APPENDIX C

STATUTORY PLANNING CONTROLS APPLICABLE TO THE STUDY AREA

The study area is covered to a large extent by the following planning instruments -

(a) Interim Development Order No. 19 - Municipality of Botany;

(b) Interim Development Order No. 21 - Municipality of Botany;

(c) Interim Development Order No. 18 - Municipality of Randwick;

(d) Interim Development Order No. 20 - Municipality of Randwick;

(e) Interim Development Order No. 21 - Municipality of Randwick; and

(f) the Randwick Planning Scheme Ordinance.

Interim Development Order No. 19 - Municipiality of Botany aimed to operate as a short term holding measure pending assessment of major development and limits increased residential densities to those areas least affected by the concentration of industry, the port development or aircraft noise. The zonings of the Order largely reflect the existing pattern of development so as to keep as many planning options as possible open and not prejudice proposals arising from current studies on the planning of the area. A direction under Section 101 of the Environmental Planning and Assessment Act, 1979, of 31st July 1981 requires the Council to refer applications for development in relation to the ICI land, to the Department for the Minister for Planning and Environment determination.

Interim Development Order No. 21 - Municipality of Botany permits the establishment and operation of a port providing wharfage, cargo handling and storage facilities and development works and a number of other uses. A deemed direction under Section 101 of the Act, of 2nd September, 1977 requires the Council to refer applications for development, within the area covered by the Order, to the Department for the Minister for Planning and Environment determination.

Interim Development Order No. 18 - Municipality of Randwick permits the establishment and operation of a port providing wharfage, cargo handling and storage facilities. A deemed direction order section 101 of the Act of 11th April, 1980 requires the council to refer applications for development, within the area covered by the Order, to the Department for the Minister for Planning and Environment determination.

Interim Development Order No. 20 - Municipality of Randwick permits generating works and oil refineries. A deemed direction under section 101 of the Act of 4th October 1979 requires the Council to refer applications for devleopment, within the area covered by the Order, to the Department for the Minister for Planning and Environment determination.

Interim Development Order No. 21 - Municipality of Randwick permits industrial purposes and a number of other uses.

The Randwick Planning Scheme Ordinance operates as a detailed guide for development.

In relation to all residential zones however, the abovementioned planning instruments do not control the development of dwelling houses, that is consent under the Act is not required and accordingly, the council is not able to take into account whether the land is suitable for development by reason of it being subject to any risk under section 90 (1)(g) of the Act.

APPENDIX D

APPLICABLE SAFETY CODES

1. Standards, Codes and Specifications

A number of standards, codes and specifications have been used by industry on the basis of general engineering practice. These codes are generally used for design purposes and are considered the minimum level or standard in procedural or constructional undertakings.

The two most applicable codes or standards relevant to this study are the 'SAA Flammable and Combustible Liquids Code' and the 'SAA LPG Code'.

1.1 SAA Flammable and Combustible Liquids Code (AS 1940)

This standard covers aspects of minor storage (including service stations), packaging and handling, storage in tank farms, fuel dispensing, piping and ancillary equipment, operational procedures and fire fighting. The standard classifies flammable and combustible liquids on the basis of their flash points.

For the purposes of this study sections 4, 8 and 9 of this standard are particularly relevant and require some examination.

Section 4 sets out: venting requirements; spacing and separation distances, between tanks and on-site facilities; bund capacities; and installation methods, which include foundations and supporting structures.

On-site facilities are separated in accordance with the following Table.

TABLE D1

SEPARATION DISTANCES - TANKS AND STORAGES TO ON-SITE FACILITIES

Separation required	Separation distances[1] Class A and Class B liquids	Class C liquids	Class D liquids
Filling points*, platforms or package storage	Diameter of the tank or 15m, whichever is the lesser, but not less than 6m	Diameter of the tank or 7.5m, whichever is the lesser, but not less than 3m	Not less than 3m
Office buildings, warehouses, manufacturing areas, workshops or amenities blocks on the same premises	Distance required by Table D2 but need not exceed 15m	Distance required by Table D2 but need not exceed 7.5m	Not less than 3m
Boundary of the premises	Diameter of the tank or 15m, whichever is the lesser, but not less than 6m	Diameter of the tank or 7.5m, whichever is the lesser, but not less than 3m	Not less than 3m

* Points for filling packages, drums or tank vehicles and not the filling point into the storage.

1. Refer to the various rules for alternative distances when vapour barriers are used.

Bunds are required to hold the capacity of the largest tank and are to be divided into sub-bunds if total capacity exceeds 10,000 cubic metres.

The distance separating storage tanks from the building line of a protected works is determined under the standard by Table D2 reproduced below.

TABLE D2

SEPARATION DISTANCES - ABOVEGROUND TANKS AND STORAGES

Minimum distance m	Maximum capacity of tank or maximum volume held in packages, m^3			
	Class A liquids	Class B liquids	Class C liquids	Class D liquids
Unrestricted	0.1	0.5	2.5	5
3	1	4	10	20
4	2	8	20	40
5	4	16	40	80
6	7	28	70	140
7	10	40	100	200
8	14	56	140	280
9	20	80	200	400
10	26	104	260	520
11	34	136	340	680
12	42	168	420	840
13	52	208	520	1040
14	64	256	640	1280
15	77	308	770	1540
20	170	680	1700	or over
25	310	1240	3100	
30	500	2000	or over	
35	750	3000		
40	1100	or over		
45	1500			
50	2000 or over			

Note: For distances above 3m, the distances applicable for any intermediate capacity may be obtained by interpolation.

In considering the separation distances between tanks the standard states:-

(a) If neither tank exceeds 6m in diameter, the distance between them shall be not less than either one-third of the diameter of the larger tank or 1m, whichever is the greater.

(b) If one of the tanks is more than 6m but neither is more than 20m in diameter, the distance between them shall be not less than one-half of the diameter of the larger tank.

(c) If the tank is 20m or more in diameter, the distance between it and any other tank shall be not less than 15m.

Section 8 of the standard details procedural matters governing the operation of a flammable or combustible liquid storage facility. Relevant matters of concern to the standard include the prevention of ignition sources, control of entry and vehicle movements, contract work, leakage and spillages, fire fighting drills and testing, training and supervision, construction and maintenance inspections of pipes and tanks, emptying and cleaning tanks and the removal of flammable vapours within tanks or equipment. The formulation and implementation of emergency procedures are not specified.

Section 9 of the Code deals specifically with "fire protection facilities". For storage tanks in excess of $5,000m^3$, foam requirements are examined in detail, while the water supply needs to be adequate for 1.5 hours for the greatest foam supply demand.

Cooling water should be used where a distance of less than 1.5 tank diameters between tanks occurs for Class A or B liquids while at least three hydrants should be provided per installation with a minimum flow rate of 8.3 l/sec at 550 kPa pressure when cooling or foam water are operating.

Cooling water quantities for the circumferential shell is determined by:-

Q = dHW	Where	d =	diameter of tanks to be protected (m)
= Litres/min		H =	height of tank
		W =	factor determined by separation distance
		=	tank diameter ratio

on the basis of worst case tanks within 1.5 times the tank diameter. Roof water for tanks within 1 tank diameter is added to Q by a factor of $0.25\ d^2W$. A minimum time period of 1.5 hrs is indicated for this rate of water usage.

1.2 SAA LP Gas Code (AS 1596)

The Australian Standard governing the location and safety aspects of LPG storage facilities ranging from small installations (service stations type) to storage terminals of up to 500 tonnes storage capacity is AS 1596-1979, the so called SAA LP Gas Code.

Table (D3) indicates minimum safety separation distances required by the standard to public places and protected works for above ground installations. Table (D4) gives corresponding distances for underground installations.

Typical tanks in LPG service stations are 7.5 kl capacity (about 3 tonnes) above ground tanks which according to AS 1596-1979 (Table D3) require a minimum separation distance of 6 metres to a public place such as a road and 10 metres from a protected work which includes houses, schools and other flammable storage facilities.

Additional safety controls such as pressure relief valves, fire water deluge systems, operational procedures and sloping of ground, if applicable, are outlined in AS 1596-1979 and required by the Dangerous Goods Act, 1975. The safety separation distances adopted by the standard rely heavily on the integrity of tank design and fire protection to contain the impact of a mishap.

Two other standards have been examined in relation to separation distances between LPG storage vessels and other properties and/or land-uses. These are:-

(i) API 2510 - Design and construction of LP Gas Installations at marine and Pipeline terminals ... and Tank Farms (American Petroleum Institute - U.S.).

(ii) NFPA-58 - Storage and Handling Liquified Petroleum Gases. (U.S. National Fire Protection Association) adopted by American National Standards Institute. As 1596, in contrast, separates LPG on the basis of public places/passenger rail/combustible liquid tanks or 'protected works'. Both NFPA-58 and API 2510 separate tanks from the 'line of adjoining property which may be built upon'.

A public place is any place other than private property, open to the public and including a street or road.

Protected works includes a dwelling, a hall, church, public entertainment or amusement centre or public offices, a dock or wharf, storage of flammable (Class A and B) liquids, stores, warehouses, trade or business house.

Essentially the U.S. codes cover a compromise between 'Protected works' and 'public places' as those (i.e. U.S.) codes relate to a 'property line'. Separation distances for these U.S. standards are also given in Table D3 for comparison to the Australian standard.

TABLE D3

COMPARISON OF AS, API AND NFPA CODES FOR LPG TANK LOCATIONS (IN METRES) - ABOVE GROUND

Capacity (kl)	AS 1596 'Public places'	AS 1596 'Protected works'	API-2510 Property line	NFPA-58
0.5	1.5	1.5	1	Nil
1	2	3	3	3
2	4	6	3	3
5	5	8	7.5	7.5
7.5	6	10	15	18
50	10	17	15	18
200	12	25	15	25
500	22	45	30	42
1000	40	75	45	Subject to approval
2000	subject to approval	subject to approval	60	subject to approval

The API code indicates that sources of ignition (say stationary internal combustion engine) should be located a minimum of 7.5 metres away. This code does not account for ancillary equipment or other major sources of risk upon the vessel.

The AS 1596 code appears to allow for risk to vessels from public places but not the risk of the vessel upon public places. Protected works considers both the imposed upon vessel integrity and the LPG vessel placing protected works at risk. Variations in distances may be permitted but distances are 'minimum' and 'should be exceeded where reasonably possible'.

The NFPA on the surface would not appear to be much different but the distances are in general greater than AS or API and relate to property line. Additionally a requirement is that if a facility stores more than about 15 kl water capacity of gas and are located in 'heavily populated or congested areas' then the plan should be modified by a fire safety analysis. "The mode of protection shall be arrived at through compotent fire safety analysis of local conditions of hazard within the container site, exposure to or from other properties, water supply, the probable effectiveness of plant fire brigades, and the time of response and probable effectiveness of fire departments". Special coatings and insulation are recommended (200 kW/m^2 for 50 mins as test).

TABLE D4

LOCATION OF UNDERGROUND STORAGE TANKS

1	2	3	4
Water capacity of any tank	Minimum distances between tanks within a group	Minimum distances from public places or passenger railway line	Minimum distances from protected works
kL	m	m	m
Up to 1	1	1.0	1.5
2	1	1.5	3.0
15	1	3.0	4.5
50	1	4.5	6.0
Over 50	1	As required by Statutory Authority	

NOTE: The distances in this table are horizontal distances measured from vertical projections through air. These distances may be altered proportionately for intermiediate tank capacities.

Dangerous Goods Act, 1975

The Dangerous Goods Act is administered by the Department of Industrial Relations. This Act provides for the: licensing of; keeping on premises; conveyance, by vehicle or vessels; selling, packaging or handling of dangerous goods (Part III). The Act provides the opportunity for a wide range of responsibilities. Under Part V of the Dangerous Goods Act: licences and permits may be renewed, transferred, suspended or cancelled; appeal provisions to the Minister for a final and binding decision on a suspended or cancelled licence are provided; the appointment and duties of inspectors are indicated; the procedures for taking legal action and liability of employers established; and the provision for the making of regulations.

Regulations may be made on a range of matters such as: license provisions; the import and export of dangerous goods into or out of the state; vehicle (or vessel) design; the manufacturer (or preparation) of dangerous goods; safety provisions; the keeping of records; inspection, examination and testing of dangerous goods, equipment or procedures.

Regulations may also class dangerous goods and include reference to standards, codes, rules or specifications. Flammable gases (including LPG) are of class 2 and Flammable liquids are generally of class 3.

Because of the importance of the making of regulations, Section 41(1) of the Dangerous Goods Act is reproduced below.

"41. (1) The Governor may make regulations, not inconsistent with this Act, for or with respect to any matter that by this Act is required or permitted to be prescribed or that is necessary or convenient to be prescribed for carrying out or giving effect to this Act and, in particular, for or with respect to:-

(a) the issue, renewal, transfer, suspension, cancellation, duration and terms of permits, whether under this Act or the regulations, and licences, the fee payable therefore and the conditions subject to which they are issued;

(b) the import or export of dangerous goods into or from the State;

(c) the preparation for use, packing, keeping, conveying, manufacture, use, sale, abandonment, disposal, destruction and rendering harmless of dangerous goods and containers which are intended for use, are being used or have been used in connection with dangerous goods;

(d) the design, construction, cleanliness, venting, ventilation, marking and maintenance of vehicles, vessels, containers, pipelines and any other equipment or things which are intended for use, are being used or have been used in connection with dangerous goods;

(e) the siting, design, construction, ventilation, illumination, fittings, fixtures and management of premises intended for use or used in connection with dangerous goods;

(f) regulating or prohibiting smoking, the lighting or use of fire and any other dangerous, or potentially dangerous, prescribed activities in the vicinity of dangerous goods and on or in, or in the vicinity of, premises, vehicles, vessels, containers or pipelines used or that have been used in connection with dangerous goods;

(g) prescribing the procedures to be followed in respect of any premises licensed under this Act that cease to be so licensed and the persons by whom those procedures are to be followed;

(h) the provision, maintenance, testing and use of safety and first aid facilities, including fire-fighting equipment, in any premises licensed under this Act, in a vehicle or vessel used for the conveyance of dangerous goods and in prescribed circumstances involving a risk of injury or damage arising from dangerous goods;

(i) prescribing the procedures to be followed in the event of an escape or a spillage of dangerous goods;

(j) applications to have an explosive declared to be an authorised explosive under section 16 and fees payable in connection therewith;

(k) the inspection, examination and testing of dangerous goods and equipment intended for use or used in connection therewith, and the fees payable therefore;

(l) the driving of vehicles and the navigation and mooring of vessels conveying dangerous goods; and

(m) the making, keeping, production and inspection of records relating to dangerous goods and the furnishing of returns and other information relating thereto.

Any examination of this Act, therefore, also requires a brief discussion of the regulations.

Of particular relevance to this study are the provisions for keeping and conveying of Flammable Gases (Class 2.1) including LPG and Flammable (Classes 3.1, 3.2 and 3.3) and Combustible Liquids (Classes 3.4 and 3.5):-

(a) Liquified Flammable Gases (Class 2.1)

Under Clause 113 a flammable gas vessel (tank) is to be approved, be fitted with approved safety relief devices (such that 'flames from the device will not impinge on the tank or any other depot' or tank), have a fence (1.8 metrs high) and two gates around the vessel, be on non-combustible supports, be on firm foundations and be readily accessible by employees. Should LPG being stored, be unodourised, then a flammable gas detector with automatic alarm is to be provided.

Building provisions (Clause 114) and area (Clause 115) requirements are also given.

Clause 117 indicates the methods of fire protection which require:-

(i) a garden hose to reach all parts of the depot;

(ii) two water hydrants for depots storing more than 4 tonnes of liquified flammable gas or 500 cubic metres of compressed flammable gas, at opposite sides of the depot; and the garden hose requirement;

(iii) for each tank of LPG greater than 50 tonnes capacity (or 7,500 cubic metres of compressed flammable gases), fixed water sprays, or monitors to deliver water at the rate of 10 litres/min per square metre surface area; plus the previous requirements.

Sufficient reticulated or stored water is to be provided for a period of 3 hours to the three (3) largest tanks. Fire equipment is to be tested weekly.

The separation distances for flammable gases (Clause 119) are given in Table D5. This is compared to the requirement of the SAA LPG Code for above ground tanks, which is based on a range of tank capacities and referred to in clause 281 of the Dangerous Goods Regulations.

TABLE D5

SEPARATION DISTANCE FOR DEPOTS FOR FLAMMABLE GASES

Column 1 Exposure	Separation distance (in metres) Column 2 Cylinders not exceeding 150 cu m	Column 3 Cylinders exceeding 150 cu m	Column 4 Tanks
Other depot for flammable gas	5	10	..
Building or structure - (a) not of fire-resistant construction;	3	8	15
(b) of fire-resistant construction;	..	..	3
(c) being a protected work not elsewhere specified in this Table	8	15	15
Above-ground depot for flammable liquid having a licensed capacity:- (a) not exceeding 5,000 litres;	3	8	8
(b) exceeding 5,000 litres	8	15	15
Underground depot for flammable liquid (distance to be measured from vent and fullpipe).	3	8	8
Public place	3	4	4
Place where solid materials that burn rapidly, such as wood shavings or paper, are stored	15	15	15
Place where solid materials that burn slowly, such as coal or timber, are stored.	8	8	8

Table D5 (cont'd)

In conveying liquified flammable gases and flammable liquids the appropriate codes are applied and the recently released 'Code of Practice for the Transportation of Dangerous Goods' has taken effect. In the case of pipelines, the appropriate codes are generally the 'SAA Gas Piepline Code', 'SAA Pressure Piping Code' and the 'SAA Non-ferrous Pressure Piping Code' as appropriate.

Flammable and Combustible Liquids

The basic requirements of the regulations for flammable and combustible liquids is the observance of the "SAA Flammable and Combustible Liquid Code" described previously. Tanks may be kept above ground or underground.

APPENDIX E

THE EXISTING PHYSICAL AND SOCIO-ECONOMIC ENVIRONMENT

1 Physical Environment

1.1 Topography/Geology

The study area lies within the Botany Basin geomorphic unit of the Cumberland Plain. The Botany Basin consists of alluvially deposited sandy moorland, undulating sand hills and a broad valley flood plain.

Two river systems, the Cooks and Georges Rivers, discharge into the waters of Botany Bay. The deposited sands, silts, clays and gravels are Quaternary in age and are felt to be of marine origin.

Topographically the area is generally flat with some undulation and rising to a maximum of 30 metres at the La Perouse ridge to the east.

The Botany sands provide the only significant groundwater resource (known as the Botany aquifer) within the Botany Bay sub-region and lies within the study area. Port Botany is a man-made feature of nearly 200 hectares of reclaimed land behind a protective revetment wall.

The soils of the area have been named after their parent material source. The Hawkesbury soils to the east are skeletal, shallow and stoney soils having shallow profiles of sand or sandy clays. The alluvial sandy soils are highly susceptible to wind erosion if vegetation is disturbed and soil exposed.

1.2 Meteorology and Climate

The area is dominated by a warm, sub-tropical climate with a strong coastal influence which moderates temperatures. Mean summer and winter temperatures are 22°C and 12°C respectively. Extreme temperatures of 45°C and 12°C have been recorded.

During the summer periods the predominant winds are north-easterly and easterly with some strong southerly gusts. In winter winds are stronger and from the west and south. A sea-breeze develops for about 50 per cent of days throughout the year with a greater number of seabreezes developing in summer than winter.

The surface wind analysis for Mascot (based on average wind records for more than 36 years) below has been adopted as representative of localised wind movements in the study area.

Winds from south - 28%
Winds from west - 26%
Winds from north - 20%
Winds from east - 20%
Calms - 5%

Fogs and temperature inversions are frequent and occur on about 12 per cent and 80 per cent of all days respectively. Average rainfall is about 1,200 mm and occurs at a frequency of about 105 days per year.

1.3 Air Quality

Generally, the area is of poor air quality due to relatively high emissions from motor vehicles and industrial sources, together with incidents of poor ventilation (dispersion) at critical times.

The nature and scale of industrial processes, storage terminals and the amount of traffic in the area result in it being a major contributor of photochemical smog precursors, hydrocarbons and nitrogen oxides, in the Sydney Region.

At the local level, episodes of high odour emissions, sulphur oxides, dust and other particulate matters have been reported particularly at residential areas close to the industrial complex. Major sources include the I.C.I. petrochemical plant, the Total oil refinery and major fuel storage depots (Caltex), etc.

Local air pollutants in the area have gradually improved, and further reductions are expected in the future as the result of various control measures being implemented together with a change in the nature of fuel used. Because of technical and economic control limitations however residents adjacent to emission sources would be exposed to relatively higher levels of pollution. In terms of dispersion characteristics, ventilation rates measured at Mascot indicate that mornings have poorer dispersion than in the afternoon.

1.4 Water Quality

The waters of Botany Bay have been extensively researched and reported by the State Pollution Control Commission through its Environmental Control Study of Botany Bay.

In general terms, Botany Bay is circular in shape having some additional bays on the foreshores. The north-south runway of Kingsford-Smith Airport and Port Botany are reclaimed lands which extend out into the Bay breaking up the circular line of the foreshore.

Water quality of the Bay is generally good, although changes in current and wave directions as the result of establishment of the airport runway and further dredging of the Port, has had some dramatic effects. Turbidity however would be confined to the Port areas due to shipping movements and would not significantly affect the Bay generally. Runoff from static installations have not caused any deterioration in water quality, although there is the potential for spillages into Botany Bay during accidents (e.g. Caltex, Total, etc.). The Bay provides for significant movements of petroleum products and chemical tankers, the spillage of which constitute the major threat to its sensitive ecology which includes seagrasses, mangrove areas, fish habitats and oyster leases.

1.5 Acoustic Environment

The major noise sources in the study area include aircraft, industry and traffic. A recent noise survey conducted by the Department indicates that residences in proximity to industrial installations such as I.C.I., APM, Kelloggs, Johnson & Johnson and AC Hatricks are exposed to relatively high noise levels, particularly at night. When industrial noise contribution is added to traffic noise and in some cases aircraft noise, noise levels well in excess of 'acceptable' ambient levels for residential developments are experienced in many cases.

2. Socio-Economic Environment

2.1 Community Profile

Population

According to 1981 Census data, the total population of the Study Area, i.e. within 1 kilometre of the Industrial Area Boundary, is 8,000 an overall drop in the growth rate of -2.3. All age groups showed a negative growth rate except for those in the working age group of 25-44. The 0-4 age group showed the largest decline of -8.3. The population within 300 metres is about 4,500, which also reflected a negative growth rate of -2.2. The largest decrease of any age group is in the 0-4 year cohort of - 7.4.

Length of Residence

Of the total resident population in 1976, 42% had lived in the same residence for over 5 years and 11% had lived within the same Local Government Area.

In the area closest to the industrial areas, 50% either lived in the same residence or within the same Local Government Areas for 5 years or more.

Place of Origin

83% of residents were either born in Australia or from an English speaking country, similarly for the area closest to industries.

Employment

Approximately 30% of the total workforce of 5,175 are involved in either manufacturing or office employment.

The unemployment rate for males remained at a rate of 8.0 which is high compared with the State average.

65% of the total households in the area had a combined household income of less than $15,000 in 1976.

Place of Work

Approximately 14% of those in employment either worked in close proximity to their place of residence or worked from home.

Housing

The total number of all types of dwellings in the study area was 4674 in 1976 and in the area around the industrial complex approximately 2799.

32% of the occupied private dwellings were either owned or being purchased with the majority of the homes (81%) being of brick construction.

The occupancy ratio was calculated at 1.9 compared with what has been calculated as the crude 1981 Census rate of 3.06 for the Sydney Metropolitan Area, thus indicating a low occupancy rate for the study area.

Density

The ratio of units (i.e. all types of attached housing) to houses is 13.5, indicating a low density in the majority of the study area.

2.2 Community Facilities

Health and Welfare

Whilst a number of Federal and State Departments have offices in either Maroubra or Maroubra Junction, East Botany Municipality and the southern part of Randwick Municipality have inadequate service for target groups, particularly for mothers and children. Although most of the services are located on the major north-south arterial route to the C.B.D., limited access by public transport is available in an east-west direction.

The only centre providing a comprehensive range of welfare and recreational activities in the Hillsdale Information Centre in Hillsdale Plaza on Bunnerong Road.

The following list of health and welfare services (excluding child care) are available to residents in the area, although not easily accessible. Those marked * are located within the study area.

- Community Youth Support Scheme (C.Y.S.S.), Boyce Road, Maroubra.
- * Commonwealth Employment Service - Botany Road, Mascot
- Anzac Parade, Maroubra Junction
- Department of Youth and Community Services, Anzac Parade, Maroubra.
- * Community Information Centre, Hillsdale Plaza, Bunnerong Road, Hillsdale.
- * St. Vincent de Paul Family Centre, Anzac Parade, Maroubra Junction.
- Community Health Centre, Coward Street Mascot.
- * Botany Family and Children's Centre, Botany Road, Botany.
- * Australian Quadraplegic Association, Jennifer Street, Little Bay.
- Community Help Association of Randwick Municipality (C.H.A.R.M.), Anzac Parade, Maroubra.
- * Prince Henry Hospital, Little Bay.
- Department of Social Security, Anzac Parade, Maroubra.

<u>Education</u>

Primary and Secondary Schools in the area are currently adequate for the existing population.

Of the 6 primary schools, Banksmeadow Public School at Banksmeadow Road, Botany; La Perouse Public School, Yarra Road, La Perouse; and Matraville Public School, Bunnerong and Beauchamp Roads, Matraville, are located closest to the Industrial Complex.

Over the past 6 years enrolments at the schools listed above show that there has been a loss of over 100 pupils within the ast three years at Matraville Public (Total 556) whilst at La Perouse there has been a steady increase in numbers which are currently at 252.

2.3 Cost of Housing

One popular assumption is that proximity to major industry lowers property values but in fact this is not the case in the study area. There is a wide range of estimated house values over the study area but value determinants seem to be related more to local issues, such as proximity to aboriginal areas at La Perouse, than to location close to industry.

Factors determining house valuations appear to depend on perceived benefits that could apply to any area, such as location with a good aspect on an elevated block. In the Botany Municipality, Stephens Street frontages which overlook I.C.I. and other chemical industries, has had recent house sales of $85,000 while houses further west, relatively further away from industry, have sold for over $15,000 less.

A general valuation estimate of the Hillsdale medium density residential area shows that prices differ little between close to and away from hazardous industries. These are:

flat buildings	-	1 bedroom	$34,000 - 40,000
		2 bedroom	$48,000 - 59,000
		3 bedroom	$49,000 - 61,500
villas	-	2 bedroom	$70,000
		3 bedroom	$81,000

It is noted that in Grace Campbell Crescent relatively in close proximity to hazardous industry prices remained concurrent, while Templeman Crescent, further away, was lowest generally in value. Similarly, the Hillsdale single density residential area inside a potentially hazardous area compares favourably with development located further east (an estimated $95,000 - $105,000 inside and $85,000 - $101,000 outside a potentially hazardous area).

Denison Street adjoining I.C.I., is reportedly hard to sell but the operative factors are probably the relatively low standard of dwellings, flat topography, and, most notably, frontage on a major industrial artery.

Estimated valuations in the area of Randwick bound by Botany Municipality to the west and Bunnerong Road shows that the range of house valuations ($80,000 = $93,000) which is consistent with valuations both in proximity and relatively further away from industry.

The Chifley East area, off Bunnerong Road opposite Total, has an estimated value range of $77,000 - $90,000 (close to the refinery) and further away is higher at $80,000 = $100,000 but it should be noted that land further west is more elevated and this is likely to be the determining factor.

The Phillip Bay area between La Perouse High School and the aboriginal area has a broad range of values within the hazard area, $70,000 to $124,000. The determining factors appear to be the quality of the housing which varies enormously in this area and that some properties have good water views.

In conclusion, a general estimate of recent sales in the area show little difference between similar properties inside and outside a potentially hazardous area. It would appear that proximity to industrial facilities (fuel storage tanks, etc.) has no more effect on perceived housing benefit than would proximity to a reservoir.

2.4 Accessibility

Easy access to transport determines accessibility to opportunities ranging from employment to weekend leisure activities. The study area has a high access to such opportunities by road but ranks relatively low in car ownership; average household car ownership is 0.8 and 29% of households have no car. Much of the residential population is therefore dependent on public transport. The study area has been identified in the public transport issue paper (part of the Botany Bay regional study) as having low accessibility compared with other areas in the sub-region.

In employment opportunities, both manufacturing and non-manufacturing, and in access to comparison shopping, the area between Little Bay and Botany and Pagewood was seen as needing major improvements in public transport. For this reason the southern part of Botany and Randwick are designatd as unsuitable areas for urban consolidation. The study area is disadvantaged by being far from suburban rail lines relative to other areas 10-14 kilometres from the Central Business District. The area rates in the lowest 40% of zones in the sub-region in accessibility to comparison shopping (neighbourhood convenience shopping was not considered). There is an underprovision of retail floor space in this area and aside from Maroubra Junction, not a major centre, comparison shopping must be done close to the Central Business District.

Although the study area rates low in public transport accessibility compared with other areas of the Botany Bay region, accessibility is relatively high when compared with the growing residential areas in the western suburbs. Over the Sydney region, the study area ranks in the 17th to the 30th percentile in an accessibility index whereas the western suburbs all rate below the 50th percentile with the exception of areas just outside of Parramatta and Blacktown. Looking at one indicator, the per cent of job opportunities accessible by public transport within 40 minutes: Randwick - 18.4%, Botany - 15.5%, while Liverpool is only 3.3% and Penrith - 4.5% (Sydney Region average is 14.3%).

One can see from the above that even public transport accessibility to weekend shopping and recreational opportunities is not bad; there are at least five services between 10.00a.m. and 6.p.m. on both Saturday and Sunday.

In conclusion, the study area ranks low in access to employment, shopping and recreational opportunities relative to the rest of the sub-region but access is high when compared with the rapidly growing residential areas in the western suburbs.

APPENDIX F

METHODS OF CONSEQUENCE ESTIMATIONS

1. Fires

The impact of fires on various land uses depends on the intensity of heat and on the duration of the fire. Whilst atmospheric storage tank fires are of relatively long duration, fire balls from say pressurised LP Gas storage are shorter in time. As such, longer duration fire incidents were quantified and assessed differently to short duration fires.

The following principles have been adopted generally to compute heat flux levels at various distances from a fire:-

. the rate of fuel consumption (say from a leak, a pool or from a complete rupture of the containment vessel) is calculated;

. this rate is converted to a heat release rate accounting for the specific characteristics of the fuel in question including its heat of combustion;

. total heat radiation from the source is then computed; and

. resultant heat flux levels received at various distances from the heat radiating source are estimated by applying well-established methods.

1.1 Stock Tank Fires

The heat radiation (Q) from a stock tank pool fire is determined by the quantity and rate of fuel consumption in the fire, the fuels' heat of combustion and the portion of heat radiated to the surrounds.

Heat radiation was determined from:-

Q = mass x heat of combustion x efficiency

Q = (Surface area x burning rate x density) x efficiency x heat of combustion.

$$Q = \Pi \times \frac{D^2}{4} \times r \times d \times n \times HC$$

Where D = tank diameter (m)
r = burning rate (mm/sec)
d = density of fuel (kg/m ^{3} taken as 800kg/m ^{3})
n = portion of heat radiated to the surrounds (taken as 30%)
HC = heat of combustion of fuel (MJ/kg)

Flammable liquids were divided into three broad categories, namely, Class A (Light Petroleum Products), Class B (Solvents) and Class C (oils). For each class the rate of burning was varied between 6mm/min and 10mm/min. The heat equation indicated above can then be presented in terms of tank diameter as follows:-

$Q_A = 1.363D^2$ (Class A Flammable Liquids)

$Q_B = 1.068D^2$ (Class B Flammable Liquids)

$Q_C = 0.4335D^2$ (Clas C Combustible Liquids).

Figure 4(a) presents the above relationships for the three classes of fuel considered in the study.

In order to translate radiated heat at the source into heat flux received at various distances, methods suggested by API and by the view factor technique were investigated.

The following relationships were derived as the result of these investigations and implemented in the assessment.

TABLE F1

RESULTANT HEAT FLUX IN TERMS OF TANK DIAMETER

Heat Flux (kW/m^2)	Distance in Tank Diameter from the centre of the flame, m (Class B)
38	1.3D
25	1.55D
12.6	2.2D
4.7	3.7D
2.1	5.5D

Figure 4(b) presents a plot of these relationships used in stock tank fires consequence analysis computations. The following Table is relevant for the range of tank diameters encountered in the study area.

TABLE F2

HAZARD RANGE TO PEOPLE FROM TANK FIRES

Tank Diameter (metres)	Hazard Range Distance to adjacent storage and associated plant items (fire water required)	Distance to people (injury after 30 seconds exposure)
5	8	18.5
10	16	37
15	24	55.5
20	32	74
25	40	92.5
30	48	110

Fireballs (BLEVE)

The method of estimating fireball characteristics and impact is that discussed, suggested and implemented by several overseas authorities and technical advisers including the U.K. Health and Safety Executive the Departments of Economic, Social, Environment and Labour Affairs and TNO in the Netherlands. The estimations approximate experimental data and observations from actual fireball incidents.

In all cases it is assumed that half of the vessel inventory would be contained in the fireball.

The following computations are presented:-

Vessel capacity	Fireball Mass	Radius of Fireball	Duration
250t	125t	180m	23-30 sec
200t	100t	170m	20-26 sec
125t	60t	140m	18-24 sec
20t	10t	80m	10-14 sec
10t	5t	65m	8-12 sec

Estimates of heat flux received at various distances from the burning fireball are as follows (it was assumed that 30% of the heat generated at the source is radiated - duration of fireball is accounted for).

TABLE F3

HEAT FLUX AND EFFECTS FROM FIREBALLS

Mass of Fireball	Heat Flux (kW/m2)	Distance from Fireball (metres)* No attenuation From atmospheric water vapour	Attenuation at an approximate rate of 20% per 50m
100 tonne	150	195	150
	120	220	175
	100	240	190
	60	320	250
	38	400	320
	25	480	375
	13	660	530
	5	1050	850
20 tonne	150	110	95
	120	120	100
	100	135	120
	60	170	150
	38	220	180
	25	270	220
	13	380	340
	5	600	500
10 tonne	150	90	70
	120	100	85
	100	110	90
	60	140	120
	38	180	145
	25	220	180
	13	250	200
	5	490	400

* Distance is computed from -

$$Q = \frac{FHMa}{12L^2t}$$

where
Q = Heat flux
L = Distance to source
t = Duration of fireball
F = Fraction of heat released taken as 0.3
H = Heat of combustion of fuel taken as 50 MJ/Kg for Australian LPG
a = Atmospheric absorption coefficient (0.75 at 50m, 0.061 at 500m)

Figures 4(c) to 4(f) inclusive graph the relationship between incident heat flux and distance for various fireball sizes.

Consequences

For a very short duration exposure, the threshold heat flux for people is taken as 5 kW/m^2 (severe blistering, derived from 1 - 50/t 0.71) and average duration of 20-25 sec. Accordingly individuals within the following distances could be affected if shelter is not immediately sought.

Fireball size	Hazardous Range (m) (attenuation applies)
100 tonne	850
20 tonne	500
10 tonne	400

The distances indicated above would vary depending on the atmospheric water absorption available at the time.

At the estimated radius of fireballs, storage vessels could be engulfed in the fire during the duration of mishap. The heat radiation within the fireball is theoretically estimated above 800 kW/m^2. Several workers have, however, suggested heat intensity levels below 400 kW/m^2. Computations outlined in this section consider incident fluxes up to 150 kW/m^2.

A generalised indication of BLEVE and fireballs impact could also be derived from the correlation -

$R = pM^{0.4}$ (work at the Department of Chemical Engineering, University of Aston in Birmingham)

where

R = hazard range to severe burns with fatality to people

M = mass of burning fuel in kg

p = 3.5 for butane BLEVE

p = 5.1 for butane fireball

The following hazard range is tabulated accordingly (also refer to figure 4(g).

Mass of Burning Fuel (Tonne)	Hazard Range	
	BLEVE	Fireball
250	510m	740m
100	350	510m
20	200	285m
10	140	210m

These distances are for fatality and severe burn effects.

2. Dispersion Estimations For Quasi-Instantaneous Releases of Liquified Flammable Gases :

The following dispersion estimations for the possible instantaneious releases of various amounts of liquified flammable gases releases have been undertaken using an approximation of the DENZ model developed by the U.K. Safety Reliability Directorate (SRD) of the U.K. Atomic Energy Commission. DENZ is the computer code for evaluating the dispersion of heavier-than-air gases released instantaneously, i.e. the release duration is very short. This method is currently widely implemented for the consequences analysis of mishaps from potentially hazardous installations such as the one proposed.

The basis for the dispersion estimations is as follows (reference Canvey, a second report - U.K. HSE September, 1981):

Material	Propane	Butane
Source Temperature	15°C	15°C
Boiling point	-45°C	-2°C
Flash fraction	0.28	0.10
Air entrained	11.2m*	2.8m
Total mass vaporised	m	0.78m
Cloud density (kg/m^3)	1.41	1.73
Cloud temperature	-16°C	-45°C

*m is the mass of material released in tonnes.

The distances to the lower flammability limit of dispersing short duration releases of propane and butane and the methods of estimations are derived hereafter:-

TABLE F4

HAZARD RANGE FOR PROPANE AND BUTANE RELEASES

Material	Propane		Butane	
Weather Category Wind Speed	D 5m/s	F 2m/s	D 5m/s	F 2m/s
Distances to Lower Flammability Limit				
. Downwind Range (R) of Cloud:-	$0.12M^{0.4}$	$0.17M^{0.4}$	$0.10M^{0.4}$	$0.14M^{0.4}$
10 tonnes	300m	430m	250m	350m
50 tonnes	570m	810m	480m	670m
100 tonnes	760m	1070m	630m	880m
200 tonnes	1000m	1415m	830m	1165m
. Maximum Width:-	0.8R	1.2R	R	1.6R
10 tonnes	240m	515m	250m	560m
50 tonnes	460m	970m	480m	1070m
100 tonnes	600m	1280m	630m	1400m
200 tonnes	800m	1700m	830m	1860m
. Maximum Width of Cloud occurs at:	0.5R	0.4R	0.4R	1.2R
10 tonnes	150m	170m	100m	420m
50 tonnes	285m	320m	190m	800m
100 tonnes	380m	420m	250m	1050m
200 tonnes	500m	570m	330m	1400m
. Upwind Range:-	0.1R	0.25R	0.2R	0.6R
10 tonnes	30m	110m	50m	210m
50 tonnes	60m	200m	95m	400m
100 tonnes	75m	260m	125m	520m
200 tonnes	100m	350m	160m	700m

3. Estimation of The Consequences of Vapour Cloud Explosions

The method used to compute blast overpressure impacts from the release of various amount of LPG is that recommended by the U.K. Advisory Committee on Major Hazrds (2nd Report). The method is widely implemented by the U.K. Health and Safety Executive for assessment purposes.

For the purpose of this analysis, it is assumed that the explosion would occur close to the point of release, i.e. cloud drift effect is largely ignored. Evidence indicates that in average weather conditions only a very large cloud, or one being formed very rapidly could drift so that the centre of the explosion is 100m from the leak. Other evidence indicates that less than 4% of the plume could reach a distance of 500 metres before ignited. In recent assessment studies for LPG installations (mainly in the U.K. and The Netherlands) the consequences of vapour cloud explosions at the boundaries of residential developments 100 metres to 600 metres from the source of release were considered.

The TNT equivalent M for a mass of LPG vapour V tonnes is estimated from -

$$M = \frac{p \times \text{Heat Combustion of vapour} \times \text{mass of vapour (v)}}{\text{Heat combustion of TNT}}$$

where:

p = efficiency of explosion relative to TNT assumed to be 3%

For Propane and Butane vapours:

$$M = 0.03 \times \frac{11950 \text{ kcal/kg}}{1100 \text{ kcal/kg}} \times V$$

$$M = 0.3V.$$

It was also assumed that the explosion would occur at $R = 3 (V)^{0.3}$.

On the basis of these assumptions and methodology, the following estimates are presented:-

TABLE F5

ESTIMATIONS OF UNCONFINED VAPOUR CLOUD EXPLOSION EFFECTS

. Tonnes of Hydrocarbons Vapour in Cloud	5	10	20	50	100
. TNT equivalent (Tonnes)	1.5	3	6	15	30
. Distance to 70 kPa	40m	50m	60m	80m	100m
. Distance to 35kPa-50kPa (Plant items overturned, extensive damage)	50m	80m	90m	110m	170m
. Distance to 21kPa-35kPa (Reinforced structures distort, atmospheric storage tanks fails)	90m	110m	120m	170m	200m
. Distance to 7kPa-21kPa (Walls collapse, house uninhabitable, possible domino ancillary equipment)	160m	200m	240m	320m	400m
. Distance to 3.5kPa (90% glass breakage)	270m	350m	500m	600m	1000m
. Distance to 1.7kPa (50% glass breakage)	600m	900m	1000m	1200m	1500m

4. Toxic Gas Release

Estimations of toxic gas concentrations at various distances from the possible sources of release have been extensively discussed by Lees (1980), Harris (1980), the U.K. Health and Safety Executive and TNO (The Netherlands).

The method adopted for this assessment for relatively buoyant gas releases is that known as the Pasquill continuous plume model in which:-

$$(Co) = \frac{168QF}{udh\Theta}$$

Where

Q = release rate in m^3/sec

u = wind speed (m/s)

d = distance from source (m)

O = lateral spread (degrees)

h = vertical spread (m)

$$F = \exp\left(-2.303 \left(\frac{H}{h}\right)^2\right) = 1 \text{ for a ground level release.}$$

For the slightly stable (D stability class) atmospheric conditions and 2m/sec wind velocity (most prevalent conditions in the study area, see Appendix E. The above equation can be simplified as:-

$$Co = \frac{4.2 \times 10^6 Q}{dh} \quad \text{in parts per million.}$$

For gases which are heavier than air the Pasquill model indicated above has been modified in accordance with the work of Ooms, Van Ulden and te Reile described by Harris (1980) and Lees (1980) particularly for the cases of large releases.

Figure (4h) presents a plot of toxic concentrations for various release rates (in m^3/sec) as applicable to chlorine releases. The most relevant releases are tabulated as follows:-

TABLE F6

TOXIC HAZARD RANGE FOR VARIOUS RELEASES OF CHLORINE GAS AT 2m/s AND D STABILITY METEOROLOGICAL CONDITIONS

Release Rate (m^3/sec)	Distance for exposure of 1 hr maximum (m)	Distance for respiratory irritation (extended (period) (m)
3.6	1000	1900
2.4	770	1200
1.2	450	800
0.6	250	480

APPENDIX G

ASSESSMENT CRITERIA: BASIS FOR FORMULATION

Overview on Risk Perception and 'Acceptability' of Risk

One of the Fundamental questions addressed by risk analysis studies is 'How safe is safe enough'. Attempts to answer this question in the context of land use planning reveal potential problems for decision makers. Here are some of the issues involved:-

- Anyone studying man-made/environmental hazards involving the potential of some harmful event happening to an individual soon appreciates that, from the public point of view, there is a wide range of responses extending from virtually total indifference to evangelistic concern. When we consider how inconsistent communities are in their behaviour toward potential risks such as smoking, car driving, aircraft crashes, train accidents and proposed hazardous installations, we realise how little understanding of community risk perception we have.

- Acceptability involves many considerations of which safety is only one, but is now playing an increasingly important role in planning considerations.

- Risks may only be acceptable when they are outweighed by certain advantages which residents perceive as being associated with the considered activity. However, regions of unacceptable risk - whatever the advantages may be - can be shown to exist.

- Perception of an unacceptable level of risk is important, since if a risk is perceived by a large proportion of the population, then even if the actual risk is NIL, there is a loss of utility, residential amenity or environmental quality.

- Even after the prescription of risk reducing measures, there will still be residual risk. For the judgement of the acceptability of this risk, other aspects, such as social and economic factors, should also be considered.

- Recent research into how people may perceive and process probabilitistic information generally indicates that making decisions about risky activities is difficult and people may not be equipped intellectually to respond to that difficulty constructively. People do not always have accurate perceptions about the risks they are exposed to. Problems of misperception are aggravated by the fact that people's beliefs are extraordinarily resistant to change.

- People's perception of risk may depend greatly upon the way in which relevant information is presented. Reassuring statements from technical experts may do little to alleviate public fears.

- People in general are willing to voluntarily take great individual risk by smoking, driving or private aviation, etc. On the other hand, society is offering growing resistance to risks imposed (involuntarily) on one group of people for the benefit of others such as by the presence of hazardous industries close to neighbourhoods, or the transport of dangerous substances.

- Risks, with possible large consequences, are usually those to which people are exposed to involuntarily. An employee may voluntarily accept risks associated with working in or on a plant, but a member of the public is subject to hazard from the plant involuntarily. Generally it is presumed that the risk should be lower for the third party than for the employee.

- It has been shown by various researchers that people are prepared to accept considerably higher risks when they do so voluntarily. Voluntary risks are accepted by defintion. However, the involuntary ones are accepted by implication in so far as there is no serious outcry against them.

- Attitudes towards risk acceptability can vary widely depending on local situations.

- There are two dimensions of risk which should be considered separately, personal-vs-societal. On the one hand, the individual's concern about their own life is mostly independent of whether the fatality risk is high from an isolated incident or a large scale disaster. Society's risk perception, however, is influenced by multiple fatality disasters. Society could be risk-neutral to isolated incidents but quite risk adverse with respect to multiple fatality events because of the social disruption caused by such events.

<u>Fatality Risk Criteria</u>

From overseas studies and limited local data, it is suggested that people - generally - are voluntarily accepting risks of being killed in the order of 1 chance in 10,000 per year and higher. For example the risk of being killed whilst driving on New South Wales roads is about 3 changes in 10,000 per person per year. The risk of being killed from smoking 20 cigarettes per day is as high as 50 chances in 10,000 per person per year (or 0.5 chance per one hundred). People are still willing to take such risks presumably because of some advantages. People necessarily accept a number of some involuntary risk such as being killed by an earthquake, run over by a motor vehicle while crossing a street or being bitten by venomous creatures.

The Table below presents some voluntary and involuntary fatality risks to which people in general are exposed. It has been argued that if risks from hazardous industrial plants are contained below everyday 'accepted' risks, then the risk should be 'accepted'.

Table G1
Fatality Risks for some Voluntary and Involuntary Risks

Voluntary Risks	Chance of Fatality per million per year per person
Smoking (20 cigarettes/day)	500
Motoring in New South Wales	300
Drowning in New South wales	60
Playing Football	40
Rock climbing	40
Working in chemical plants (UK)	40
Taking Contraceptive pills	20
Train accidents in New South Wales	10
Air Crashes in New South Wales (mainly private aviation)	10
Involuntary Risks	
Run over by a car in New South Wales	100
Run over by a car in the UK	60
Run over by a car in the USA	50
Leukemia in UK	50
Fire in houses in New South Wales	20
Explosions in New South Wales	5
Being struck by lighting in the UK	3
Bushfires in Australia	1
Poisonous spider bites in New South Wales	0.2
Explosions from pressure vessels in the USA	0.5

Considerations of such voluntary and unvoluntary risks led many researchers to conclude that if a community is subjected to fatality risks from hazardous installations in the range of 1 to 0.1 chance per million per year for any member of this community, then the risk from the installation is low in relation to other acceptable risks and should be tolerated.

While this approach may appear to some to be impersonal or even cold-blooded, it recognises that in a society with limited resources, it is not possible to do everything at once. It is important to determine priorities and not to put grossly disproportionate effort into reducing risks which are already relatively low, if there are other much higher risks yet to be tackled.

Limitations of Fatality Risk 'Acceptability'

The applicability and subsequent interpretation of the voluntary-involuntary risk model have been called into question on a number of counts. Firstly, the rating of risks on a voluntary-involuntary dimension has been considered as artificial in that it ignores personal, social and economic conditions that influence people's choices. The main criticism of this approach is that the risk of living near an oil refinery, for example, is imposed from outside, and therefore involuntary, while that of driving a car is voluntary, because the mechanism by which the risk is felt has been unjustifiably differentiated. The risk of living near an oil refinery is, in simplistic terms, only imposed if the refinery is located there after residential development. However, for many of the 'involuntary' risks, people have chosen to live in areas that present a known appreciable risk (e.g. flood prone and earthquake areas) thus making a 'voluntary' decision that benefits will outweigh any costs. In the example of the oil refinery, it is not the activity of living near an oil refinery that is necessarily risky, but the spatial and temporal distribution of hazards incumbent in the refinery's operations.

It has been suggested that it is fallacious to conclude that we should accept lower fatality criteria for those activities which involve a natural or technological risk being imposed on an innocent, dormant populace than for those which involve people actively and knowingly taking a personal risk for pleasure or profit. This distinction can only be made in the first case, by assuming that people exist within the risk area prior to its operation, or are unable to move; while in the second case, by assuming that people have perfect mobility and freedom of choice. It is therefore not surprising to see that, where risks have been dichotomised according to whether the subject has a choice available, a distinction appears between the levels of risk that people are prepared to accept.

The main criticism of the voluntary-involuntary model for assessing acceptable risk therefore, is that it ignores the many personal, social and economic factors which help to make decisions in risky situations. Other variables considered relevant by researchers include the immediacy of consequences; the reversability of consequences; the catastrophic potential, i.e. whether the consequences will be fatal; whether the frequency and consequences are familiar to those at risk; whether the risks are gradually increasing; to whom the benefits accrue; whether safety is seen as a private or public good; the reducability of the risk; the observability and newness of the risk; whether it is delayed in its manifestation; the number of people exposed; personal exposure, reactions of dread and the threat to future generations.

Suggested Fataliy Risk Criteria for Assessment

Whilst acknowledging the limitations associated with establishing a precise criterion for an 'acceptable' fatality risk, a level of 1 chance in a million per person per year was adopted as a guide for assessment pending further refinement. It must be emphasised that this level has been applied to the assessment as only one component of total risk evaluation. Risk of injury (but not fatality) to people and damage to property was also accounted for as discussed later.

Based on such an approach, the following criteria of assessment for various land uses were considered appropriate:

Table G2

Fatality Risk Criteria

Land Use	Fatality Risk Criteria per million per person per year
Residential	Up to 1
Open Space	
Passive	Up to 10
Active	Up to 5
Commercial	Up to 5
Public Roads	Up to 20
Industrial	Up to 50 (per employee)

The Department is currently analysing the results of a risk perception survey undertaken by household interviews for selected residential areas in the study area. This survey may help determine the local population's perception of risk from the industrial operations.

Injury/Damage Risk criteria

The individual risk of death criterion of 1 to 0.1 chance per million per person per year as discussed above, has been translated into an overall plant risk factor, to include accident risks such as injury to people and various effects on houses.

The U.K. Advisory Committee on Major Hazards stated

> "If, for instance, such tentative conclusions indicated with reasonable confidence that, in a particular hazardous plant, a serious accident was unlikely to occur more often than once in one ten thousand years (or to put it another way, a 1 in ten thousand chance in any one year), this might perhaps be regarded as just on the borderline of acceptability, bearing in mind the known background of risks faced every day by the general public."

This statement implies that a frequency of less than 1 in ten thousand of 'serious accident' per year could be acceptable for community exposure. The term 'serious accidents' - which presumably would include all events where damage exceeds defined threshold - is not defined by the Advisory Committee on Major Hazards. Some may argue that a heat flux of 4.7 kW/m^2 (see Table 4, no fatality at this level but will cause pain in 15-20 seconds and injury after 30 seconds expore) and an explosive overpressure of 7 kPa (see Table 5, no fatality, but damage the internal partitions and joinery but which could be repaired) as 'serious' incidents while others may consider lower values as the threshold of acceptability. The table below summarises the view of workers in this field (Kletz and Batstome and Tomi) and of the Health and Safety Executive in that regard.

Table G3

Comparison of Criteria established by Batstone/Tomi, Kletz and the UK Health and Safety Executive

CRITERIA	Batstone/Tomi	Kletz	Health & Safety Executive
Overpressures for Safety Distances			
Pressurised plant equipment	5 psi	5 psi	-
Low pressure plant equipment	2 psi	3 psi	-
Housing	1 psi	0.7 psi, 0.4 psi if possible	0.6 psi
Control Buildings) Other occupied bldgs)	-	Design for pressure at location (10 psig max)	(Design for 10 psig. (Design for pressure at location

<u>Maximum Heat Radiation</u> Housing	1.6 kW/m 2 (sometimes 4.7 kW/m 2)	-	-
Equipment which must be operated in an emergency	4.7 kW/m 2	5 kW/m	-
Wood, plastic, etc	12.5 kW/m 2	12.5 kW/m 2	-
Storage tanks	37.8 kW/m 2	38 kW/m 2	-
Areas such as roads to which the public have access	-	12.5 kW/m 2	-
<u>Acceptable Frequency of Major Incident Affecting Community</u>	10^{-4}/yr	10^{-4}/yr if 0.7 psi is taken as allowable overpressure at housing.	10^{-4}/yr

While it is prudent, particularly in the case of planning new residential areas in the neighbourhood of existing plants or when locating new hazardous installations, to ensure low probabilities of 2.1 kW/m ^{2} heat flux and 3.5 kPa explosion overpressure, when we are dealing with an existing fully developed situation, the following criteria were considered appropriate:

- Incident heat flux radiation at residential areas should not exceed 4.7 kW/m ^{2} at frequencies of more than 50 chances in a million per year.

- Incident heat flux radiation at residential areas should not exceed 12.6 kW/m ^{2} at frequencies more than 10 chances in a million per year.

- Residences should not be exposed to continous heat radiation of 23 kW/m ^{2} or higher at frequencies of 0.1 to 1 in a million per year.

- Explosion overpressure risk at residential areas should not exceed 7 kPa at frequencies of 50 chances in a million per year, 14 kPa at less than 10 chances in a million per year.

- Maximum allowable risk levels for adjacent industries were taken as 23 kW/m ^{2} and 35 kPa at maximum frequencies of 100 in a million.

- Exposure to toxic gas concentrations at residential areas which are dangerous for periods of 1/2 - 1 hour with a frequency of 10 chances in a million or greater or which can be considered fatal at a frequency of about 0.1 - 1 in a million or greater.

- Toxic gas concentrations in neighbouring industrial facilities should not exceed frequency greater than 10 in a million or dangerous concentrations at more than 50 chances in a million.

APPENDIX H

SAFETY CONTROLS: OPERATIONAL AND ORGANISATIONAL

This appendix presents the results of assessment of specific organisational and operational safety controls currently adopted by those industries investigated in this study.

As indicated in the body of the report, it is not the purpose of this risk assessment survey to assess in detail the adequacy of all in-plant technical safety controls and measures, but rather to quantify the overall cumulative resultant risk levels outside plant boundaries and the 'acceptability' of such levels to surrounding land uses.

As such, the same failure rates were assigned for all plants and associated equipment irrespective of the degree of control. These failure rates were based on well established data for similar installations and by reference to similar overseas studies and were adopted in the hazard computer model in order to estimate resultant risk levels from each installation and for the whole complex as indicated in figures (8) to (28) inclusive.

In light of the results obtained, a 'qualitative' assessment of safety controls at each installation was then undertaken in order to investigate the effect of varying degrees of controls at the source on the computed resultant risk levels. Obviously, those industries with above normal industry safety standards, where specialised safety controls are implemented, would have their overall risk contours reduced, while those with below normal industry safety practices would result in a larger risk contour area.

The exact extent of expansion or reduction in the risk contour areas as the result of varying degrees of hazard control is difficult to estimate in the context of this study. It is, however, reasonable to state that those facilities with relatively high risk levels at residential areas, or with a relatively high potential for accident propagation and having normal or below normal safety standards should have their hazard controls 'tightened up' and upgraded.

It is important to note that hazard controls in that context refer to design, operational and organisational safety measures. That is those measures required by various standards (such as safety separation distances, fire fighting appliances and facilities, etc.), safety software such as monitoring, emergency procedures and management safety practices. As discussed in the report many instances exist where normal standard requirements are inadquate to cope with a locational situation where 'unacceptable' high risk levels result at sensitive land uses such as residential. Such situations warrant more stringent safety controls.

Basis for Assessment

The information relevant to this assessment was gathered from:-

(i) replies to survey questionnaire submitted by industry as part of the hazard audit survey;

(ii) site inspections: once for most installations surveyed and twice for selected industry where relatively high risk levels were identified;

(iii) additional information provided by relevant government authorities; and

(iv) information provided to the Department as part of environmental impact assessment.

An overall rating system was developed. The following aspects were considered:-

* History of hazardous incidents

- Are hazardous incidents with a potential to place the public at risk a continuing way of life for the organisation;

- Do the same types of incidents recur;

- Is there evidence that effective corrective action is taken after an incident.

* Safety Management

- Is there a safety officer, or if the organisation is small, does management understand its responsibility for safety;

- Is there any suggestion of routine audit of technical safety;

- What procedures are adopted to report on accidents or unusual occurrences, and is there any evidence of follow up;

- What is known of the attitude of the management of the organisation to safety.

* Safety Features

- Compliance with normal safety standard requirements;

- Any additional engineering standards, controls, etc.;

- What evidence is there of the organisation aiming for intrinsic safety as much as possible: low inventories, temperatures, pressures, etc. (within process constraints);

- What evidence is there of the role of automatic protective systems: alarms, automatic shutdowns, gas detectors, combustion detectors, etc. Are any of these features present?;

- Where the organisation handles flammable materials, what fire protection equipment is there? Are these adequate for the situation in hand?

* <u>Emergency Procedures</u>

- Does the organisation have formal emergency procedures?;

- Are such procedures reasonably comprehensive in view of the range of potential hazardous incidents at present on site?;

- Are emergency procedures practiced periodically?;

- Does the organisation have any continuing liaison with the emergency services: fire brigade, police, ambulance, etc.?;

- Are these procedures co-ordinated with adjacent installations and with relevant state emergency services. Do evacuation plans account for affected residences?;

- What are available on-site communication systems for emergency and evacuation?

Section 8.2 present a detailed evaluation of emergency procedures in the study area).

The assessment results were then classified in three categories:

A: Industries with above normal standard requirements.

B: Acceptable safety controls in principle, but improvements suggested in view of risk analysis results.

Comprehensive hazard studies strongly recommended in order to assess the need for additional control measures, particularly emergency planning.

C: Deficient -

Urgent overall safety review, update of safety controls and practices strongly recommended.

Comprehensive hazard studies should be undertaken as soon as possible as part of an overall safety review.

<u>Results of Assessment</u>

The attached tables present the results of assessment (by reference to the three categories outlined above).

It must be recorded that these judgements were based without detailed discussions with the management concerned.

*A: The following installations have been identified as implementing advanced safety controls (design, operational and organisational) with 'acceptable' risk levels to adjacent land uses, low potential for interaction internally, remotely isolated systems, comprehensive monitoring, adequate fire fighting facilities and co-ordinated emergency procedures. In all cases, detailed risk analysis have been undertaken by each company as a recognition of sound safety management.

- Caltex Oil (Australia) Ltd - Banksmeadow Terminal
- I.C.I. Hydrocarbon Storage Terminal - Port Botany
- Terminals Pty. Ltd. -

  Storage and Distribution facilities at Port Botany.
- P.D. Oil & Chemicals Pty. Ltd. -

  Storage and Distribution facilities at Port Botany.
- Catoleum Pty. Ltd. - Botany

B: The following installations have been identified as lacking in some aspects of safety controls and where a hazard analysis is warranted in view of risks identified.

- A.C. Hatrick Pty. Ltd. - Chemical Plant, Botany.

  Although technical and management safety controls are comprehensive, resultant risk levels at nearby residential areas are well above 'acceptable' relevant risk criteria. This is mainly due to the proximity of residences to the plant. A detailed risk analysis for the plant is strongly recommended together with specific review of emergency procedures in light of the results obtained.
- Carba Australia - Botany

  Johnson and Johnson - Botany

  La Porte Chemicals

  Liquid Air Australia

  Emergency procedures for these facilities should be reviewed in accordance with the guidelines published by the Hazard/Emergency Sub-Committee and detailed in Appendix I.

. <u>I.C.I. Petrochemical Plant</u> - Botany - <u>Plastics Factory</u>

An overall safety review for this plant with particular emphasis on isolation, shut-off systems, detection and emergency isolation is strongly recommended in view of potential toxic hazards from chlorine escape and effects on nearby residences.

- <u>Other Factories</u>

Safety controls are advanced and comprehensive. In light of the results of this study, an overall co-ordinated emergency plan specific to the whole I.C.I. site is warranted. This plan should combine all existing individual plans currently implemented.

C: The following installations have been identified as urgently requiring an overall safety review, based on comprehensive hazard analysis studies.

Major improvements to operational and organisational safety controls at these installations are strongly recommended.

- H.C. Sleigh (now Caltex) Storage Terminal, Botany.
- Amoco (Australia) Limited - Storage Terminal, Botany.
- B.P. (Australia) Limited - Storage Terminal, Botany.
- Total Distribution - Storage Terminal, Botany.
- Bayer Australia Limited - Agricultural and Veterinary Products.
- Total Oil Refinery, Matraville.
- Wool Processors - Botany.
- Mayne Nickless Pty. Ltd. - Container Depots.
- Esso Australia - Storage Terminal, Botany.

The installations indicated above have primary risk areas covering extensive residential areas and/or with high potential for accident propagation. In addition to the proximity of residential dwellings, safety controls are in many cases 'basic and minimal' or non-existent, particularly in relation to level/pressure/temperature controls (as applicable), isolation measures, leak detection and monitoring. No formal emergency procedures have been submitted, and many do not have a safety officer on site.

There is also a need for reviewing the adequacy of their fire fighting facilities particularly in view of the quantified high potential for on-site accident propagation. Fire fighting requirements should be based on detailed fire and risk analysis studies (see NFPA code as a guideline).

It is strongly recommended that an immediate inspection of all these facilities be undertaken together with a detailed risk study and that an overall update of existing controls be implemented.

KEY TO TABLE H1

A: Above industry standard and normal code requirements.

B: Acceptable, but improvements suggested in view of risk analysis results.

C: Deficient

Urgent overall safety review and improvements to operational and organisation controls strongly recommended.

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APPENDIX 1

GUIDELINES FOR THE PREPARATION OF EMERGENCY PLANS BY INDUSTRY

1. INTRODUCTION

The following Guidelines have been compiled to assist those industries, which can be described as potentially hazardous or those which are located in close proximity to hazardous industries, in the preparation of their internal emergency plans.

These Guidelines are intended ~~to~~ provide a basic framework for the formulation of internal emergency plans and represent the minimum requirements that should be included. Individual emergency plans would vary from one installation to another depending on the nature of the facility and the type of hazards involved. Industries will therefore need to incorporate specific procedures to suit their own needs.

An emergency is described as a critical situation which cannot be immediately contained by staff on duty utilising available resources and would therefore require external assistance; where injuries or fatalities to plant personnel or any member of the public have, or could be incurred; where property damage has occurred or such property is placed in jeopardy or where the impact is likely to cause serious environmental consequences.

The rationale for the suggested guidelines therefore, is based on safety considerations for both plant personnel and the neighbouring community as well as for the protection of property and on the integration of those considerations into the wider provisions and requirements of external emergency service organizations.*

Once an emergency plan has been prepared, it must be regularly tried, tested and updated so that in the event of an emergency, its effectiveness can be assured. Copies of the updated plans should be lodged with relevant Government Authorities. Close liaison with Emergency Service Organizations is essential.

2. DOCUMENTATION

When preparing emergency plans, the following information needs to be included as an integral part of the overall emergency plan to enable all facets of an emergency situation to be handled efficiently and effectively.

Footnote: * 'External Emergency Services' in the context of these Guidelines refers to either the Polic Department, Board of Fire Commissioners, State Emergency Services, The Ambulance Brigade, or all of the above depending on the nature of the emergency situation.

(a) Emergency Plan Procedures. These should encompass the definition of emergency situations, the aim or purpose of an emergency plan, the types of emergencies to be catered for, the duties of responsible personnel, as well as evacuation and termination procedures.

Preparatory emergency measures such as the consideration of manpower and physical resource requirements, installation of communication and alarm systems, emergency facilities and the need for regular training should also be outlined in the emergency procedures. Refer to Section 3 for more details.

Should procedures to contain an emergency outside normal operating hours be different in any way to those during normal hours, then these should be detailed separately.

(b) Site Layout Plan. As well as showing the location of buildings and facilities, the site plan should also show the location of the following by colour coding using for example those standards covered by AIP CP5-1979 Code of Practice for Pipeline Identification or AS 1345 for the Identification of Piping, Conduits and Ducts -

- hazardous process and storage facilities, heating plants, critical components of the electrical supply system, (particularly control switches and generators), main gas control valves, fire hydrants, water sprinklers, fire alarms, drainage channels/outlets, bund walls, local and remote control facilities and activating devices;

- first aid equipment, fire fighting equipment, communications systems;

- evacuation routes and assembly points.

(c) Emergency Operations Flow Chart showing roles, responsibilities and line of command for both company personnel involved and those of outsiders, either from emergency services or from adjacent companies.

Telephone contact numbers (both day and after hours) of key personnel or their deputies should be shown.

The Emergency Operations Chart and the Site Plan containing the above details should be displayed at strategic points throughout the plant.

(d) Specific Emergency Procedures. Detailed procedures for individual plant items and transfer pipelines, transportation of dangerous goods, oil spill clean-up, procedures for the loading and unloading of road and rail tankers, etc, should be appended.

(e) Data Sheets. These sheets should include detailed information on the types of chemicals handled, stored and processed; their location and quantities; their physical, chemical and biological properties such as toxicity, flammability, miscibility, vapour density, corrosiveness, etc. are to be indicated. Detailed methods for containment, applicability of appropriate fire fighting techniques, neutralising agents needed, etc. should be clearly identified. For ease of reference, and uniformity, appropriate HAZCHEM Codes should be used.

Data sheets should be updated regularly and kept in a known, safe and easily accessible location. This location should be clearly identified on the site layout plan and any major variations notified to the relevant emergency service organisation.

3. EMERGENCY PLAN PROCEDURES

(a) Definition. As the definition of a threat/emergency forms the basis for all subsequent action, it is essential to clearly and precisely define all possible and likely emergencies, both internal or external - i.e. an imbalance in the system inside the plant, an emergency at an adjacent facility, etc.

Different types and levels of emergencies will need more or less sophisticated procedures depending on the nature of the emergencies identified, the vulnerability of the organisation to these emergencies and the likely impacts.

(b) Preparation of the Plan. In preparing emergency plans the following aims should be considered:

- to decrease the level of potential risk to human life, property, and the environment, both inside and outside the plant boundaries;
- to mitigate the consequences of the mishaps;
- immediately attend to any potential mishap and localize and limit the scope of emergencies;
- to facilitate rescue operations through communication and co-ordination with emergency services; and
- to facilitate the reorganisation and reconstruction activities so that normal operations can be resumed.

Procedures outlined in the Plan must provide the basis for quick action before, during and after the event. In general, plans must follow a logical sequence of emergency operations from the initial warning to the final debriefing.

Consideration should be given to the compatibility of intended plans with existing Counter Disaster Plans (e.g. Polic District Plans and those of adjacent companies). The nature of outside involvement should be comprehensively discussed with all concerned prior to drafting any emergency plans.

External authorities must then be fully satisfied and conversant with the resultant plans. A copy of the emergency plan and related documentation should be lodged with relevant emergency organisations, specifically the Board of Fire Commissioners and Police.

Adequate consideration should be given to procedures for the company when emergencies arise at adjacent facilities. Liaison with such neighbouring facilities should be formalised.

Provision will need to be made for regular testing and updating to ensure that the plan is fully operational at all times.

When preparing emergency plans, individual industries may also need to take into account, in addition to the suggested minium requirements, the following considerations for their own benefit:-

- the protection of key items of plant (computers, files, etc.), and the provision for the security and preservation of essential records;
- any economic lag as a result of a disaster;
- insurance requirements;
- alternative accommodation or use of facilities.

(c) Elements to be considered (see figure 32)

(i) Emergency Identified. When the initial alarm is raised it is important that there is a minimum time delay between the discovery of an emergency and the notification of senior management and emergency service organisations. An important time element can be unnecessarily introduced, should the most senior person be nominated as the only person to sound the alarm.

Assistance from emergency services should be obtained by telephoning 000 and giving essential information as to the nature and location of the emergency (see figure 32). Where it can be demonstrated that there is a need to have direct contact with an emergency organisation, e.g. because of the nature of the products being processed, stored and handled, then alternative alerting systems may be appropriate.

Consideration should be given to emergencies that could occur outside normal operating times or when functioning at reduced capacity.

Call-out procedures covering emergencies occurring during normal operations and out of hours will need to be specified, listing contact numbers for involved personnel and deputies.

The role and duties of emergency personnel and their chain of command, should be clearly stated in the main body of the Plan, preferably in the form of a flow diagram.

Care should be taken so as not to jam the switchboard with unnecessary calls after the alarm has been raised. Radio telephones, two way radios, couriers, etc., should be used for on-site communications.

Adjacent companies should also be notified and mutual assistance arranged. Trained internal fire fighting teams should be deployed in the interim while waiting for outside assistance.

(ii) Evacuation Procedures. When considering evacuation procedures, attention should be given to:-

- alternative routes to safe assembly areas for roll call;
- collection of appropriate stock records/inventories;
- the shut-down of operations safely and speedily;
- the removal of tank trucks, etc,; and
- the initiation of appropriate welfare action.

Assembly areas should be readily accessible, in secure locations, able to provide for the welfare needs of personnel, and be suitable for determining plans and equipment replacement requirements. (i) and (ii) should have occurred prior to the arrival of the Emergency Organisations. When the Emergency Organisations arrive, control for the specific emergency must be handed over to the appropriate Emergency Service officer. However, internal emergency procedures will continue to take place concurrently.

(iii) Termination of an Emergency. Briefing at all stages will enable a continuing review of emergency procedures to occur and changes or modifications may result.

At some point the emergency controller, in consultation with the relevant Emergency Organisation(s) will make the decision either to abandon attempts to commence normal operations or to resume normal operations.

A comprehensive report to meet the requirements of various authorities should be compiled to include the effectiveness of the action, plans for reconstruction including proposals for the prevention or reoccurrence, on damage and loss for insurance purposes, etc.

(d) Emergency Preparedness

(i) Resources. The resources necessary to cope with emergency situations must be identified, located, assessed and recorded so that these resources can be deployed and employed appropriately and effectively.

Names, addresses and contact numbers of all personnel and next of kin should be kept up to date and held in a safe and an easily accessible location e.g. gatehouse, weighbridge.

All personnel should be issued with identity cards so that emergency service workers can assist or give appropriate directions. These cards are also useful in case there are any casualties.

As a memory prompt, it is suggested that cards be issued to each individual listing their role and duties in an emergency.

Some form of visible identification should be worn by those company personnel who have a co-ordinating or controlling role. Coloured armbands or helmets are suggested. This will all readily identify company personnel when emergency services personnel arrive.

Standby technical personnel should be on hand immediately an emergency occurs to give advice on chemicals stored, their location and physical properties. Such personnel should be at the first point of contact with outside emergency services.

(ii) Equipment. Emergency and medical equipment as well as warning and communication systems must be kept fully maintained and regularly tested. A listing of this equipment and its location should be included in the appendices of the Emergency Plan.

Back-up systems (particularly for power generation) should be planned and installed with adequate provision of manual facilities. These details should also be included in the Plan.

(iii) Communications. Communication systems to be employed in an emergency should be listed in the Appendices of the Plan with responsibilities for the use of, and when to use such facilities being detailed in the main body of the

Emergency Plan. Two-way radios, radio telephones, explosion protected telephones and public address systems are all important components of an emergency communications network.

(iv) Facilities. Provision should be made for the allocation of a medical/causalty clearing centre; assembly areas; briefing/debriefing and emergency catering area(s) as well as media briefing facilities.

(v) Training. Scheduled exercises must be regualrly planned for, and involve both internal and external resources and emergency organisations so that the plan, equipment and the training program can be evaluated as frequently as demanded by the risk involved.

All personnel must be kept informed of current emergency procedures and their individual responsiblities.

APPENDIX J

Land Use Controls - Statutory

IMPLEMENTATION

Having made an assessment of the hazard impact, a change in the existing land use controls is justified.

As a first priority, all development involving the erection of a building; the carrying out of work; the use of land, a building or work the subdivision of land within the primary and secondary risk areas will need to require consent of the council and the concurrence of the Director of Environment and Planning. Where the land is affected by a direction given under section 101 of the Environmental Planning and Assessment Act, 1979 then the Director of Environment and Plannings' concurrence is not considered necessary.

There is also a need to repeal provisions which would increase the dwelling density of these areas as currently exist (e.g. Dual Occupancy, Medium density provisions, etc).

The aim of any rezoning will be to expose fewer residences and hence people to potential hazards. A rezoning to non hazardous industrial, commercial or most special use purposes is of the utmost importance especially in recognition of the potential hazards. An open space (buffer) zone is also favoured. The permissible uses for open space (buffer) should include agriculture (other than feed lots, piggeries or poultry farming), forestry, open space, public utility undertakings, utility installations (other than gas holders or generating works).

There are various courses of action available to implement the above proposals -

(a) State environmental planning policy - while the issue is one of state-wide significance and has State-wide application the study was confined to the Botany/Randwick industrial complex (although the method was under application) and accordingly the results are limiting.

(b) Regional environmental plan - as the further expansion and development of the petrochemical and chemical industrial complex at Botany/Randwick is one of regional significance, its impacts are by necessity of regional concern. While the State policy procedure does offer a means of quick implementation, the regional plan which is a subsequent instrument can be prepared without the need for an environmental study. Regional plans may include policies on regional issues which require refinement and application in local plans, or can deal explicitly with the issue so that it can be directly implemented under the regional plan. For example, this could include the precise delineation and reservation of regional open space. The acquisition of land for regional purposes can be financed out of Regional Development Funds, to which state and local governments contribute (ss. 130, 143 of the Act).

(c) Local environmental plan:

(i) the preparation of a local environmental plan jointly by Botany and Randwick Municipal Councils in consultation with the Department. The councils will need to enter into an agreement under s.521 of the Local Government Act, 1919, for the purpose of preparing that plan;

(ii) failing the proposals outlined in (i) above the Minister may issue a directon under s.55 of the Act to Botany and Randwick Municipal Councils to prepare a local environmental plan within such time or period as specified.

RECOMMENDED COURSE OF ACTION

The most expedient course of action is the preparation of a regional environmental plan to deal explicitly with the hazards issue.

The regional plan should, in addition to that outlined above in fact identify that as a consequence of carrying out of development in the Botany/Randwick Industrial Complex that there is likely to be a demand for public amenities (namely open space to act as a buffer) and stipulate that dedication or a contribution or both may be required as a condition of any consent to that development, and to require a reasonable dedication or contribution for the provision of the public amenities. The Draft Regional Environmental Plan is presented below.

This will enable the corporation to recoup, to some extent at least, the costs of acquisition of land rezoned for open space purposes.

IMPLICATIONS

If the land is reserved for a public purpose, owners will eventually face displacement. The development potential of the land will not be realised and will more than likely retard the property value. Also the designation of an area as a risk area may make it difficult to obtain insurance against property damage. Restrictions on the development potential will not attract compensation - only in the case where land is reserved under s.26 of the Act or where it is necessary to revoke or modify a consent granted under S.103 of the Act is compensation recoverable.

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979
SYDNEY REGIONAL ENVIRONMENTAL PLAN NO.
BOTANY/RANDWICK INDUSTRIAL COMPLEX

Citation.

1. This plan may be cited as "Sydney Regional Environmental Plan No. Botany/Randwick Industrial Complex".

Region to which plan applies

2. This plan applies to the region comprising that land within the Municipalities of Botany and Randwick as shown edged heavy black on the map marked "Sydney Regional/Environmental Plan No. Botany/Randwick Industrial Complex".

Aims, objectives, strategies and policies.

3. The general aims and objectives of this plan are to -

(a)

Relationship with other environmental planning instruments.

4. (1) This plan amends -

(a) Interim Development Order No.19 - Municipality of Botany, in the manner set out in clause 5(1); and

(b) the Randwick Planning Scheme Ordinance, in the manner set out in clause 5(2)

Amendment of Interim Development Order No. 19 - Municipality of Botany

5. (1) Amendment of Interim Development Order No.19 - Municipality of Botany is amended -

(a) by inserting after clause 1 the following clause:

Aims, objectives, strategies and policies.
1A. The particular objectives of this Order are, with respect to Zone No. 6(e) - to maintain land...

(b) by inserting in the definition of "I.D.C. Map" in clause 2(1) after the last word occurring in that definition the words "as amended by the map marked Sydney Regional Environmental Plan No. deposited in the office of the Department".

(c) by inserting at the end of clause 3 the following subclause:

(2) The council may consent to development being carried out for a purpose, on land within each of the zones specified in Column I of the Table to this clause, being a purpose which is not included in Column IV of that Table, provided the purpose is compatible with the purposes which may be carried out with or without consent and will not detract from the objectives of that zone.

(d) by inserting at the end of the Table to clause 3 after the matter relating to Zone No.6(c) in Columns I, II, III, IV and V, respectively, the following matter:

(e) Special Purpose ... Uncoloured with dark green and heavy black edging and lettered 6(e)	...	Agriculture(other than feed lots, piggeries or poultry farming);forestry; open space;public utility under-takings;utility installations (other than gas holders or generating works)	Any purpose other than those inc-luded in Col.IV

(e) by inserting after clause 3 the following clause:

3A. (1) In this clause -

"primary risk area" is that area shown cross-hatched on the map titled "Composite Risk Area Classifications".

"secondary risk areas" is that area identified as being greater than a 0.1 chance of fatality per million per year per person, the extent of which is shown by horizontal hatching on the map titled "Composite Risk Area Classifications".

(2) A person shall not erect a building; carry out a work; or use land or a building or work; or subdivide land within the primary and secondary risk areas without the consent of the council and the concurrence of the Director except where that land is affected by a direction given under section 101 of the Act.

(3) The Director, in deciding whether concurrence should be granted under subclause (2), shall take into consideration whether any environmental issues are involved in or raised by the proposed development and, if so, whether adequate safeguards have been or will be made to protect the environment of the locality.

(f) by inserting at the end of clause 5A the following subclause:-

(9) This clause does not apply to land to which Sydney Regional Environmental Plan No. Botany/Randwick Industrial Complex applies.

(g) by inserting after clause 42 the following clauses:

Use and acquisition of reserved land.
43.(1) The land shown on the I.D.C. Map uncoloured with dark green and heavy black edging and lettered 6(e) is reserved pursuant to section 26(c) of the Act for use for the purposes of open space.

(2) Subject to sub clause (4), the owner of the land referred to in subclause (1) may by notice in writing require the corporation constituted under section 8(1) of the Act to acquire that land and upon receipt of the notice the corporation shall acquire the land forthwith.

(3) The council may with the concurrence of the Minister permit the development for any purpose of land reserved under this clause until that land is acquired by the corporation.

(4) The corporation need not comply with the notice given under this clause during the currency of a permit obtained by the owner under subclause (3).

(5) In considering whether to grant concurrence under subclause (3) the Minister shall take into consideration -

(a) the effect of the proposed development on the costs of acquisition; and

(b) the imminence of acquisition;

Payment towards provisions of amenities.
44. As a consequence of the carrying out of development in accordance with this Order (as in force when the development is carried out), there is likely to be an increased demand for public amenities as specified in Schedule 8 for the provision, extension or

augmentation of which dedication or a contribution under section 94(1) of the Act, or both, may be required as a condition of any consent to that development.

Advertisement of certain applications.
45. Pursuant to section 30(4) of the Act, the provisions of sections 84, 85, 86, 87(1) and 90 of the Act apply to and in respect of development for a purpose referred to in clause 3(2) in the same way as those provisions apply to and in respect of designated development.

(h) by inserting after Schedule 7 the following Schedule:

Schedule 8

Clause 44

Acquisition of land for open space

Amendment of Randwick Planning Scheme Ordinance.
5,(2) The Randwick Planning Scheme Ordinance is amended -

(a) by inserting after clause 1 the following clause:

Aims, objectives, strategies and policies.
1A. The particular objectives of this Ordinance are, with respect to Zone No. 6(e) - to maintain land...

(b) by inserting in the definition of "scheme map" in clause 4(1) after the last word occurring in that definition the words ", as amended by the map marked 'Sydney Regional Environmental Plan No. ' deposited in the office of the Department".

(c) by inserting at the end of clause 24 the following subclause:

(2) The council may consent to development being carried out for a purpose on land within each of the zones specified in Column I of the Table to this clause, being a purpose which is not included in Column IV of that Table, provided the purpose is compatible with the purposes which may be carried out with or without consent and will not detract from the objectives of that zone.

(d) by inserting at the end of the Table to clause 24 after the matter relating to Zone No.6(d) in Columns I, II, III, IV and V, respectively, the following matter:

(e) Special Purpose ... Uncoloured with dark green and heavy black edging and lettered 6(e)	...	Agriculture(other than feed lots, piggeries or poultry farming); forestry; open space; public utility installations (other than gas holders or generating works)	Any purpose other than those included in Column IV.

(e) by inserting in Part V the following clause:

33. (1) In this clause -

"primary risk area" is that areas shown cross-hatched on the map titled "Composite Risk Area Classifications"

"secondary risk area" is that area identified as being greater than 0.1 chance of fatality per million per year per person, the extent of which is shown by horizontal hatching on the map titled "Composite Risk Area Classifications".

(2) A person shall not erect a building; carry out a work; or use land or a building or work; or subdivide land within the primary and secondary risk areas without the consent of the council and the concurrence of the Director except where the land is affected by a direction given under section 101 of the Act.

(3) The Director, in deciding whether concurrence should be granted under subclause (2) shall take into consideration whether any environmental issues are involved in or raised by the proposed development and, if so, whether adequate safeguards have been or will be made to protect the environment of the locality.

(f) by inserting at the end of clause 56 the following subclause:

(6) This clause does not apply to land to which Sydney Regional Environmental Plan No. Botany/Randwick Industrial Complex applies.

(g) by inserting after clause 98 the following clauses:

Use and acquisition of reserved land.
99. (1) The land shown on the scheme map uncoloured with dark green and heavy black edging and lettered 6(e) is reserved pursuant to section 26(c) of the Act for use for the purposes of open space.

(2) Subject to subclause (4), the owner of the land referred to in subclause (1) may by notice in writing require the corporation constituted under section 8(1) of the Act to acquire and upon receipt of the notice the corporation shall acquire the land forthwith.

(3) The council may with the concurrence of the Minister permit the development for any purpose of land reserved under this clause until that land is acquired by the corporation.

(4) The corporation need not comply with the notice given under this clause during the currency of a permit obtained by the owner under subclause (3).

(5) In considering whether to grant concurrence under subclause (3) the Minister shall take into consideration -

(a) the effect of the proposed development on the costs of acquisition; and
(b) the imminence of acquisition.

Payment towards provisions of amenities.
100. As a consequnce of the carrying out of development in accordance with this Ordinance (as in force when the development is carried out), there is likely to be an increased demand for public amenities as specified in Schedule 7 for the provision, extension or augmentation of which dedication or a contribution under section 94(1) of the Act, or both, may be required as a condition of any consent to that development.

Advertisement of certain applications.
101. Pursuant to section 30(4) of the Act, the provisions of sections 84, 85, 86, 87(1) and 90 of the Act apply to and in respect of development for a purpose referred to in clause 24(2) in the same way as those provisions apply to and in respect of designated development.

(h) by inserting after Schedule 6 the following Schedule.

Schedule 7

clause 100

Acquisition of land for open space.

APPENDIX K

CONSEQUENCES OF LP GAS PIPELINES FAILURE

(A) - Postulated Event: Rupture of the I.C.I. Liquified Flammable Gas ship to Shore unloading line with failure to detect the leak and stop the flow.

Explosion

Flow Rate = 250 t/hr i.e. 69.5 kg/sec

Assume the leak to be propane and not detected and isolated for a 10 min duration, at which time the vapour formed could explode.

Assuming the material to be Propane at 20°C and vaporisation to be twice adiabatic flash.

The proportion of leak that would vaporise is given by:-

$$\text{Proportion in vapour} = 2 \frac{Cp\ (T_1 - T_2)}{Hv}$$

where

Cp = Specific heat of propane taken as 0.53

Hv = Latent heat (or heat of vaporisation) or propane taken as 103

T_1 = -44°C, T_2 = 20°C.

$$\text{Proportion in vapour} = 2 \frac{0.53\ (20 + 44)}{103} = 66\%$$

Size of cloud after 10 min leak = 0.66 x 69.5 x 60 x 10

= 27.5 tonne.

TNT equivalent = 27.5 x 0.3

= 8.25 say 8 tonnes

Distance to 35 kPa = 120m (effect on plant equipment)

Distance to 14 kPa = 200m

Distance to 7 kPa = 350m (90% window breakage).

For a 6 min duration of leak, that is a 16.5 tonne vapour cloud (5 tonne TNT equivalent), damage distances are as follows:-

Distance to 35 kPa = 90m
Distance to 14 kPa = 180m
Distance to 7 kPa = 300m

A 3min duration leak (8 tonnes vapour cloud or 2.5 tonnes TNT equivalent) would result in the following damage distances:-

Distance to 35 kPa = 80m
Distance to 14 kPa = 140m
Distance to 7 kPa = 230m

Fire

In this case, we assume that the ship unloading line fails and liquid propane escapes to full pumping rate and ignite at once (within one second)

Flow rate = 250t/hr i.e. 69.5 kg/s
Heat from Combustion = 3475 MW
Heat Radiated = 3475 x 0.3 = 1040 MW.

Distance to 4.7 kW/m^2 = $\frac{1040000}{4 \times 3.1416 \times 4.7}$ = 130m

Distance to 12.6 kW/m^2 = $\frac{1040000}{4 \times 3.1416 \times 12.6}$ = 81m

Distance to 25 kW/m^2 = $\frac{1040000}{4 \times 3.1416 \times 25}$ = 57m

Distance to 38 kW/m^2 = $\frac{1040000}{4 \times 3.1416 \times 38}$ = 47m

Flash Fire

Assuming a vapour cloud dispersing to its lower flammability and igniting and flash back.

The U.K. Advisory Committee on Major Hazards approximates the hazard limit of the cloud to the 70 kPa boundaries.

Thus, for a 10 min release radius of flash fire = 76m
for a 6 min release radius of flash fire = 65m
for a 3 min release radius of flash fire = 52m

These distances could be compared with the hazard distances derived from the UK Health and Safety Executive DENZ and ICI Mond Division dispersion models for D stability class as follows:

for a 10 min release, radius of flash fire = 75 - 90m

for a 6 min release, radius of flash fire = 65 - 90m

for a 3 min release, radius of flash fire = 55 - 90m

(B) - Postulated Event: Rupture of a transfer line carrying Liquified Flammable Gas from the Port Botany area to the Industrial Complex and/or within the Port - Assuming Transfer Rate of 20t/hr of Propane.

Vapour Cloud annd Release Rate

If the leak (assumed to originate from a complete pipe failure) occurs at some 300 metres from the transfer pump then:-

Release within 3min = 1.5 tonnes
Release within 6min = 3 tonnes
Release within 10min = 4.6 tonnes (say 5 tonne)

The above release rates account for both pumping rate to isolation time and in pipe inventory held.

Vapour cloud, assuming 66% would vaporise (twice adiabatic flash)

Vapour cloud, 3min = 1 tonne
Vapour cloud, 5min = 2 tonnes
Vapour cloud, 10 min = 3.3 tonnes

Explosion

Vapour Release less than 3-5 tonne of hydrocarbons are unlikely to constitute an unconfined vapour cloud potential. As such, releases in excess of 10min would present an explosion risk.

TNT equivalent for 10in = 1 tonne
Distance to 35kPa = 55m
Distance to 14kPa = 100m
Distance to 7kPa = 180m

Fire

Assuming instantaneous ignition,

Heat from combustion = 275MW
Heat Radiated = 85MW

Distance to 4.7 KW/m^2 = $\frac{85000}{4 \times 3.1416 \times 4.7}$ = 40m

Distance to 12.6 KW/m^2 = $\frac{85000}{4 \times 3.1416 \times 12.6}$ = 25m

Distance to 25 KW/m^2 = $\frac{85000}{4 \times 3.1416 \times 25}$ = 17m

Distance to 38 KW/m^2 = $\frac{85000}{4 \times 3.1416 \times 38}$ = 13m

Flash Fire

Radius of flash fire (to 70 kPa overpressure)

10min release = 50m
6min release = 45m
3min release = 30m

APPENDIX L

SAMPLE SURVEY QUESTIONNAIRE

NEW SOUTH WALES DEPARTMENT OF ENVIRONMENT AND PLANNING - BOTANY BAY REGION

SURVEY OF MAJOR HAZARDS

COMPANY NAME:

ADDRESS:

CONTACT PERSON:

POSITION:

TELEPHONE NUMBER:

Page No. 1

Q1: Could you please describe the general nature of your manufacturing operation, type of products and production capacity of various plants?

Page No. 2

Q2: Did your plant experience major hazardous incidents that resulted in plant/process shutdown, modification to original design, injury or death to employees or any member of the general public? Please provide general information on cause and extent of damage.

Page No. 3

Q3: Do you have a safety officer on site?

If yes - What are his duties?

What are his qualifications?

To whom does he respond?

What accident reporting procedures do you use?

Page No. 4

Q4: Please provide a site plan layout of your facility (to scale if possible) and a plot diagram of major processes if available.

Page No.12

Q5: Could you please outline general safety features on your plant?
Any specific feature in addition to codes requirements?

SUMMARY OF HAZARDOUS MATERIALS IN STORAGE AND IN PROCESS.

MATERIAL	MAXIMUM QUANTITY			PLEASE COMPLLETE DATA SHEET	
	IN STORAGE	IN PROCESS	TOTAL	If Total Quantity exceeds the following (tonnes)	Use Data Sheet No.
TOXIC SUBSTANCES					
Chlorine				2	4
Acrylonitrile				2	4
Hydrogen Cyanide				2	4
Carbon disulphide				2	4
Sulphur Dioxide				2	4
Bromine				2	4
Ammonia Anhydrous				2	4
HIGHLY REACTIVE SUBSTANCES					
Ethylene oxide					
Propylene oxide				1	1
Organic Peroxides				5	5
Nitrocellulose compounds				50	5
Ammonium nitrate				500	5
Sodium chlorate				500	5
Liquid oxygen				100	1

Continuation of table on page 6. .../6

Page No. 6

MATERIAL	MAXIMUM QUANTITY			PLEASE COMPLLETE DATA SHEET	
	IN STORAGE	IN PROCESS	TOTAL	If Total Quantity exceeds the following (tonnes)	Use Data Sheet No.
<u>FLAMMABLE GASES</u>					
Hydrogen				2	3
Others				15	3
<u>LIQUIFIED FLAMMABLE GASES</u>					
Propane, Butane, ethylene, etc				20	1
<u>FLAMMABLE LIQUIDS</u>				10,000	2

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DATA SHEET NO. 1

DATA SHEET FOR LIQUIFIED FLAMMABLE GASES, ETHYLENE OXIDE, PROPYLENE OXIDE AND LIQUID OXYGEN.

Note: Please use one separate sheet for each separate inventory.

COMPANY NAME:

VESSEL NAME:

LOCATION (please mark on site plan)

NATURE OF CONTENTS (e.g. liquid name)

ABOVE OR BELOW GROUND:

NORMAL QUANTITY IN VESSEL (kilograms):
(storage and process vessel)

If normal quantity less than 1 tonne,* no further details needed.
If normal quantity 1 tonne or more, please complete below
* for liquid oxygen 10 tonnes.

Density of liquid (relative to water = 1)
Normal operating pressure (p.s.i.)
Normal operating temperature (°Celsiu)*
* If atmospheric temperature
put 20°C

DETAILS OF LIQUID PIPELINES CONNECTED TO VESSEL
(including short ones for instrumentation)

Cont'd next page ......

DATA SHEET NO. 1 (Cont'd)

Line No.	Diameter (inches)	Total length of main line-feet (not branches)	Is there a pump in the line? If yes		Is there a remotely operated valve prior to the pump? Yes/No
			Type of seal	Material of casing	

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DATA SHEET No. 2

DATA SHEET FOR FLAMMABLE LIQUIDS

Notes: 1. Please use one separate sheet for each separate inventory.

2. If the flammable liquid has a boiling point at atmospheric pressure below its normal operating temperature, please use data sheet No. 1.

COMPANY NAME:

VESSEL NAME:

LOCATION (please mark on a site plan):

NATURE OF CONTENT (e.g. liquid name):

NORMAL QUANTITY IN VESSEL (kilograms):
(storage and process vessels)

If normal quantity less than 10 tonnes, no further details needed.
If normal quantity 10 tonnes or more, please complete below.

Is vessel avove or below ground?	Above/Below
If above ground, is tank surrounded by bund?	Yes/No
Approximate bund dimensions	
Methods of draining bund content	
Normal oplerating pressure (psi)	
Density of liquid (relative to water = 1)	
Normal operating temperature °Celsius) *	
* If atmospheric, put 20°C	
Type of tank (e.g. floating roof, fixed roof, horizontal cylinder)	
If vertical tank — diameter of tank	
height of tank	

Continuation of table next page ......

DATA SHEET NO. 2 (Cont'd)

Please show on a sketch above or list below any of the following features:

Level measurement/control/
protection against high or low level

Temperature measurement/control/
protection against high or low
temperature (include method of
heating or cooling)

Pressure measurement/control/
protection against high or
low pressure

Page No. 9

DATA SHEET NO. 3

DATA SHEET FOR COMPRESSED FLAMMABLE GASES (not liquified).

Note: 1. Please use additional shets if so required.

2. Please complete this data sheet only for materials where largest container holds more than 0.5 tonne of flammable gas.

Please show location of container on a site plan.

Material	Maximum quantity stored on site (tonnes)	Maximum size of container	Maximum pressure in container	Diameter of largest nozzle or connection to container

Page No. 10

DATA SHEET NO. 4

DATA SHEET FOR TOXIC SUBSTANCES

Note: Please use separate data sheet for separate inventory.

COMPANY NAME:

VESSEL NAME:

LOCATION (please mark on site plan):

NATURE OF CONTENT:
(e.g. name of toxic substance)

NORMAL QUANTITY IN VESSEL (kilograms):
(storage and process vessels)

If normal quantity less than 2 tonnes, no further details needed for this vessel.

If normal quantity 2 tonnes or more, please compllete below.

Density of liquid (relative to water = 1)
Normal operating pressure (psi)
Normal operating temperature (°Celsius)
if atmospheric put 20°C

DETAILS OF LIQUID AND GAS PIPELINES CONNECTED TO VESSEL

Line No.	Diameter (inches)	Total length of main lines (feet)	Is there a pump in the line? If Yes: Type of seal	Material of casing	Is there a remotely operated valve prior to the pump? (Yes/No)

Page No. 11

DATA SHEET NO. 5

DATA SHEET FOR HIGHLY REACTIVE SOLID SUBSTANCES.

COMPANY NAME:

Please mark location of containers on a site plan.

NAME OF SUBSTANCE	MAXIMUM QUANTITY STORED AND IN PROCESS	SIZE OF LARGEST SINGLE CONTAINER	MEASURES TAKEN TO PREVENT HAZARDOUS INCIDENTS

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Table (9)

IDENTIFICATION OF HAZARDOUS INCIDENTS IN THE STUDY AREA

Type of material and installation/operation \ Type of incident	Fire	BLEVE Fireball	Flash Fire	Vapour Cloud Explosion	Dust Explosion	Other Explosion	Toxic Gas Escape	Toxic Fumes
1. Liquified Flammable Gas								
. Pressurised storage	X	X	X	X				
. Atmosphere pressure storage	X		X	X				
. Processing plant	X	X	X	X				
. Road/rail tanker loading bay	X	X	X	X				
. Road/rail transport	X	X	X	X				
. Shipping and wharf operations	X	X	X	X				
. Cross country pipelines	X		X	X				
2. Flammable Liquid								
. Tank storage	X							
. Drum storage	X	X						
. Processing plant	X	X	X	X				
. Road/rail tanker loading bay	X							
. Road/rail transport	X							
. Shipping and wharf operations	X							
. Cross country pipelines	X							
3. Flammable Gas								
. Storage or processing	X		X	X				
4. Flammable Powder								
. Storage or processing	X				X			

Table (9) cont.

Type of material and installation/ operation — Type of incident	Fire	BLEVE Fireball	Flash Fire	Vapour Cloud Explosion	Dust Explosion	Other Explosion	Toxic Gas Escape	Toxic Fumes
5. **Highly Reactive Materials**								
. Storage	X			X	X	X		X
. Processing	X			X	X	X		X
6. **Toxic Gas**								
. Storage							X	
. Processing							X	
7. **Materials with Toxic Combustion Products**								
. Storage or processing								X

TABLE 10: TYPES OF HAZARDS IDENTIFIED BY COMPANY

TABLE 10: TYPES OF HAZARDS IDENTIFIED BY COMPANY

Type of Hazards	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
I.C.I. - Botany	*	*		*			*	*		*	*	*	*		
Esso	*	*									*	*			
Amoco	*	*									*	*			
H.C. Sleigh	*	*									*	*			
B.P.	*										*	*			
Total Distribution	*										*	*			
A.C. Hatrick	*	*		*					*	*					
Aust. Paper Manufacturers						*		*			*				
Catoleum	*		*						*	*					
Kellogg			*											*	
Carba			*			*	*								

Table (10) cont.

Type of Hazards	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Johnson & Johnson		*	*			*									
Mayne Nickless		*				*			*	*		*			
Ampol		*	*												
Wool Processors						*									
Fibre Containers						*									
Continental Distill-eries			*			*									
Bayer		*	*	*					*						
Total Refineries	*	*		*	*		*		*		*	*	*		*
Caltex	*	*									*	*			
F.D. Oil & Chemical	*	*			*				*	*	*	*			*
Boral (Proposed)					*		*				*		*		*
Terminals	*	*							*	*		*			*

Type of Hazards	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
~~Terminals~~	~~*~~	~~*~~							~~*~~	~~*~~		~~*~~			~~*~~
La Porte		*	*	*				*	*	*					
I.C.I. - Port					*		*				*				*
C.I.G.			*				*	*							
Liquid Air				*	*		*	*			*				
Collie	*	*	*						*						
Sea Containers		*				*			*	*		*			
Davis Gelatine		*	*				*	*	*						
Ready Mix			*												
Crest Chemicals			*						*						
Knebel			*												
Shead's Transport		*				*			*	*		*			
Davis Fuller		*	*						*						

Table (10) cont.

Type of Hazards	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Cubico		*	*			*			*	*		*			
Email			*												
Alfa Romeo			*												
A.C.I.			*												
Pulford Compressors			*												
Transport Services		*	*			*			*	*		*			
Differential & Gearbox Overhauls			*												
A.N.L.						*			*						
C.T.A.L.						*			*						
Maritime Services Board											*				*

Table 22. Emergency Planning Requirements.

	Primary Risk Area	Secondary Risk Area	Port Botany
Emergency Planning	1. Internal Company emergency plans to be prepared as a mandatory requirement for all existing and new installations. 2. All plans must be revised and co-ordinated with adjacent industries and include provisions for residential land users within the boundary of the primary risk area. 3. A Committee comprising appropriate emergency service organisations, D.I.R., D.E.P. would assess the adequacy of emergency plans. 4. Where appropriate, industries should form Mutual Aid Organisations. 5. An overall Emergency Plan for the area should be formulated to incorporate specific requirements for individual companies as well as detailed evacuation procedures for residents. Police 'C' District Counter Disaster Plan will need to be amended to accommodate these additional requirements if it is to take into account all contingencies.	An overall emergency plan specific to the area indicated in figure (28) should be formulated and implemented immediately. The types of contingencies that could be encountered as well as details of specific co-ordinated responses should be included. Evacuation procedures for residents must also be included and residents should be familiarised with the procedures through local Councils. The above provisions constitute the major control opitions for the prevention and control of emergencies in this area. This plan should be fully formulated and tested within 6 months. Subsequent testing should be undertaken at least on an annual basis. The Plan should be available at Local Councils.	A separate overall Emergency Plan for the Port area needs to be drafted to incorporate specific responses for the various processes in the area as well as considering the cumulative impact. The Plan should also include potential incidents involving pipelines and ships berthed at wharves. Adequacy of existing fire prevention facilities would need to be reviewed. Such a Plan would need to co-ordinate with provisions of MARDAP as it relates to incidents on Botany Bay.

TABLE H1

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
A.C. Hatrick Chemicals Pty. Ltd.	Process chemicals and storage	B	A	B	Three major fires in the last 30 years. No injuries.	- Primary risk area includes some 55 single dwelling houses seriously affected. - Johnson & Johnson, Cubico and Esso Terminal potentially at risk. - Hazards of most concern are fires and release of toxic material.	- Resultant high risk levels mainly due to proximity of residential areas across Stephen Road. - Adequate controls are generally provided at the plant but review of emergency plans and a detailed hazard-operability study to update controls whenever applicable suggested with particular emphasis on monitoring.
Amoco Australia Limited	Storage and Distribution of petroleum products	C	C	C	No incidents reported.	- Primary risk area includes at least 40 residential dwellings exposed to high risk.	- In addition to proximity to residential areas high risk levels result from the 'basic' controls at the source considered inadequate.

Organisation Nature of Opera- Technical Safety Safety Manage- Emergency Procedures Past Hazard- ous Incidents (only those Summary Results of Risk Assess- ment and Major Comment

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
						- Adjacent facilities affected are Sea Containers, Metal Recyclers and La Porte Chemicals. - Part of Banksmeadow Public School is also at risk. - Major hazard of concern is fire.	- No emergency procedures. No safety officer on site. Housekeeping is poor (various leaks noticed when inspected). No monitoring. - Overall safety review and extensive update of controls strongly recommended.
Australian Paper Manufacturers	Paper Manufacturers	No information to assess	A	B	26/7/77 - Fire Number of minor incidents (fires). No death/injury.		Awaiting information from the company to complete assessment.
Bayer Australia Limited	Formulation of agricultural and veterinary products.	C	C	C	Fire releasing noxious gases, local residents evacuated, some effects and hospitalisation	- Primary risk area includes at least 50 residential dwellings seriously affected. - Major hazards	- No emergency plans submitted. - No specific safety officer on site. - Although housekeeping

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
					occurred October 1st, 1981.	are toxic gas release and fires.	is generally good, safety controls at source are inadequate, protective systems are virtually non-existent plant outdated, no monitoring alarms. - Strongly recommended to undertake a hazard operability study and institute extensive controls at the source if operations are to continue on the site. Relocation of the plant is a preferred option.
BP Australia	Storage of Petroleum Products	C	C	C	No incidents reported.	- Primary risk area does not include residential area but potentially affects the nearby Total Distribution site. - Major hazard is fires.	A co-ordinated emergency plan with Total Distribution strongly recommended. - Monitoring measures and review of fire fighting facilities should be instituted.

Organisation Nature of Opera- Technical Safety Safety Manage- Emergency Procedures Past Hazard- ous Incidents (only those Summary Results of Risk Assess- ment and Major Comment

- Major hazard is fires.

Organisation	Operations	Safety Features and Controls	Management	Procedures	ous Incidents (only those for which records exist)	of Risk Assessment and Major Hazards of Concern	
Caltex Oil (Australia) Pty. Ltd.	Storage and Distribution of petroleum	A	A	B	One plant shut down due to fire. No fatalities.	- Primary and secondary risk areas do not include any residential dwellings. - Extent of impact is generally limited. - Major source of hazard is loading bays.	- Hazard analysis undertaken by the company and controls are adequate. - Fire fighting facilities have been updated. - Monitoring with special emphasis on loading operations suggested.
Carba Australia	CO2 production and storage	B	B	C	26/12/77 Explosion in gas pipeline	-Quantitative assessment not undertaken because of low inventories. - Potential hazard of explosion (deflagration type) but controls adequate.	- Safety controls adequate, but formalised emergency procedures should be prepared and implemented.
Catoleum	Chemical manufacturers.	B	A	A	No major incidents.		

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
Esso Australia	Storage and Distribution of petroleum products.	B (monitoring facilities should be introduced.	A	B	2/10/80 Spillage of petrol from a pipeline.	- Primary risk area does not include any residential dwellings. - Major hazard to adjacent facilities is fire.	- Update of emergency procedures and monitoring facilities should be introduced immediately.
H.C. Sleigh (Golden Fleece Ltd.)	Storage and Distribution of Petroleum Products	C	C	C	One fire is believed to have occurred date unknown.	- A minimum of 200 dwellings are are included in the primary risk area and are potentially at from fire hazards at the terminal. - Risk of accidents interaction within the terminal is also relatively high.	- No safety officer on site and no emergency procedures. - In addition to the proximity of residential areas, technical controls at the source are totally inadequate (many tanks have not the basic level measurement and control). - A detailed hazard operability study and comprehensive review and update controls.

Organisation Nature of Technical Safety Safety Manage- Emergency Procedures Past Hazard-ous Incidents Summary Results of Risk Assessment and Major

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comments
I.C.I. - Hydrocarbon Terminal Storage	Ethylene and LPG (proposed) storage	A	A	A	No incidents.	All 'risks' are contained within plant boundaries.	- Standards of control are well above normal requirements including separation distances, technical controls, etc. - Hazard operability studies have been undertaken.
I.C.I. Botany Plant:	Chemical and petro-chemical manufacturing				28/10/69 - gas leak dispersed with water sprays. 29/11/76 - Ethylene fire. 29/11/76 Olefines fire. 21/9/77 - Explosion. 28/1/81 Ethylene leak.	- Primary risk area includes some 260 dwellings. Secondary risk area includes adjacent facilities. - Major hazards include fire, explosion and release of toxic gases - Major components of risk are explosion and particularly the release of toxic gases (chlorine).	- Resultant risk levels are mainly due to the proximity of residential uses. - Technical controls at the source are advanced and comprehensive. - The plant needing the most urgent attention is the plastics plant in view of the serious impact of any chlorine escape. An overall safety review for this plant should be undertaken particularly in
- Chemical Factory		B	A	B*			
- Ethylene Oxide		A	A	B			
- Plastics		B*	A	B			
- Olefines		A	A	B			
- Tank Farm		A	A	B			
- Polythene		A	A	B			

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
- Polypropylene		A (see notes)	A	B	21/1/82 - Fire Polythene plant 9/3/82 - Fire - Polypropylene plant. Other incidents have occurred.		relation to isolation, shut-off mechanisms, monitoring and detection. - Although individual emergency plans for each plant are adequate, there is a need to co-ordinate all procedures into an overall emergency plan for the whole site. An overall review of fire fighting appliances and practices are also suggested.
Johnson & Johnson	Manufacturers of non-durable consumable products in the fields of dressings, baby products and woven fabrics.	B	A	C	No major incidents.	Hazardous invtory on site, do not warrant quantitative assessment. Major risks are contained within the plant.	

	dressings, baby products and woven fabrics.					within the plant.	

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
La Porte Chemicals	Peroxygen products manufacturers.	B	A	-	30/10/76 Fire.	Quantitative assessment not undertaken.	Emergency Procedures not submitted.
Mayne Nickless Pty. Ltd.	Container Depots - Potentially hazardous materials are stored.	C	C	C	Release of chlorine gas and fire on 3rd and 4th February, Fire brigade attended.	Main hazards include fires and release of toxic substances.	- Major deficiency in hazard prevention and control. - No emergency procedures. - No safety officer. - Content of consignments not known to operators in most cases until unpacked. - Overall mechanism for handling dangerous goods should be instituted. - Safety controls virtually non-existent.

Organisation	Nature of Operations	Technical Safety Features and Controls	Safety Management	Emergency Procedures	Past Hazardous Incidents (only those for which records exist)	Summary Results of Risk Assessment and Major Hazards of Concern	Comment
P.D. Oil & Chemical Storage Ptyl. Ltd.	Bulk Liquid Chemical Storage	A	A	B	No major incidents.	- Acceptable risk levels. - Toxicity potential should be controlled.	Controls adequate.
Terminals Pty. Ltd.	Bulk Liquid Chemical storage.	A	A	B	No major incidents.	Accpetable risk levels. - Toxicity potential should be controlled.	Controls adequate.
Total Distribution Pty. Ltd.	Storage and Distribution of Petroleum Products.	C	B	C	15/1/59 - Spillage during transfer from tanker.	- Primary risk area does not include any residential dwellings but significant interaction with the adjacent BP terminal. In extreme cases residences could be affected. - Main hazard is fire (tanks and loading activities).	- Controls, monitoring virtually non-existent. - No emergency procedures. - Overall review, particularly for loading operations strongly recommended. - Review to include fire fighting facilities.

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