Proposed Development in Townsville Supplementary Advice on Ammonium Nitrate and Class 1 Explosives in Townsville Port

for Hyder Consulting

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1 Introduction

Hyder Consulting are assisting their client to assess the responses to an EIS for the proposed ocean terminal and residential development adjacent to the Port of Townsville. The Townsville Port Authority (TPA) has raised significant objections, particularly with regard to the proximity of the development to berths handling Class 1 explosives and Security Sensitive Ammonium Nitrate (SSAN).

Hyder Consulting requested Robert Hutchison of Lloyd's Register (LR) to provide additional information on the overpressures that would occur following explosions of various quantities of Class 1 explosives and SSAN.

2 Current Berth Limits in Townsville

The current ordinary berth limits for Class 1 explosives and SSAN are given in Table 2.1.

Table 2.1 Ordinary Berth Limits

Berth No.	Ammonium Nitrate (te)			Explosives (te NEQ)		
	AN	Emulsions	Additional Transit AN	Class 1.1, 1.2, 1.5, 1.6	Class 1.3	Class 1.4
1	400	25	1000	100	250	358
2	400	25	1000	58	250	265
3	400	25	1000	17	92	250
4	400	25	1000	6	5.4	250
7	400	25	1000	11	13.2	250
8	400	25	1000	11	5.2	250
9	400*	25*	1000*	6*	19.8*	250*
10	400*	25*	1000*	2.2*	19.8*	250*
11	400	25	1000	240	250	680

* Ammonium Nitrate, Oxidising Liquids Class 5.1, Calcium Hypochlorite and Dangerous Goods classified as packaging group 1 exceeding 500kgs will only be permitted to be transported or handled on Berths 9 and 10 during periods of inactivity at the Townsville Breakwater and Convention Centre. (Port Notices, November 2006)

If quantities are required to be present in excess of those shown in Table 2.1, a "Special Berth" will have to be declared. This will require evacuation of all personnel not directly involved in the loading or unloading from the ship. The evacuation distance will vary depending on the quantity of explosive[1]. For example, a shipment of 2000 tonne (te) of SSAN will require

[1] In Queensland, both Class 1 explosives and Class 5.1 ammonium nitrate (SSAN) have been declared to be "explosives".

an evacuation distance of 456 m around the ship, which will prevent any ships from being at any adjacent berths. This will result in significant increased costs for the ship carrying the ammonium nitrate.

3 DME Guidelines

Information Bulletin No. 50 (version 3) 8 Feb 2008 issued by the Queensland Explosives Inspectorate states that for SSAN in containers, up to 400 te can be loaded or unloaded at an ordinary berth. Additionally up to 1000 te can be conveyed on a ship as transit cargo at an ordinary berth. "This means a ship may carry up to 1400 te, comprising 1000 te transit, plus 400 te that may be loaded or discharged without requiring a special berth."

However, changes to approved port explosives limits may occur if the Chief Inspector of Explosives is reasonably satisfied they are no longer appropriate for the port.

The tests that are proposed by the Chief Inspector of Explosives include the following:

- Does the overpressure from detonation[2] of the entire quantity of ammonium nitrate at the nearest protected works (e.g. residences) exceed 14 kPa?

  If so, the port explosives limit will most likely be reduced.

3.1 Modelling of Effects Distances of Ammonium Nitrate Explosions

The model required to be used by the DME results in the following estimations of overpressure at various distances.

Table 3.1 Overpressure from Ammonium Nitrate Explosions

Quantity of Ammonium Nitrate (te)	Distances to Overpressure (m)				
	35 kPa	21 kPa	**14 kPa**	7 kPa	3.5 kPa
150	193	291	378	647	807
400	267	403	**524**	897	1119
500	288	434	565	966	1205
1000	363	547	711	1218	1518
1150	380	573	745	1276	1591
1400	406	612	**796**	1362	1699
1800	441	666	865	1481	1847

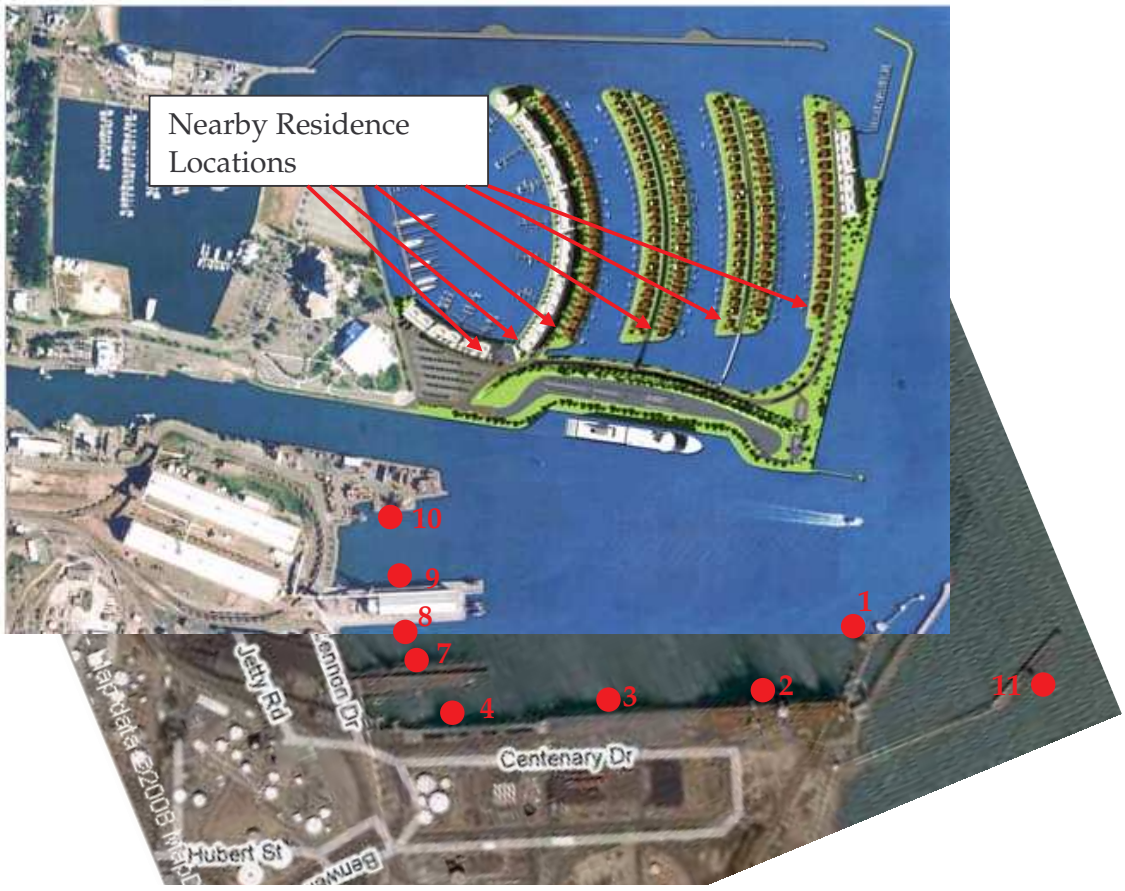
[2] The Explosives Inspectorate specifies the model to be used when calculating the overpressure from detonation of ammonium nitrate.

For an explosion of the entirety of the load of a ship containing 400 te of SSAN, an overpressure of 14 kPa would travel 524 m from the location of the explosion. For an explosion of the entirety of a ship carrying 1400 te of SSAN, an overpressure of 14 kPa would travel 796 m from the location of the explosion.

The effect on people of such an explosion is given in the NSW Department of Planning Document (*Hazardous Industries Planning Advisory Paper No. 4 – Risk Criteria for Land Use Planning*). An overpressure of 14 kPa will render a house uninhabitable and badly cracked. An overpressure of 21 kPa will result in 20% fatalities to people in buildings.

3.2 Possible Reductions in Berth Limits

The distances from the berths to the nearest residences has been used to estimate the possible reduction in berth limits that could be applied by the Chief Inspector Explosives.



500 m

Figure 3.1 Berth Locations Relative to Proposed Marina

The maximum quantities of SSAN and Class 1 explosives that could be present at these berths without having the 14 kPa overpressure being exceeded at the nearest residences is shown in Table 3.2 below.

Table 3.2 Maximum Quantities of Explosives Potentially Permissible at Berths

Berth	Distance to nearest residence (m)	Maximum SSAN quantity (te) permissible	Maximum Class 1 quantity (te NEQ) permissible
1	610	629	201
2	714	1012	324
3	714	1012	324
4	714	1012	324
7	571	518	166
8	533	421	135
9	429	219	70
10	343	112	36
11	819	1526	488

The difference to the current berth limits is highlighted in the following table. The green highlighted cells show where there would be no change in the port limits. The orange highlighted cells show where there would be a decrease of less than 50% and the red highlighted cells show where there would be a decrease of greater than 50%.

Unfortunately, there is an ambiguity in the Australian Standard (AS3846), which is called up in the explosives regulations. The maximum permitted transit quantity[3] of SSAN is 1000 te. There is an uncertainty whether this quantity of SSAN includes or excludes the 400 te SSAN that may be loaded or unloaded at the port. In Gladstone Port, the interpretation has been that a maximum of 1400 te of SSAN may be on a ship at an ordinary berth, whether this comprises 1000 te transit and 400 te loaded/unloaded or comprises 1400 te transit.

Thus the values given in Table 3.3 have two entries for transit AN (relative to 1000 te maximum on the ship; and relative to 1400 te on the ship).

[3] at an ordinary berth. Otherwise a Special Berth will have to be declared.

Table 3.3 Ordinary Berth Limits

Berth No.	Ammonium Nitrate (te)				Explosives (te NEQ)		
	AN	Emul.	Transit 1000 te	Transit 1400 te	Class 1.1, 1.2, 1.5, 1.6	Class 1.3	Class 1.4
1	400	25	629 (↓ 37%)	629 (↓ 55%)	100	201 (↓20%)	358
2	400	25	1000	1012 (↓ 28%	58	250	265
3	400	25	1000	1012 (↓ 28%	17	92	250
4	400	25	1000	1012 (↓ 28%	6	5.4	250
7	400	25	518 (↓48%)	518 (↓ 63%)	11	13.2	250
8	400	25	421 (↓58%)	421 (↓ 70%)	11	5.2	250
9	219* (↓45%)	25*	219* (↓ 78%)	219* (↓ 84%)	6*	19.8*	250*
10	112* (↓72%)	25*	112* (↓72%)	112* (↓ 92%)	2.2*	19.8*	250*
11	400	25	1000	1400	240	250	680

Note: There is no change to the limits for Class 1.4 explosives as an unlimited quantity may be permitted to be transported through an ordinary berth under the regulations. The only limit is that which is imposed by the Port Authority.

* Ammonium Nitrate, Oxidising Liquids Class 5.1, Calcium Hypochlorite and Dangerous Goods classified as packaging group 1 exceeding 500kgs will only be permitted to be transported or handled on Berths 9 and 10 during periods of inactivity at the Townsville Breakwater and Convention Centre. (Port Notices, November 2006)

This shows that there is only a minor impact on the berth limits for Class 1 explosives. Only berth 1 would be subject to a 20% reduction in the limit for Class 1.3 explosives and this quantity could be unloaded on berth 2.

Similarly there is not a significant impact on the berth limits for AN being loaded or unloaded from a ship. Only berths 9 and 10 would have a lower limit. This would probably mean that these berths would not be used for AN loading or unloading in the future.

There would be no impact on the berth limits for AN emulsion.

The greatest impact is on the transit of AN through the port. If the transit quantity is 1000 te, only berths 2, 3, 4 and 11 will not be affected. Berths 1

and 7 will have their transit limit reduced by up to 50% and berths 8, 9 and 10 will have their transit limit cut by more than 50%.

If the transit quantity of AN is 1400 te, all the berths will be affected except for berth 11, which does not have facilities for handling containers. Berths 2, 3 and 4 will have a 28% reduction in limit for AN, whereas the other berths will have a reduction of greater than 50%, some as high as 92% (berth 10).

4 Conclusion

The impact of the proposed development on the berth limits for Townsville Port are minimal for the transportation of Class 1 explosives and for AN emulsions.

The impact of the proposed development on the berth limits for SSAN are significant, most especially for transit AN. The quantities of AN that could transit through the port would be less than 1400 te at all berths (except for berth 11, which does not have container handling facilities).

If the transit quantity for AN is only 1000 te, the berth limits would be reduced for most of the berths, although berths 2, 3 and 4 would still be able to handle 1000 te of AN in transit.