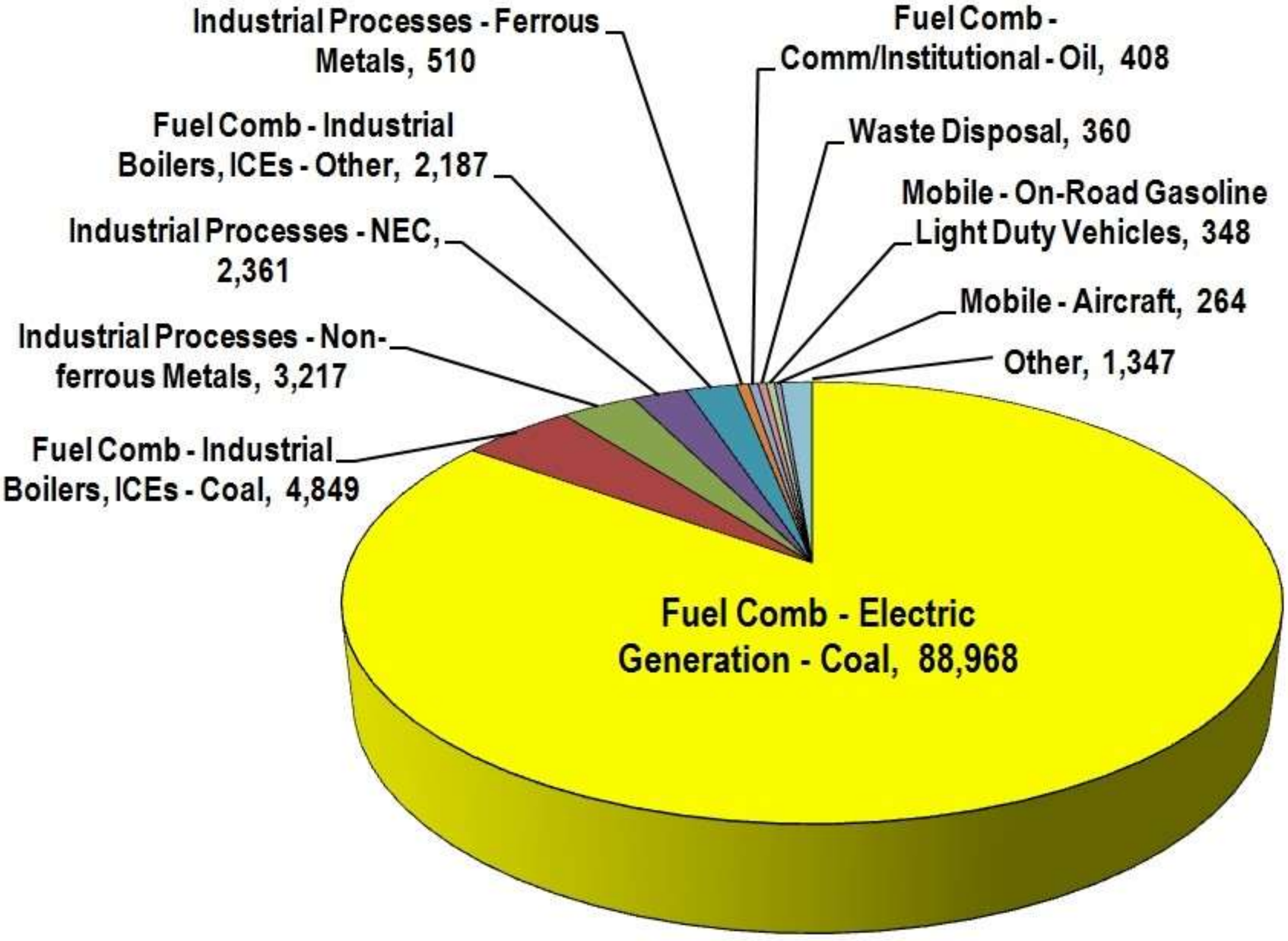
BACKUP

Formation of Acid Clouds and Acid Rain



Source: U.S. EPA

Top Sources in 7 County Area for SO2 Emissions (104816 tons/year)



Worldwide sulfuric acid end-use