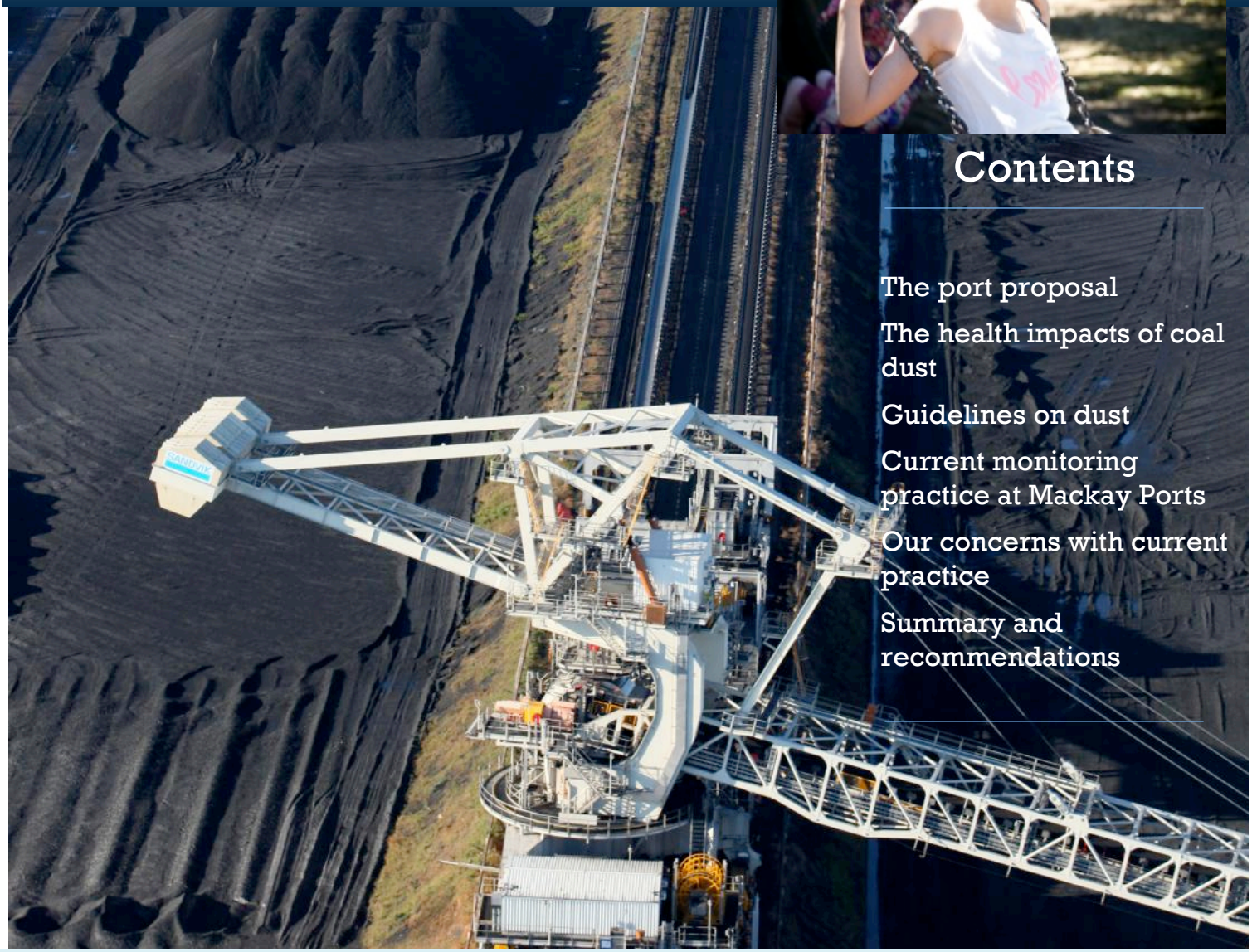
February 2013

Coal Dust and Health

In the Mackay Region.

This brief is intended for health professionals and the public. It analyses the health impacts of the proposed new coal port at Dudgeon Point on the community of Mackay.



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By Communities Protecting Our Region

Summary

About the proposed coal port

1. The two new coal terminals proposed for Dudgeon Point, 13 kilometres south east of the Mackay city centre, will triple the amount of coal currently through the Hay Point coal port lands complex of Hay Point and Dalrymple Bay coal terminals.

The health impacts of coal dust

2. Coal dust, especially fine coal dust, contributes to a range of diseases and health problems including respiratory illness, cardiovascular diseases and lung cancer. Fine particles penetrate deeply into the lungs and are difficult for the body to expel. Over time these particles accumulate and do more damage. There is no safe level of exposure to coal dust.

Queensland government dust standards

3. Current Queensland and Federal Government dust standards for the most harmful fine dust are advisory only and monitoring is not mandatory. Therefore these standards offer little protection to our community.

Monitoring practice of coal dust at Hay Point

4. North Queensland Bulk Ports is responsible for monitoring dust from Hay Point and Dalrymple Bay. Only total dust levels are reported (on a 24 hour and monthly average basis)- coarse and fine particulates (PM 10 and PM 2.5) are not monitored, despite their proven health impacts. Only one monitor for PM10 is operational in Mackay, operated by the Queensland Department of Environment and it is 19 kilometres away in Mackay.

Our concerns with current practice

5. Fine and coarse particulate matter should be monitored in communities around the ports, as well as in Mackay. "Spikes" in dust can also trigger health problems, so continuous data (rather than daily or monthly) should be available. Alerts of high dust and particulate levels should be available for vulnerable people such asthmatics, the elderly and people with heart and lung problems so they can take precautionary measures to avoid dust exposure. As fine coal dust is cumulative in the lungs the community needs to know levels of exposure to coal dust specifically.

Recommendations

There must be no new coal port infrastructure that will affect the health of our community through increased coal dust. To ensure this, the health impacts of the current coal terminals must be independently assessed.

This would entail:

§ continuous monitoring and reporting of PM2.5 and PM10 coal dust particles in a comprehensive monitoring network covering the Hay Point coal terminals complex and the residential areas of the Mackay and Sarina area; and

§ a baseline study of the health impacts of the emissions from the current Hay Point coal terminals complex on the greater Mackay population.

The data from at least one year of PM2.5 and PM10 monitoring for existing ports and the findings of the health impacts study must be included in the Environmental Impact Statement for Dudgeon Point to enable a proper assessment of the proposed port infrastructure. The EIS should not be submitted for government and community consideration until these actions are taken.

Members of Communities Protecting Our Region surveying community members about the Dudgeon Point Port proposal.

About Communities Protecting Our Region.

Communities Protecting our Regions is working to protect our health, our communities and the Great Barrier Reef from threat of the Dudgeon Point Coal Terminal and the damage it will cause.

For more information about the group please visit dudgeonpoint.org or email dudgeon.point@gmail.com

The port proposal

The new port has a capacity of 180 million tonnes per annum – larger than the ports of Hay Point and Dalrymple Bay combined.

The proposed Dudgeon Point Coal Terminals Project (DPCT/'the proposal') consists of two coal export terminals with a combined capacity of up to 180 million tonnes per annum (Mtpa) plus associated infrastructure. The project is expected to include new coal stockyards, up to 10 new ship berths, an extensive new rail connection from the Goonyella system to Dudgeon Point, and an expansion of the existing Tug Harbour at Half Tide.[1]

The proposal is 4 km north east of the existing coal export facilities at Hay Point (Hay Point and Dalrymple Bay coal terminals), which have a combined capacity of 140 Mtpa. The terrestrial section of the port lands curves in a U shape around the pre-existing coastal township of Louisa Creek. Thirteen other townships: Hay Point; Half Tide, Salonika Beach; McEwens Beach, Dunnrock; Fenechvale; Timberlands; Chelona; Rosella; Balberra; Alligator Creek; Grasstree Beach; Bakers Creek and the southern boundary of the city of Mackay are scattered within an 8 km arc to the east, west and south of Dudgeon Point.

The Hay Point port land coal terminals are just 13 km directly from Mackay's city centre. The Mackay regional planning map shows much more future urban growth will occur between the Hay Point port lands and this city, exposing a rapidly increasing population to more hazardous fine coal particulate pollution for up to 150 years if the Dudgeon Point coal terminals are built, because the prevailing wind direction is from the southeast. Mackay is downwind of these coal terminals (Fig.1).

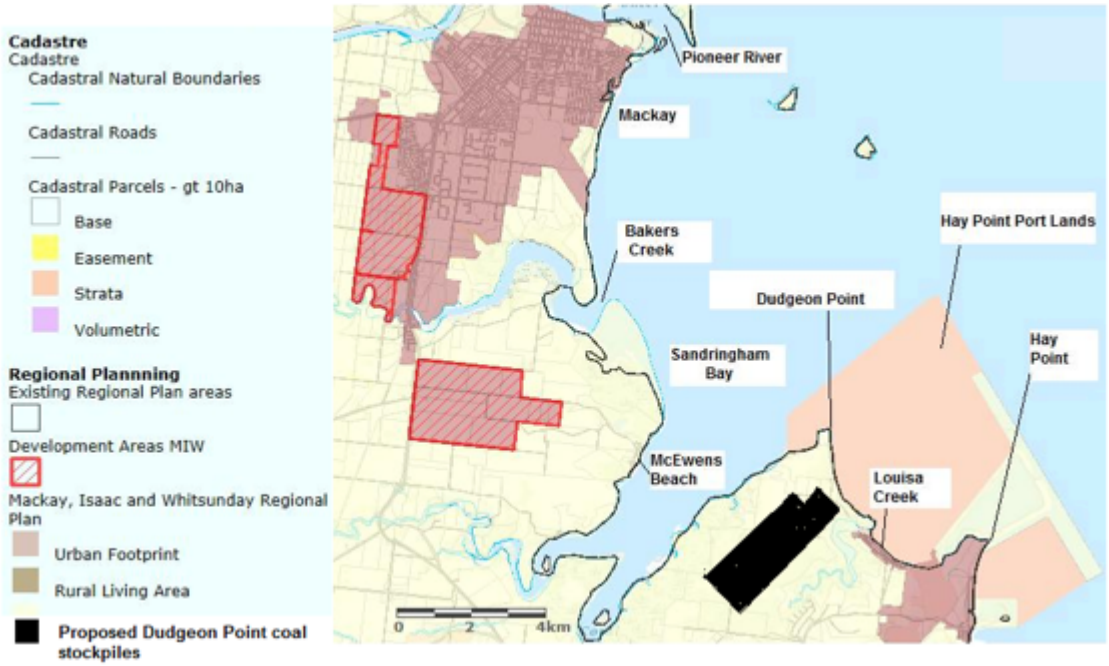
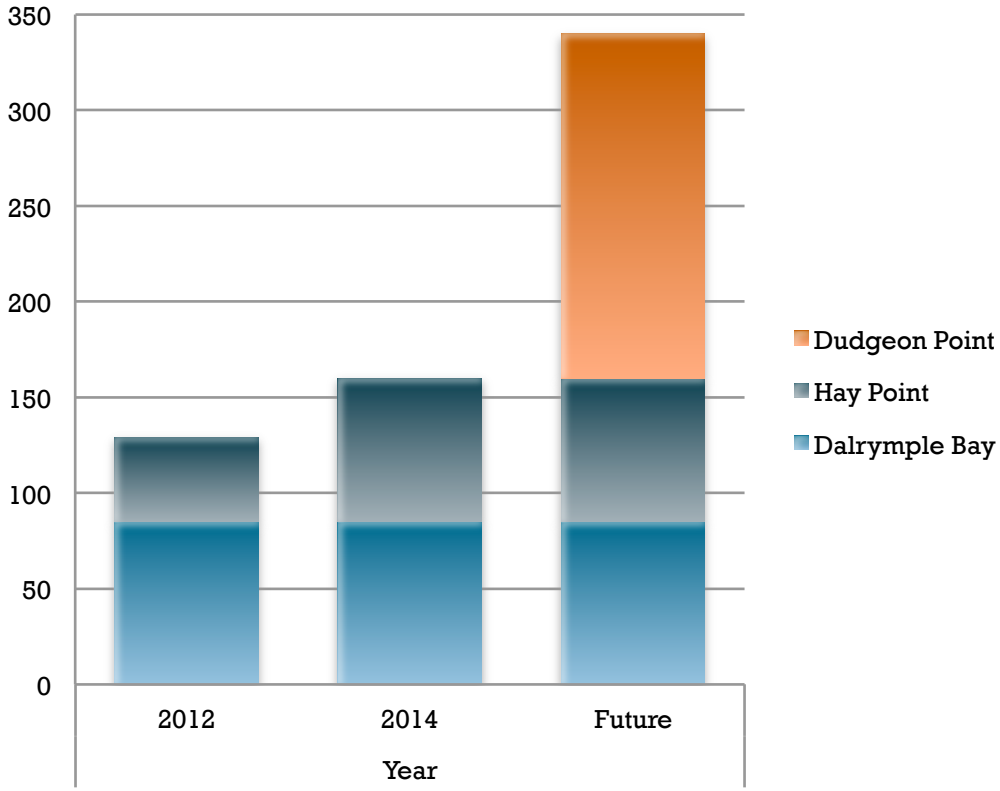


Figure 1: Location of Dudgeon Point coal stockpiles in relation to urban areas in Mackay. Adapted from the Mackay, Isaac and Whitsunday Regional Plan 2012

The proposal would include up to six new rail lines passing close to existing communities, with trains up to 2 km long running as frequently as every 30 minutes, 24 hours a day for the declared 150 year life of the project. The rail network will feed coal stockyards that will cover approximately 400 ha, where coal will be stored and blended before export. Figure 2 shows a comparison of the current and projected annual coal export capacities in million tonnes per annum (Mtpa) of the Hay Point port land coal terminals.

Dudgeon Point Project Management (DPPM)[2] and Adani Mining Pty Ltd (Adani) are the preferred proponents for the development. Each proponent plans to build and manage one of the two proposed terminals, with North Queensland Bulk Port Corporation (NQBP) facilitating the development.

Fig 2. Coal export capacity (Mtpa)



Impacts of coal dust on human health

Coal is stored in the Hay Point port lands in large stockpiles. The stockpiles for the proposed two Dudgeon Point coal port terminals would cover 400 ha and stand up to 13 m high. Coal dust will come from those stockpiles as well as from the rail wagons, unloading and loading operations, and the conveyor belt carrying the coal to the ships for export. Mitigation efforts such as water spraying, veneering (a coating over the coal in the train wagons) and partial closure of some of the equipment will reduce coal dust levels but not necessarily to a level at which there is no risk of harm to human health.

Coal dust, especially fine coal dust, has been identified by health professionals and doctors around the world as causing a range of diseases and health problems.[3] Examples include an increased incidence of heart and respiratory diseases like asthma and lung cancer. Fine invisible coal dust particles less than 2.5 microns long lodge in the lungs and are not naturally expelled, so long-term exposure increases the risk of health problems. Ultrafine coal dust particles of 0.1 micron or less can cross from the lungs into the blood stream and can cause diseases in the kidney and the brain.

The health risks increase with the level and frequency of exposure. As fine coal dust accumulates in the lungs over time duration of exposure is also a risk factor. Epidemiological research suggests that there is no threshold at which health effects do not occur.[4] This conclusion is supported both by the World Health Organization and several research studies.

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How can coal dust harm us?

- Coal dust, especially fine coal dust, contributes to a range of diseases and health problems including respiratory illnesses, cardiovascular diseases, and lung cancer.
- Coal dust contains toxic heavy metals such as cadmium and arsenic.
- The body can not easily expel fine particles so over time they can accumulate and do damage.
- The duration of exposure to coal dust may determine the health impacts, as will the amount of coal dust in the air, and the chemical composition of the particles.
- No safe level of exposure to coal dust has been established.

The factors that may influence the health effects related to exposure to particles include:

- the chemical composition and physical properties of the particles
- the mass concentration of the airborne particles
- the size of the particles (smaller particles may be associated with more adverse effects because they can be inhaled more deeply into the lungs)
- the duration of exposure (short and long term, possibly in years).[5]

These particles are present in the dust that people breathe as a result of the coal terminals at Hay Point and Dalrymple Bay, along with minerals (primarily sand) and organic matter.

A threefold increase in coal dust emissions from the Hay Point port lands coal terminals is possible based on current export volumes compared to all port terminals, including the proposed Dudgeon Point terminals, operating at full capacity.

The health impacts of a substantial increase in coal exports from new terminals in the Hay Point port lands is therefore a matter that must be addressed as a part of NQBP's economic, social and environmental license to expand coal exports at this location.

To date there has been no research on the expected health impacts in the Mackay region of coal dust from the rail and port operations at Hay Point. Data to conduct such research, such as the geographic distribution of fine PM2.5 coal dust emissions and related health impacts from current coal exports, is also lacking.

Guidelines on Dust Particles

The key issue with the current dust standards employed by all levels of government and NQBP operations is that they do not protect the community from the significant health impacts of fine coal dust. As previously stated, any amount of coal dust or particulate matter will be harmful to human health and the standards are being consistently adjusted downwards to protect our population.

The current Queensland standards are based on a low level of risk to the general population from all types of dust exposure. This risk level does not account for the fact that coal dust is more toxic than many other types of particulates and for an exposure time of up to 90+ years.

This is in spite of the fact that coal dust has specific impacts on human health related to the presence of heavy metals. The smallest ultrafine PM0.1 particles are a greater health risk as these can pass directly into the blood stream from the lungs. These very fine particles are associated with burned products such as diesel used in heavy machinery associated with port operations.

The Queensland government has dust standards regulating the amount of PM10 (see below for an explanation of terminology) and *advisory standards* for PM2.5.

WHO standards are only advisory

The amount of coal dust and other particulate matter being inhaled in sensitive residential areas (such as schools) must increase as coal exports increase from the Hay Point port and if Dudgeon Point Port is built.

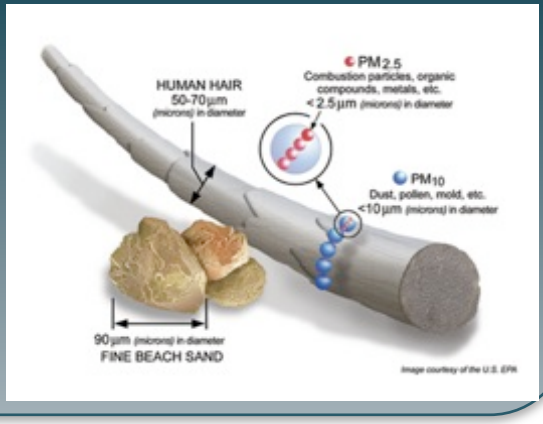
The World Health Organisation (WHO) guidelines for particulate matter are being used as advisory standards only with relation to the more harmful PM2.5. WHO also reports that the low end range of concentrations at which adverse health effects have been demonstrated is only slightly above the background concentration of 3–5 μg/m^3 for PM2.5 particulates, and 8-10 μg/m^3 for PM10.

These guidelines specify that the length of exposure time changes the mortality risks. WHO estimates for daily exposure there is a 1% increase in mortality for each 10μg/m^3 increase in PM10 particulates.

Dust Particle Terminology

PM10 is particulate matter 10 microns or less in diameter. A micron is one millionth of a metre. PM2.5 is particulate matter 2.5 microns or less in diameter.

PM2.5 is generally described as fine particles. By way of comparison, a human hair is about 100 microns diameter, so some 40 or more fine particles could be placed on its width.[6]



Current dust monitoring practice at Hay Point Port

North Queensland Bulk Ports measures dust concentrations in and around the Hay Point port lands. Recent results are available as monthly publications for download on its website as *Hay Point - Ambient air, noise and weather monitoring data f*rom 2011–2012.[7]

Current monitoring practice only provides dust data averaged for daily or monthly values. This doesn't represent the 'spikes' in dust emissions that can set off respiratory illness.

Meteorological Conditions

Meteorological Conditions are monitored on a continuous basis at sites P1, P2 at each end of Louisa Creek; P3 north of Half Tide; and P4 at the southern end of Salonika Beach using a Vaisala WXT520 Multisensor Weather Monitor. Conditions monitored include wind speed, and direction, ambient temperature and relative humidity.

Dust Monitoring

Both ambient air and dust deposition monitoring is carried out.

Ambient Air

Continuous monitoring of ambient air quality is carried out at sites P1, P2 P3 and P4 for Total Suspended Particulates (TSP) using the TEOM 1405 TSP Ambient Particulates Monitor. The TEOM passes a known volume of air through a filter, and records the mass of particulate matter collected by the filter. The concentration of TSP is then calculated by dividing the mass of particulate matter by the volume samples.

Data is presented as daily 24 hour average concentrations in micrograms per cubic metre ($\mu g/m^3$). The Management Object Level is calculated by adding 50 $\mu g/m^3$ to the 24 hour averaging period of the most upwind site (either P1 or P4, depending on the prevailing wind conditions), as per the Development Approval. These daily 24 hour average dust levels for each monitoring site and Management Objective levels are graphed for each month.

Note that actual average 24-hour levels of coal dust cannot be separated out by this method of measurement which measures all forms of dust. To get some idea of the fraction of coal dust present NQBP measures dust deposition.

Dust Deposition Monitoring

Dust deposition gauges are installed at 23 sites next to and near the port lands. There are two control sites; six residential sites; eight sites at Dalrymple Bay Coal Terminal and four at Hay Point Coal Terminal.

Their purpose is to measure the amount of dust deposition (fallout) that is occurring around and near the Hay Point port lands. Sample collection bottles are set a 2 m above ground and sample are collected on a monthly basis and analysed by an ALS NATA accredited laboratory for soluble solids, insoluble solids, combustible matter and approximate percentage of fine dark particles.

The Management Objective Level for dust deposition is calculated as the average Total Insoluble Solids for the control sites (C1 and C2) plus 60mg/m^2/day (as per the Queensland government Development Approval conditions).

Dust deposition for residential sites is graphed for each monitoring site for the month. At each site the amount of deposition by type of dust (i.e. fine dark particles; organic matter and mineral fraction) is shown together with the Management Objective Level.

Dust deposition for the Dalrymple Bay and Hay Point coal terminal sites is similarly graphed.

Monitoring dust particle size

Historically, PM10 and PM2.5 data has not been measured within Hay Point port lands.

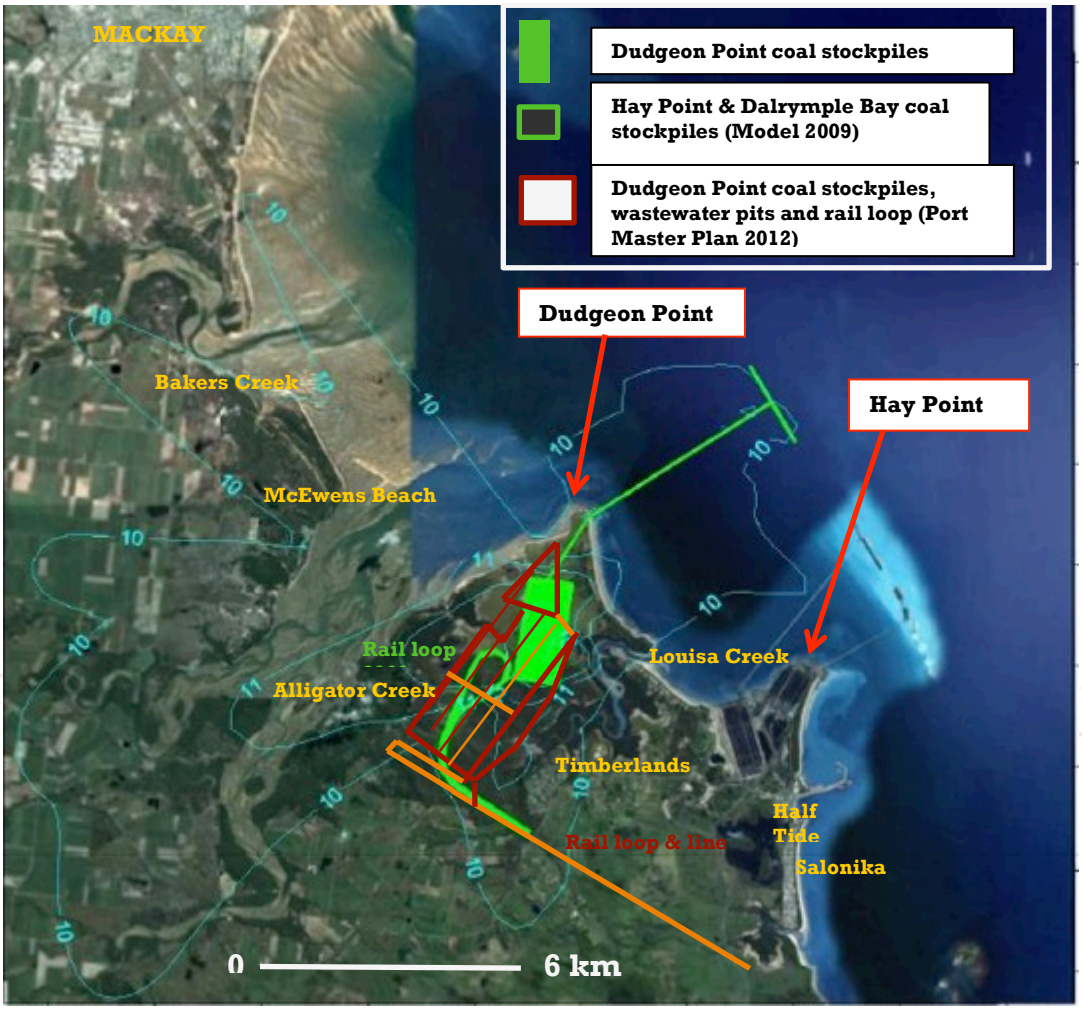
NQBP meets it's obligations under the Queensland dust standards by performing computer modeling rather than doing actual monitoring of dust levels.

A PM2.5 monitoring station is being established in 2013 in the township of McEwens Beach approximately 3 km northwest of the proposed Dudgeon Point coal stockpiles.

NQBP consultant company Katestone modeled maximum PM2.5 emissions from Hay Point coal terminals in 2009 for NQBP, including projected emissions from two proposed coal terminals at Dudgeon Point. They assumed a background dust level of 9.4 µg/m3 and coal throughput at 120 Mtpa for Dudgeon Point; 88 Mtpa for Dalrymple Bay and 45 Mtpa at Hay Point coal terminals.

Estimated emissions ranged from 10-20 µg/m3 (Fig.3). That range of emissions covered the townships within 8 km of Dudgeon Point and emissions of 10 µg/m3 reached the southern end of Mackay.

Fig.3 Modelled extent of hazardous fine coal dust concentrations from new Dudgeon Point port proposal at 120 million tonnes per annum and other coal terminals exporting at maximum capacity in the Hay Point port lands (this is 75% of current planned capacity).



Hazardous fine dust emissions from the Hay Point coal terminals will increase in the greater Mackay region if the Dudgeon Point coal terminals are built.

Modeled maximum 24-hour average ground-level concentrations of PM2.5 fine dust emissions (numbered blue contour lines) when the background level is 9.4 $\mu g/m^3$; Dudgeon Point coal terminal is operating at near capacity at 120 Mtpa; Dalrymple Bay at 88 Mtpa and Hay Point at 45 Mtpa. Source: Katestone Calpuff model for NQBP (2009).

NB: The added orange and red striped lines show the location and current projected size of the Dudgeon Point coal stockpiles, wastewater pond areas and the rail loop and line.

Concerns with current dust monitoring practice

Particulate size must be monitored

As explained above, dust from the Hay Point Port Lands is analysed for deposition percentages by type but not for particulate size.

However, given the differing health impacts of the various particulate sizes in order to accurately understand the health impacts of the port lands this must be monitored for.

There is a new PM2.5 monitoring station at McEwen's Beach but, for data to be scientifically valid, a network of PM2.5 monitoring stations, strategically placed, must be established.

As the amount of coal being exported through the Hay Point coal port terminals increases, the proportion of coal dust in these dust samples will also be higher thus the need for PM2.5 and PM10 particulates data to correlate with health impact assessments.

Monitoring must occur in Mackay and Northern Beaches

The lightness of fine dust particles allows them to remain suspended for long periods, and to blow hundreds to thousands of kilometres depending on wind and other meteorological conditions.

Prevailing winds blow from the southeast and already blow fine coal dust from the Hay Point port land coal terminals over Mackay. Coal dust from the existing Hay Point and Dalrymple Bay port terminals within the Hay Point port lands has been reported in east Mackay, Mackay Harbour apartments and as far as Blacks Beach, a northern suburb of Mackay 26 km directly northwest of the Hay Point port lands.

As these particulates are visible they are likely to be PM10 so it seems both PM10 and PM2.5 and smaller particulates are reaching Mackay.

Monitoring must be continuous rather than averaged

While you can get some idea for the month of the percentage and amount of each month's fine dark particulates (probably the more hazardous coal and diesel particulates) from the monitoring sites, you still do not know daily, hourly, or minute levels of these emissions.

You do not get data that shows more dangerously high levels in "spikes" of emissions due to variability in wind and moisture conditions, and the degree of disturbance of the coal, because they are lost in the presentation of reported data as "averaged" daily and monthly values.

The continuous form of data is more useful for helping to monitor more acute health impacts because it is the spikes in emissions that can set off respiratory illness attacks such as asthma in the more susceptible sectors of the population.

Conclusion

As the Keystone modeling data is a 24 hour average it is quite probable there will be times when emissions over Mackay will be at 10µg/m^3 or higher. The modeled 24 hour average ranges fall within WHO's, Australian and Queensland standards but still are in the range at which could harm the health of some of the affected population.

Based on available information the health risk does not appear acceptable for fine coal dust given that such particles:

- Are hazardous above background levels of 3-5 µg/m3 and there may be no safe level of exposure to fine coal dust
- Cannot be expelled from the lungs and will cumulate there and in other parts of the body and
- Multiple generations of people in the greater Mackay region will be exposed over the life of these coal ports e.g. Adani has stated in its EIS that its proposed coal port terminal at Dudgeon Point would operate for 150 years.

This information suggests that there should not be a further increase in exports of coal from the Hay Point port land terminals.

References

1. http://www.nqbp.com.au/hay-point/
2. A consortium of Carabella Resources Limited, Macarthur Coal Limited, Middlemount Coal Pty Ltd, New Hope Corporation Limited, Peabody Energy Australia Pty Ltd
3. http://www.psr.org/resources/coals-assault-on-human-health.html, http://beyondzeroemissions.org/blog/coal-health-report-121023
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