THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

REPORT
relating to the
RELOCATION OF ALBION EXPLOSIVES FACTORY TO MULWALA, NSW

(Seventh Report of 1988)

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

Twenty-Ninth Committee

Mr Colin Hollis, MP (Chairman)
Mr Percival Clarence Millar, MP (Vice-Chairman)

Senate	House of Representatives
Senator Bryant Robert Burns	Mr Maxwell Arthur Burr, MP
Senator John Robert Devereux	Mr George Gear, MP
Senator Dr Glenister Sheil	Mr Robert George Halverson, OBE, MP
	Mr John Graham Mountford, MP

Sectional Committee on relocation of Albion Explosives Factory to Mulwala, NSW.

Mr Colin Hollis, MP (Chairman)
Mr Percival Clarence Millar, MP (Vice-Chairman)
Mr George Gear, MP
Senator Bryant Robert Burns

EXTRACT FROM THE VOTES AND PROCEEDINGS
OF THE HOUSE OF REPRESENTATIVES

NO. 41 DATED THURSDAY 25 FEBRUARY 1988

PUBLIC WORKS COMMITTEE - REFERENCE OF WORK - RELOCATION OF ALBION EXPLOSIVES FACTORY TO MULWALA, NSW: Mr West (Minister for Administrative Services), pursuant to notice, moved - That, in accordance with the provision of the Public Works Committee Act 1969, the following proposed work be referred to the Parliamentary Standing Committee on Public Works for consideration and report: Relocation of Albion Explosives Factory to Mulwala, NSW.

Mr West presented plans in connection with the proposed work.

Debate ensued.

Question - put and passed.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

RELOCATION OF ALBION EXPLOSIVES FACTORY TO MULWALA, NSW

By resolution on 25 February 1988 the House of Representatives referred to the Parliamentary Standing Committee on Public Works for consideration and report the proposal for the relocation of the Albion Explosives Factory to Mulwala, NSW.

THE REFERENCE

1. The work proposed under this reference involves the provision of:

- buildings to house process and service plant;
- explosives storage buildings;
- laboratory, administrative and support buildings;
- roads and clearways;
- evaporation ponds and a burning ground for waste disposal;
- new gun propellant plant;
- protective earthwork mounds where needed; and
- utilities.

2. The work also involves the transfer and re-installation of decontaminated plant from the Albion Explosives Factory. The decontamination and sale of land at Albion are not addressed in this report.

3. The estimated cost of the proposed work when referred to the Committee in February 1988 was $78.4m at November 1987 prices.

THE COMMITTEE'S INVESTIGATION

4. The Committee received written submissions from:

- Department of Defence
- Australian Construction Services (formerly Department of Administrative Services - Construction Group)
- Roy Boland International
- Australian Heritage Commission
- Shire of Corowa
- NSW Department of Agriculture

5. Evidence was taken from departmental representatives and the Corowa Shire Council at a public hearing in Mulwala on 4 May 1988. A list of witnesses is at Appendix A. The Committee's proceedings will be printed as Minutes of Evidence.

6. Prior to the public hearing, the Committee inspected the existing factories at Albion and Mulwala and the proposed site which is adjacent to the Mulwala factory (see Appendix C - figures 1 and 2).

BACKGROUND

7. The Department of Defence operates four explosive factories:

- Albion Explosives Factory, situated 20 km west of the centre of Melbourne
- Mulwala Explosives Factory, situated 90 km from Albury
- Explosives Factory Maribyrnong, situated 10 km west of the centre of Melbourne

. Munitions Filling Factory, St. Marys, situated 50 km west of the centre of Sydney

8. It is the Government's policy to rationalise and make more efficient the operation and organisation of its establishments. In line with this policy the Minister for Defence announced in December 1985 the closure of Albion Explosives Factory and the transfer of its manufacturing capability to Mulwala near the New South Wales/Victorian border (see figure 1).

9. This closure furthers the Government's aim of rationalisation and will enable the land at Albion to be utilised for residential and other community purposes. This proposal also ties in with the decontamination and sale of the Albion site.

THE NEED

10. There are two aspects to this proposal. Firstly there is pressure from the Albion community to remove a source of risk - the explosives factory - from a densely populated area, which will enable the land to be used to improve the community's quality of life.

11. The Department of Defence is implementing NATO Safety Principles for the storage of ammunition and explosives. These safeguarding principles require explosives facilities to be separated from other structures and facilities (both within the explosives factory and outside it) by distances appropriate to the nature and quality of explosives stored or being processed.

12. The delineation of areas which may be subject to safeguarding is derived from NATO principles. Essentially there are three lines drawn at distances from a potential explosion site determined by the type and quantity of explosive at that site. These lines are the minimum distance at which:

- facilities and activities involving the public may be sited - commonly called the green line;

- dwellings may be sited - commonly called the yellow line;

- certain types of large buildings of vulnerable construction or high density residential areas may be sited - commonly called the purple line.

13. The safeguarding map for the Albion factory indicates that the yellow line is within the factory boundary, but the purple line extends well into residential areas and encompasses a number of schools and community centres and a large shopping complex. It is considered undesirable for these types of public places to be located where there is any risk of injury resulting from the explosives factory's proximity.

14. The second aspect is that, in peace time, the four existing explosives factories operate well below maximum production capacity, which creates scale of economy problems with respect to staffing levels and plant operation.

15. The Department of Defence has conducted several reviews of its explosives manufacturing establishments since World War II. Objectives of the latest review were to maximise cost effectiveness and comply with safety guidelines which the Department adopted in 1981.

16. The solution to these problems is seen as being the relocation of the Albion Explosives Factory to Commonwealth-owned land adjacent to the existing factory at Mulwala. Advantages to this relocation include:

- reduced total overheads;
- more efficient use of plant and personnel;

- some common material stocks;
- some common maintenance requirements; and
- common personnel training, especially with respect to safety procedures and equipment

Committee's Conclusion

17. A need exists to relocate the Albion Explosives from the Melbourne metropolitan area to Mulwala and to rationalise the activities of the Department of Defence explosives factories.

THE PROPOSAL

18. It is proposed to relocate the trinitrotoluene (TNT), research and development explosives (RDX) and gun propellant manufacture to a new factory at Mulwala.

Options Considered

19. A July 1985 review by the Department of Defence discarded the notion of a single new explosives complex because of the high capital cost, estimated at roughly $900m. The less costly ($200m) alternative of expanding the St. Marys plant and relocating the Albion, Maribyrnong and Mulwala facilities to St. Marys was also discarded, on the grounds of the undesirability of such a large expansion of explosives facilities in a rapidly developing urban area.

20. The following options were also considered:

Option 1 - retain all factories with a centralised administration

Option 2 - close Maribyrnong factory and relocate to other factories

Option 3 - close Albion factory and relocate to Mulwala

Option 4 - close Albion and Maribyrnong factories and transfer function to other factories

21. Option 1 - All factories would be retained, but with a centralised administration. This option was discarded because it offered relatively small savings and did not satisfy the community/environmental needs at Albion.

22. Option 2 - The functions carried out at Maribyrnong factory would be transferred to the other factories. This option was rejected on the grounds that:

- the disruption would occur at an inconvenient time with respect to two important rocket propellant/motor filling projects;
- the decontamination and clearing of the Maribyrnong site is a substantial task;
- option 3 has a higher cost/benefit ratio; and
- the community/environmental needs at Albion are not satisfied.

23. Option 3 - This is the option preferred by the Department of Defence. It involves the closure of the Albion Factory and transfer of the high explosives and part of the gun propellant facilities to Mulwala. This option includes:

- clearance and decontamination of the northern 250 ha of the Albion site to facilitate its sale;
- retention of the remaining 250 ha to enable placement of the TNT, remaining gun propellant and nitroglycerine plants in 'care and maintenance';

- cessation of gun propellant manufacture at Maribyrnong; and

- transfer of shell breakdown, boilout and miscellaneous assembly work from Maribyrnong to St. Marys.

24. Option 4 - This involved closure of both Albion and Maribyrnong Factories, with transfer of high explosives and gun propellant production to Mulwala, rocket propellant production to either Mulwala or the Defence Research Centre, Salisbury, and other facilities to Mulwala and other factories as appropriate.

25. This option was discarded because of:

- the high capital cost (over $100m);

- the significant reduction in Australia's strategic defence capabilities during the closure and relocation process;

- the shortage of skilled manpower to carry out the relocation.

26. The Department of Defence considers that no other practical and economic alternatives exist apart from those discussed above.

Preferred Option

27. The preferred option was Option 3, which was seen to deal best with the need to rationalise munitions production while at the same time addressing community concerns regarding the Albion Factory. All of the features of Option 3, however, were not adopted. The final project involves only:

- transfer of the high explosives and part of the gun propellant facilities to Mulwala;

- clearance and sale of the northern half of the Albion site and, eventually, the southern half as well.

28. Cessation of gun propellant manufacture at Maribyrnong, transfer of shell breakdown and boilout and miscellaneous assembly work from Maribyrnong to St. Marys, are currently seen as long term proposals only.

29. Essential plant items in both the TNT and RDX production process will be relocated from Albion. In addition to the major plant items: pumps, pipe spools, pipe fittings, valves and electrical fittings will also be re-used where possible, and these form a specific portion of the scope of works.

30. Decontamination of the plant to be relocated will be carried out by Defence personnel, and tagging of specific items will be done in accordance with design documentation prior to disassembly. The scope of works for this project includes receipt of certified plant and equipment at Albion, transportation to Mulwala and installation at the new site.

Committee's Conclusion

31. The Committee is satisfied that the works proposed in this reference meet both the community concerns regarding the Albion Explosives Factory and the objective of rationalising the activities of the Department of Defence explosives factories.

ENVIRONMENTAL ASPECTS

Mulwala Site

32. The proposed factory will be located on Commonwealth-owned land adjacent to the existing Mulwala Explosives Factory. The site is bounded by the factory in the east, the Mulwala State

Forest in the west, farmland in the north and 'hobby farms' in the south (see Appendix C - figure 1).

33. An Environmental Impact Statement (EIS) was prepared. Issues addressed included:

- noise and air pollution
- groundwater and soil contamination
- waste management
- land management
- archaeological sites
- fire and safety risks
- local government concerns

34. In February 1988 the Minister for the Arts, Sport, the Environment, Tourism and Territories advised that the object of the Environment Protection (Impact of Proposals) Act 1974 had been met in relation to the proposal, subject to undertakings by the Department of Defence to fulfill all commitments made in the final EIS with regard to:

- environmental safeguards in the design, construction, operation and maintenance of the new factory, including all monitoring measures and adoption of the effluent irrigation scheme (if feasible);

- continuing consultation with relevant state and local government authorities;

- implementation of measures to prevent further groundwater contamination at Mulwala from existing sources; and

- completion of a hazards and operability study.

Consultations

35. A wide range of Commonwealth, State and local government authorities and as well as individuals were consulted through the environmental impact statement process. It is anticipated that consultations between the three tiers of government will continue during the construction and operational phases, particularly with respect to infrastructure and environmental issues.

Land Acquisition

36. The Department of Administrative Services has been negotiating with six landowners in order to acquire land to the north of the factory to act as a buffer zone (see Appendix C - figure 1). This land, of approximately 320 hectares, lies between the northern boundary of the factory and the Mulwala - Tocumwal Road. The holdings range from 4 - 270 hectares and the Department has, at the time of the public hearing, successfully negotiated to purchase three of the properties. Negotiations are well advanced regarding the three remaining properties. The land will be leased for agricultural purposes.

Noise and Air Pollution

37. Studies will be undertaken in the detailed design stage to ensure that all equipment and plant meet the requirements of the NSW State Pollution Control Commission.

Groundwater and Soil Contamination

38. The site is established sand dune country where drainage occurs more by seepage than by run off. In evidence to the Committee, the Department of Defence stated that contamination would be avoided by total containment of the primary effluent through the use of labyrinths, bunded areas and save-all pits. To

avoid the risk of groundwater contamination by leakage from the effluent ponds, a secondary barrier and a related monitoring system will be incorporated. There will also be groundwater bores located downstream of the ponds to monitor the groundwater quality. Rubble drains will be used to filter stormwater from the buildings so that there will be no direct link to the billabongs and wetlands.

Waste Management

39. In addition to the measures in the previous section, the Committee was concerned that effluent is being released into the Murray River from the existing factory. The amount of effluent will decrease when the new factory is commissioned.

40. Protection of an aquatic environment requires a high standard of effluent management to avoid pollution and this high standard will need to be maintained during the construction and operational phases to ensure no further degradation of the Murray River occurs.

41. The submission from the Shire of Corowa noted that the buffer zone could be irrigated by the neutralised effluent as a more desirable alternative to its release into the river.

42. At the public hearing the Department of Defence stated that although the effluent met all the requirements for discharge into the Murray River, it was not certain that the effluent, in its undiluted form, would be suitable for irrigation.

43. The Department is considering the costs associated with using the effluent to water the grassed safety mounds around the factory buildings and also discussing the suitability of the effluent for the purpose with the NSW Soil Conservation Service. The Committee suggests that, if it is feasible, the neutralised

effluent should be used to irrigate the land surrounding the factory buildings.

44. Liquid wastes will be processed through the waste water treatment facilities and recycled. When this water becomes unsuitable for recycling it will be pumped to the effluent evaporation ponds. Washdown water from the processing facilities will also be pumped to the ponds via labyrinths.

45. Solid residues will be cleared out of the evaporation ponds periodically and transported to the burning ground. This ground is isolated from the rest of the complex and consists of three reinforced concrete pads, truck turning bay and an operator's hut.

HERITAGE AND ARCHAEOLOGICAL ISSUES

46. The site contains the Mulwala Station homestead, one of the historic properties in the Riverina area (see Appendix C - figure 3). A Conservation Management Plan prepared for the property after its inclusion on the Register of the National Estate identifies two zones which are of significance. Zone A contains the homestead and woolshed complexes and a sheep dip area. This zone will remain free of any encroachment from the proposed factory, except for a roadway.

47. Given the nature of the factory, it will not be possible to inhabit the homestead once the factory is commissioned nor will it be possible to allow unrestricted access to the homestead by the public. The Department of Defence has taken steps to arrest further deterioration of the homestead and in the future there will be provision in the Department's budget for the homestead to be maintained in an acceptable state.

48. Public access will be restricted for safety reasons once the factory becomes operational, however the Department of

Defence will facilitate access by the NSW and Victorian branches of the National Trust twice yearly. At the public hearing the Department stated that it had undertaken to consider other requests for access to the homestead as they arise.

49. Zone B contains the grave of one of the homestead's original inhabitants. This grave is believed to be on the edge of the floodplain. Zone B also contains the RDX products complex and the burning ground. A review of the layout undertaken by the Department of Defence after the publication of the draft Environmental Impact Statement established that in order to maintain NATO safety distances within Commonwealth-owned land and to build the project over the 100 year flood line, these facilities could not be relocated. Given these constraints the Committee believes it is reasonable to construct the RDX complex and burning ground within Zone B.

50. In addition to the abovementioned historical sites, archaeological surveys have found Aboriginal artefacts and sites of interest scattered throughout the property. Many of these sites will not be affected by the project, however the Department of Defence has stated that it will separately fence identified archaeological sites within Zone B to prevent unauthorised access.

51. There is some possibility that excavation work will uncover archaeological material. It has been proposed that the construction on-site supervisor will be briefed on the characteristics of sites, likely finds and their archaeological implications. The Committee is satisfied that all practical steps shall be taken to safeguard archaeological matter found during construction.

FIRE AND SAFETY RISKS

52. Department of Defence factories generally comply with State Acts which govern the manufacture of explosives. The proposed

factory at Mulwala will also comply with NATO Safety Principles for explosives manufacture. Safety features include:

- containment of the effects of a possible explosion, by the separation of buildings by distances sufficient to prevent propagation to other buildings and to minimise serious damage to neighbouring places;

- separation of operations into individual buildings or bays as far as practicable;

- imposition of limits on the quantity of explosives and number of employees which may be present in a building at any time;

- promulgation of 'use lists', prescribing what tools may be used in the building;

- definition in writing of correct operating procedures;

- provision of special clothing, including footwear;

- prohibition of repairs until a clearance certificate has been issued by an authorised officer; and

- prohibition of resumption of production after close down until a full inspection and clearance to proceed has been issued.

53. In addition, strict attention is paid to the purity of raw materials and professionally qualified chemical engineers or chemists direct and supervise manufacturing operations. The accident rate from incidents involving explosives is very low and much less than that arising from ordinary industrial causes. In the proposed factory, the effects of fires and minor explosions will be minimised by plant design and separation of explosive materials.

54. As to transportation hazards, none of the chemicals used at the factory present unusual hazards, and the quantities are minute compared with the amounts of chemicals routinely transported each day in Australia. Shifting of explosives and propellant manufacture closer to Sydney, the ultimate destination of most of the production, will shorten the overall distance for explosives transport and thus achieve an overall net reduction in hazard, although increasing the risk in the vicinity of Mulwala.

55. A hazard operability study of the RDX and TNT processes, specialised fire assessment study and review of emergency procedures and contingency plans have been completed and the findings incorporated in the design of the proposed facilities.

56. Safety requirements of the explosives industry make buildings more expensive per unit of area because of the need to provide special fittings and finishes in the buildings and to have protective mounds around them. These mounds will be grassed and have in-ground watering systems incorporated to further decrease the risk.

Committee's Conclusion

57. Following assurances from the Department of Defence, the Committee is satisfied that the fire and safety risks at the proposed factory will be minimal due to the safety features incorporated in the design and the procedures which are followed in the Department's explosives factories.

LOCAL GOVERNMENT ISSUES

58. In its submission to the Committee, the Shire of Corowa commented upon, inter alia, the following issues:

- water supply
- roads
- housing

Water Supply

59. The Council was concerned that water storage is inadequate for the current needs of the town and factory.

60. The existing factory and the town are supplied from a Commonwealth-owned pumping station and filtration plant which draws water from Lake Mulwala. These facilities are 40 years old and will be upgraded and extended to service the new site. It is intended that the pumping station and filtration plant will be turned over to the Shire of Corowa. In addition the Department of Defence has indicated that the future needs of the factory will be met by construction of a 4.5 megalitre storage tank costing $0.8m. Construction will commence in 1988/89.

Roads

61. It is Commonwealth Government policy to make a contribution to local government authorities for the annual maintenance of roads which access Commonwealth establishments. The Commonwealth paid 75% ($2000) last financial year towards the maintenance of Bayley Street.

62. Access roads to the proposed and existing factories - Melbourne Street, Bayley Street and Corowa Road - are in a poor to average state of repair. The Shire of Corowa believes that the contribution of the Commonwealth to the repair of roads is insufficient for more than minor maintenance to occur.

63. Applications for such funds are invited each year by the Department of Administrative Services. These applications are supported by traffic studies and together these documents form the basis of apportioning costs.

64. Traffic studies have been undertaken by the Shires of Yarrawonga and Corowa, the Department of Defence and the

Victorian Road Construction Authority. These studies indicate that even in the construction phase of the proposal, traffic volume will not significantly increase. The Committee believes that continuing negotiation is needed between the Shire of Corowa and the Commonwealth to resolve this issue.

Housing

65. In the construction phase there will be an influx of workers requiring temporary accommodation. At the operational phase it is anticipated that there will only be 12 factory personnel from outside the area. Thus the impact on services will not be significant.

66. The Shire of Corowa, in its submission to the Committee, expressed concern about the level of surplus Commonwealth-owned residential land which was not available to the Council for urban expansion. The Department of Defence proposes to retain sufficient land to provide for future factory housing requirements. Control of this land will be transferred to the Defence Housing Authority in July 1988. The remaining land was the subject of negotiations between the Shire of Corowa and the Department of Administrative Services at the time of the public hearing.

67. The Committee suggests that consultation continue between the Commonwealth, State and local government authorities to ensure that a reasonable amount of surplus land currently owned by the Commonwealth is available for the urban expansion of Mulwala.

SECURITY

68. A security threat assessment has been carried out and its recommendations incorporated into the design of the proposal.

These recommendations include:

- intruder detection systems;
- patrolling security officers;
- extension of the existing public address system;
- security fencing;
- linking of all fire suppression and detection systems back to the Mulwala fire station; and
- separate cabling for fire alarm, security and other controls in accordance with Australian Standards.

CONSTRUCTION DETAILS

69. The development will comprise about 60 buildings and facilities, the designs for which will comply with the relevant SAA codes, State ordinances and local government regulations. Although the project involves a large area (approximately 300 hectares), the buildings are of relatively modest scale, built of lightweight frangible material and their construction will be within the capabilities of regional contractors (see also Appendix B - Construction and Design Details).

70. No rock is expected to be encountered and therefore no blasting should be required. Care will be taken to minimise wind and stormwater erosion of excavated or filled areas (see also paragraph 38 - Groundwater and Soil Contamination).

Construction Program

71. It is proposed that site establishment and preliminary site works will commence in July 1988 and that the remaining works commence progressively after that time. Construction and commissioning tests will be completed by December 1992.

LIMIT OF COST

72. The limit of cost of the proposal when referred to the Committee was $78.4m at November 1987 prices. This cost is broken down as follows:

Buildings and infrastructure, including relocation of existing plant and installation of new plant	$62.3m
Purchase of new plant	$16.1m
TOTAL	$78.4m

COMMITTEE'S RECOMMENDATION

73. The Committee recommends construction of the work in this reference.

CONCLUSIONS AND RECOMMENDATIONS

74. The conclusions and recommendations of the Committee are set out below with the paragraph in the report to which each refers:

		Paragraph
1.	A need exists to relocate the Albion Explosives Factory from the Melbourne metropolitan area to Mulwala and to rationalise the activities of the Department of Defence explosives factories.	17
2.	The Committee is satisfied that the works proposed in this reference meet both the community concerns regarding the Albion Explosives Factory and the object of rationalising the activities of the Department of Defence explosives factories.	31
3.	Following assurances from the Department of Defence, the Committee is satisfied that the fire and safety risks at the proposed factory will be minimal due to the safety features incorporated in the design and the procedures which are followed in the Department's explosives factories.	57
4.	The limit of cost of the proposal when referred to the Committee was $78.4m at November 1987 prices.	72

5. The Committee recommends construction of the work in this reference. 73

Colin Hollis
Chairman
19 May 1988

APPENDIX A

LIST OF WITNESSES

Mr G. Arkinstall
Health Surveyor and Town Planner
Shire of Corowa

Mr J.J. Babbs
Shire Engineer
Shire of Corowa

Mr K. Boocock
Project Manager, REFA
Victoria-Tasmania Region
Department of Administrative Services

Mr C.J. Erickson
Shire Clerk
Shire of Corowa

Mr B. Pheasant
General Manager
Mulwala Explosives Factory
Department of Defence

Mr D. Powell
First Assistant Secretary
Facilities and Property
Department of Defence

Mr R.A. Richards
Associate Director, Project Division 2
Victoria-Tasmania Region
Department of Administrative Services

Mr N. Tozer
Manager Project REFA
Department of Defence

CONSTRUCTION AND DESIGN DETAILS

Design Philosophy

The overall design is strongly influenced by safety considerations. Design parameters are consistent with the maintenance of a safe environment within a facility and in surrounding facilities if any accident occurs within.

Design parameters include:

- The use of lightweight frangible materials in the construction of facilities where appropriate.
- The adoption of appropriate electrical standards, classified according to potential hazards. Electrical wiring and fittings will be specified according to Operational Safety Committee (Explosives) (OSC (e)) and AS electrical standards. The facilities are divided into three broad classifications: 'explosive hazardous', 'industrial hazardous' and 'non-hazardous'.

RDX Facilities

It is proposed to manufacture RDX and its associated products in a complex of process and support facilities.

The two main process buildings, the RDX nitration building and the RDX purification building, are centrally located, and are surrounded and separated by earth mounds.

Support facilities including the hexamine store, the acids tank farm, the tanker dock, the fume absorption plant, the waste water treatment plant, effluent evaporation ponds, and the services building surround the two central process buildings.

RDX products facilities include the RDX/TNT incorporation building, the PE (plastic explosive) incorporation facility, the PE cartridging and general packing facility and the RDX/wax drying facility.

RDX Nitration Facility

Acid resistant materials will be employed in the process area, including stainless steel roof and wall cladding with stainless steel gutters and downpipes. Steelwork and flooring will be coated with acid-resisting finishes.

The process areas will be mechanically ventilated. The control room will be serviced by a reverse-cycle air-conditioning unit.

Hexamine Preparation and Store

Air handling will be serviced by an internal supply duct connected to an external air handling unit. Exhaust air will be through wall vents and a steam heated coil will be installed in the supply ductwork.

RDX Acids Tank Farm

The RDX acids tank farm consists of two rows of five tanks, which will provide bulk storage for concentrated nitric acid and weak nitric acid respectively. The tanks will be supported horizontally on a reinforced concrete slab. A steel portal frame will support an aluminium clad roof.

Safety shower stations will be installed at opposite ends of the tank farm in case of accidents.

Solvent Tank Farm

The structure will be similar to the acids tank farm, using a steel portal frame to support a metal clad roof.

The slab will be bunded and graded to a sump.

HE Tanker Dock

The tankers will be loaded via an overhead gantry which will be painted with acid-resistant vinyl paint.

The Fume Absorption Plant

The fume absorption plant, an open free standing plant, will remove nitrogen oxide fumes from the RDX process exhausts to a level acceptable to the SPCC for discharge to atmosphere.

RDX/TNT Incorporation Facility

The floors will be graded to spoon drains, which in turn will drain to an external labyrinth.

Air handling will use an externally mounted evaporative cooler and a steam heated coil, with ducting through the roof. A reverse-cycle air-conditioner will service the control room.

RDX/Wax Drying Facility

The building will be a steel frame with lightweight stud walls and roof trusses on a reinforced concrete slab. Cladding on the roof and walls will be colour-coated metal, and the flooring and pavements will use low shrinkage concrete to avoid the formation of cracks.

PE Incorporation Facility

The PE incorporation facility will be a relatively small process facility, which will produce plastic explosives from RDX.

The building will be mechanically ventilated using axial flow fans.

PE Cartridging and General Packing Facility

Air handling will be provided by a roof mounted evaporative cooling unit, connected to internal ductwork. Heating will be provided by hot water heated steel radiator panels.

TNT Facilities

TNT is an explosive which will be manufactured in a complex of process and support facilities adjacent to the RDX complex.

The main process facility will be the TNT nitration/purification facility. Support facilities will include: the TNT drying, flaking and packing facility, the TNT acids tank farm, the bulk toluene tank farm, the intermediate toluene tank farm, the toluene tanker dock, the DNT (dinitrotoluene) crystallisation plant, the red water incinerator plant and the TNT save-all pit (labyrinth).

The process buildings in the TNT complex will be constructed using similar materials and methods as the process buildings for the RDX complex. Likewise the functional relationship of plant and equipment will dictate the shape, size and layout of the buildings.

TNT Drying, Flaking and Packing Facility

The flooring will be graded to a spoon drain, which runs to an external labyrinth for washdown wastes.

An evaporative cooler and steam heating coil will be mounted externally for the supply of air, and an exhaust fan for air extraction.

TNT Acids Tank Farm

Safety shower and eye wash stations will be provided.

Gun Propellant Facilities

The gun propellant facilities will be located to the east of the RDX and TNT complex, adjacent to existing facilities in the Mulwala Explosives Factory.

The principal production facility will be the GP main process facility and all the other buildings will be ancillary to it. They include the GP ingredients preparation building, the picrite store, the picrite sieving facility, the scrap store, the GP stoving/drying facility, the unloading building and the GP blend/pack facility.

The GP facilities require no special corrosion protection and there are no provisions for washdown wastes, but low shrinkage concrete will still be specified to minimise crack formation.

Acid Plant

Concentrated Nitric Acid (CNA) is a raw material for both RDX and TNT production and the acid plant facilities will be essentially required for the recycling of waste acids from these processes. Concentrated Sulphuric Acid (CSA) will also be required for the TNT process.

The main acid plant is an acid concentration facility, and this will be procured by the Department of Defence and installed as a separate 'turnkey' contract.

Support facilities for the acid plant will include the CNA acid tank farm, the acid tanker dock and LPG tank farm.

The acid plant facilities will be located within the existing Mulwala Explosives Factory. Siteworks preparation for the acid concentration facility will require the relocation of an existing water main and the demolition of footings from a building that has already been razed.

Non-Process Facilities

The non-process facilities referred to in this proposal are those without equipment or plant essential to the production of explosives. They include administrative offices and workers' amenities which have a higher occupancy than the process facilities. But they also include storage and expense magazines which have virtually zero occupancy, and the high explosives laboratory which fulfils special functions.

Storage and Expense Magazine

(a) High Explosives (HE) Storage and Expense Magazines:

All the magazines will use similar construction materials and methods, and will serve similar functions. Magazines will have lightweight stud walls and roof trusses on a reinforced concrete slab with colour-coated metal cladding. Each magazine will be a separate building with its own access road and will be isolated by an enclosed arch mound. They will be separated by the minimum distances nominated by NATO guidelines for the storage of explosives.

The magazines are divided into storage and expense magazines. Storage magazines will store finished products, while expense magazines will provide temporary storage for intermediate products and partly processed explosives.

(b) Gun Propellant (GP) Storage and Expense Magazines:

GP magazines will serve similar functions to the HE magazines and will follow similar criteria concerning construction and location, except the provision of mounds which are not required.

There will be two GP expense magazines and one GP storage magazine.

HE Administration Building

The Administration Building will provide a variety of functions and staff amenities, and will be centrally located east of the TNT complex.

The design will consist of three modules joined by covered ways to separate the changerooms and mess room from the office and stores facilities.

The general office and stores module will also include the remote control room. The changerooms and mess room will be separate modules.

The structure will be lightweight studs and roof truss construction on reinforced concrete slabs with metal external cladding. One hour fire-rated block walls will isolate the stores area, administration area and remote control room.

Air handling will use reverse-cycle package units connected to ducting installed in the ceiling. Domestic hot water will be steam heated.

Extension to GP Changeroom

The GP changeroom is an existing building within the Mulwala Explosives Factory. At present it only caters for male personnel and it will be expanded to accommodate ten additional male staff and ten female staff.

The structure and finishes of the extension will be in keeping with the other facilities.

Decontamination Yard and Electropolishing/BEV Building

The decontamination yard and electropolishing/BEV (battery electric vehicle) Building will be located between the RDX and TNT complexes.

The decontamination yard will service both complexes, and will contain a hot water bath, a caustic soda bath, a cold water bath and oxyacetylene facilities.

The electropolishing bay will be used to remove corrosion damage from the diluter coils used in the RDX nitration process.

A workshop and BEV bay will be located adjacent to the electropolishing bay. The BEV bay will include facilities for the maintenance and installation of batteries.

Both the electropolishing bay and the BEV bay will have fume exhaust systems.

The building will have steel portal frames on a reinforced concrete slab with colour-coated metal cladding. The yard will be fenced on three sides with galvanised chain mesh, including gates.

The Burning Ground

The burning ground will be required for the disposal of waste products which are contaminated by high explosives.

It will be located in isolation from all other facilities and will consist of two pads of reinforced concrete, a truck turning bay and an operator's hut.

There will be a third concrete pad which will be much smaller than the other two and will be enclosed with a cyclone fence. This third pad is for burning paper and packaging materials.

The operator's hut will be built from concrete blocks lined externally with colour-coated metal cladding. The operator ignites the material on the slab by remote control and observes the combustion through a mirror.

A flag will be raised when the burning ground is in operation to warn people not to approach.

High Explosives Laboratory

The HE laboratory will have a major functional relationship with the factory. Its principal function will be the physical and chemical analysis of explosives and propellants and their associated raw materials.

In addition to its role in production quality and research, it is a necessary requirement for National Association of Testing Authorities registration.

It will be sited in accordance with NATO distances from site boundaries and other facilities, and it will be centrally located to both the new and the existing factory. It is intended that it will replace existing facilities at both Mulwala and Albion which are now out of date.

Physically, the building will be designed as three separate wings radiating from an administration centre, but only one wing, the HE wing, and the administration area will be included in the scope of works.

Sitewide Utilities

Sitewide utilities will include roads and clearways, water reticulation, HV (high voltage) power reticulation, steam reticulation, security and communications and the perimeter security fence.

Other engineering requirements for particular facilities include protective earth mounds, lightning protection, and controls and instrumentation.

Roads and Clearways

Because of the necessity to isolate certain facilities and provide distances between others and the large overall area that the site covers, roadworks will comprise a large component of the civil engineering.

Main roads between the complexes and servicing the tanker docks will need to cater for road tankers. These roads will be bitumen sealed.

Clearways for access to individual facilities will need to cater for forklifts and battery electric vehicles (BEV) and most of these will be concrete hardstand.

The location of roads will be determined by cut and fill requirements, the number of trees affected and the functional relationships between facilities and complexes.

Drainage off the roads will be accommodated by table drains, as the surrounding soil is very absorbent and erosion by runoff is not foreseen as a problem.

Earth Mounds

Earth mounds will comprise another large component of civil engineering, as a number of facilities will require mounds to protect surrounding buildings from potential damage from explosions.

In the RDX complex, the RDX nitration building and the RDX purification building will be surrounded by a common vertical face mound, approximately 5 m high. A vertical face mound will be constructed for these facilities because of the restricted space requirements.

All other facilities requiring mounds will use conventional double sided mounds with a 2:1 slope, approximately 3 m high or less.

All the RDX products facilities will require mounds. In the TNT complex, the TNT nitration/ purification building and the TNT drying, flaking and packing facility will have mounds.

In the gun propellant complex, the GP main process building, the picrite store and the picrite sieving building will require mounds. Some buildings in the GP area only have fire risk and not an explosive risk, and will not require mounds.

All HE storage and expense magazines will have mounds.

Tank farms, tanker docks and buildings not processing or storing explosive materials will not have mounds.

The mounds will be constructed from onsite fill and stabilised with bitumen spray containing grass seeds. The mounds will be watered with insite sprinkler systems.

The watered grassed mounds will provide a defence against potential grass fires.

Water Supply and Reticulation

A water management study was undertaken to assess the demand from process facilities, mound watering requirements and fire suppression systems. The study also examined waste water treatment requirements and assessed the size of effluent ponds for both the RDX and TNT complexes.

The study examined the capacity of the existing water supply under maximum demand at the furthest extremity of the site. The study concluded that the capacity was adequate except for fire suppression systems, which will require booster pumps at the facilities where they are needed.

The main trunk reticulation system will have three cross-connections with the existing factory and will be sized for future factory expansion.

Steam Generation and Reticulation

The provision of steam for process facilities has to take into account existing demands of the Mulwala Explosives Factory as well as projected future demands of these works.

In light of that requirement a comprehensive study was undertaken to examine the projected demand of both facilities over the next 25 years. The study proposed to upgrade the existing boiler house.

This will comprise removing four of the old boilers and replacing them with two new ones. The remaining four boilers will be upgraded with new instrumentation and controls.

This project includes the boiler upgrade and the installation of one of the new boilers with its associated aerator, flue and footings. The installation of the second boiler with its flue, aerator and footings will be carried out by the Mulwala Explosives Factory as part of a separate program.

All boilers will be brown coal briquette fired, and the proposal includes new ash handling equipment.

Steam reticulation will be a major extension of the existing factory's system, with completely new reticulation for these works and is included in this proposal.

In addition to the boiler house and its associated reticulation, there will be two mobile 150 kW electric powered steam generators for backup steam.

Electrical Services

(a) HV Reticulation and Substations

HV reticulation will be achieved by expanding the existing network for the Mulwala Explosives Factory into a ring main that includes both sites.

The design comprises a number of substations spread sitewide with the specific intention that if one substation is off line, other facilities will not be compromised.

(b) Lightning Protection

Lightning protection was evaluated for various facilities and will be provided for the following:

The RDX nitration building, the RDX purification building, the TNT nitration/purification building, the TNT drying, flaking and packing building and the RDX/TNT incorporation building.

All process facilities, including those without lightning protection, will have static earth bonding to ensure equal electric potential for plant, equipment and the building itself.

Instrumentation and Controls

A major design requirement in relocating RDX and TNT process plant from Albion to Mulwala is the need to upgrade controls and instrumentation for improved operational safety.

The objective is to provide remote operation of major process functions, thus decreasing the period and frequency of operator occupancy at the workface, as well as reducing the number of personnel required to operate the facilities.

The main remote control station will be the remote control room in the administration building. This will provide remote monitoring and operator control for both the RDX and TNT facilities, including the ancillary facilities as well as the main process facilities.

Remote control stations will also be provided in the RDX nitration, RDX purification and TNT nitration/purification facilities.

Security and Communications

A security threat assessment arranged by the Department of Defence identified the following buildings as requiring special attention:

- The magazines will include solid doors with hasp and staple locks fitted with padlocks. Windows will be laminated safety glass and external lighting will be activated by photo-electric cell.
- The magazines, the RDX, TNT and gun propellant production facilities, the laboratory and the administration complex will have electronic intruder detection systems installed.
- The intruder detection systems will be individually monitored and controlled from the existing Mulwala factory guard house. They will be connected by security-dedicated underground cables.
- The existing public address system will be extended for supervisory and security purposes in the appropriate areas.
- Telephones will be provided where necessary and connected to the existing PABX in the Mulwala Explosives Factory.

Security Fence

A security fence already exists on the eastern boundary adjoining the Mulwala Explosives Factory. This will remain intact, except a 400 m portion which will be relocated to the west to incorporate the gun propellant facilities into the existing factory. The remaining southern, western and northern boundaries are stock fences in a bad state of repair and these will be replaced with security fencing.

The fence will be a standard high security fence type 2, which is 2.5 m of chainwire with 4 strands of barbed wire on top. Gates will be included along the western boundary for access to the river by fire tenders. There will be two gates connecting to the existing factory. The main entrance will be in Bayly Street and another gate will give secondary access in the north-eastern corner alongside the Mulwala canal. Where suitable existing stock fences within the site will be retained for grazing purposes.

Fire Safety and Risk Assessment

A comprehensive study was carried out to assess the fire risk and make appropriate recommendations both on an overall site basis and for each facility.

In considering the overall site, particular consideration was given to the Mulwala environment and the potential bushfire risk. The report also addressed potential fire risk from arson/terrorism and lightning strikes and took into account the previous history of both Albion and Mulwala factories.

Separation distances afforded by following NATO guidelines, are more than adequate for risk by radiant heat, especially when the facility is protected by an earth mound.

All buildings are designed to ensure bushfire embers cannot penetrate through vents or other openings.

In addressing individual facilities, the study included fire hydrant locations for safe operating distances, access roads for fire tender trucks, the indirect risk to neighbouring facilities and specific recommendations relating to unique hazard situations. In process areas, the study addresses potential ignition sources and operation procedures concerning fire-safe housekeeping.

Specific recommendations include the location of heat, flame and smoke detectors, manual call points (break glass alarms) and fire suppression systems. Particular attention was also given to the ease of egress from process facilities as staff instructions in most facilities are not to fight fires, but to leave. This criterion affects the location of manual call points and the location of hand held extinguishers.

As the long term intention at Mulwala is to provide safer and healthier work practices through greater dependence on remote control, quick acting fire detection and suppression systems were recommended along with video surveillance systems.

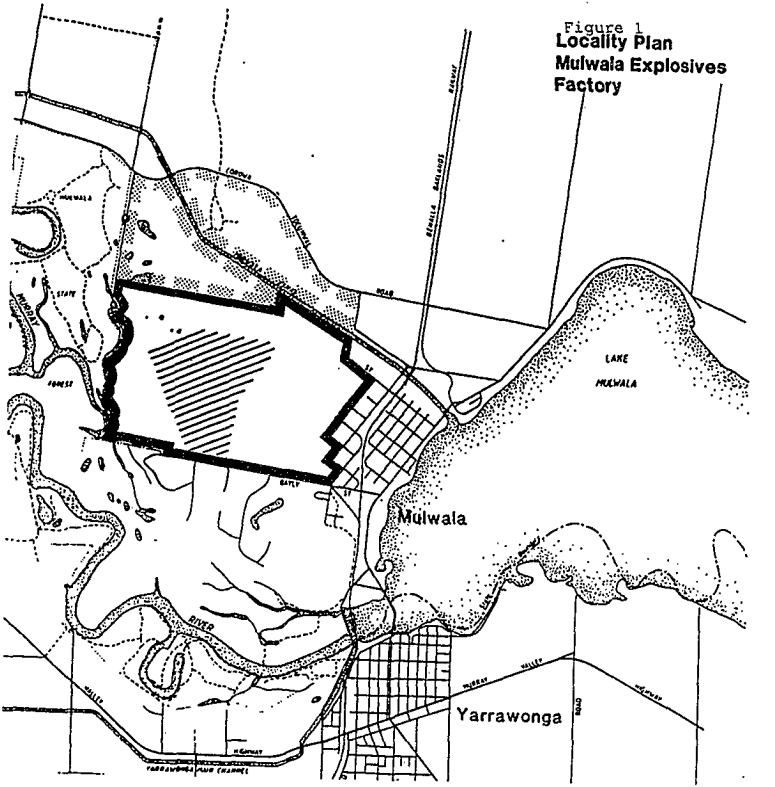
The existing practice at Mulwala of linking all fire suppression and detection systems back to the fire station will be followed on this project. Cabling for fire alarm monitoring will be segregated from security and other controls cabling in compliance with Australian standards.

Fire sprinkler services recommended for some facilities require booster stations and holding tanks. Steam condensate water will be used to supplement mains water for watering the mounds. The grassed mounds are a first defence against bushfires after boundary firebreaks.

Hazard and Operability Study (HAZOP Review)

In accordance with NSW State legislation, a HAZOP review is required for process and controls design which must be followed through to construction and commissioning. Australian Construction Services have been represented on the HAZOP review.

Figure 1
Locality Plan
Mulwala Explosives Factory



MULWALA EXPLOSIVES FACTORY AREA

PROJECT R.E.F.A. SITE

LAND ACQUISITION

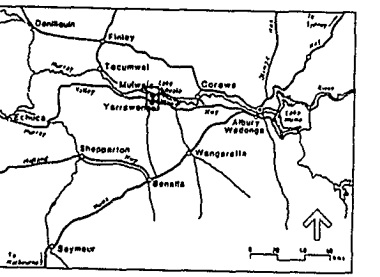
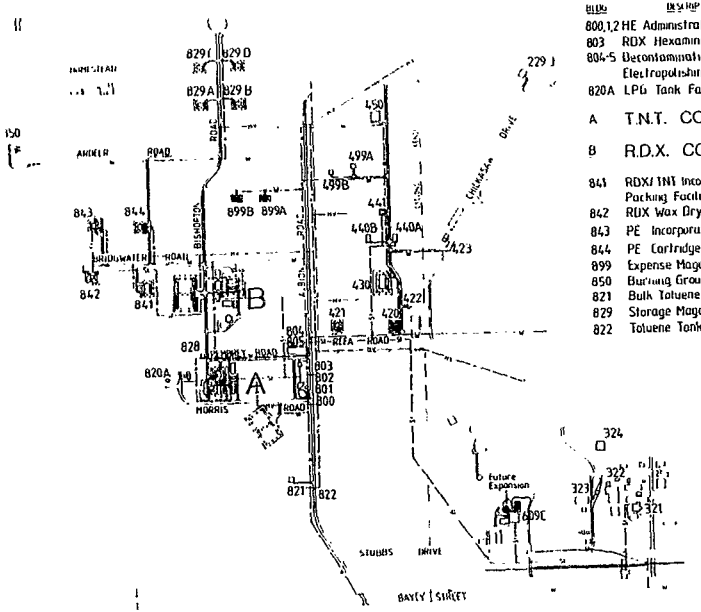


Figure 2

LOCATION PLAN
Not to Scale
PROPOSED RE.FA SITE
REFER TO SITE PLAN FOR DETAILS
MULWALA EXPLOSIVES FACTORY
MULWALA CANAL
LAKE MULWALA
YARRAWONGA
MELBOURNE
HUME HIGHWAY
BARTY STREET



LEGEND

Bldg	Description
800,1,2	HE Administration Building
803	RDX Hexamine Prep & Store
804-5	Decontamination Yard, Electropolishing & BCV Facility
820A	LPG Tank Farm (Red Water)
A	T.N.T. COMPLEX
B	R.D.X. COMPLEX
841	RDX/TNT Incorporating and Packing Facility
842	RDX Wax Drying Facility
843	PE Incorporating Facility
844	PE Cartridge & Gen Packing Facility
899	Expense Magazines A & B
850	Burning Ground
821	Bulk Toluene Tank Farm
829	Storage Magazines A-D
822	Toluene Tanker Dock

GUN PROPELLANT

Bldg	Description
420	Picrite Store
421	Picrite Sieve Facility
422	Scrap Store
423	Ingredients Prep/Store & Workshop
430	Main Process Facility
440	Slowing & Drying Facilities A & B
441	Unloading Building
450	Blending & Packing Building
499	Expense Magazines A & B
229	Storage Magazine J

MISCELLANEOUS SITES

321	Acid Plant
322	CNA Tank Farm
323	Tanker Dock (Acid Section)
324	LPG Tank Farm (Acid Section)
609C	High Explosives Laboratory

SITE SERVICES

HV	High Voltage
St	Steam
W	Main Water

REFA SITE PLAN

0 50 100 400 800

Figure 3
Proposed factory layout