Hazard and Risk Assessment Planning Scheme Policy

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1 Introduction

Industrial and storage activities involving hazardous materials often present a hazard and risk to the health and safety of people and the environment. Hazardous events from activities can include explosions, fire, release of toxic gas or release of toxic products of combustion.

These events may result in fatalities, injury, damage to property and impacts on the biophysical environment. Facilities that consume, handle or produce hazardous materials are, however, an essential part of our society and generate significant community benefits. Accordingly, it is necessary to ensure that they are appropriately sited and managed to minimise the potential for adverse impacts.

The separation of incompatible land uses and the identification and maintenance of risk consideration areas around hazardous facilities is often the most effective way of managing hazard and risk. The role of land use safety planning is to ensure that:

- new hazardous facilities are suitably located so they do not pose a risk to sensitive land uses, and conversely
- incompatible development is not allowed to encroach on existing or proposed hazardous facilities.

The purpose of this Planning Scheme Policy is to:

- identify information requests and matters for consideration when assessing applications for facilities with the potential to generate significant hazards and risks
- identify information requests and matters for consideration when assessing applications for uses located in areas subject to hazards and risks from established or likely future activities
- provide guidance to applicants and Council on what constitutes acceptable levels of hazard and risk.

2 What is hazard and risk?

In the context of land use safety, hazard and risk are defined as:

- hazard—a situation or an intrinsic property with the potential to cause harm to people, property or the environment
- risk—the likelihood of harm occurring from a hazard.

Potential hazard typically depends on five main factors:

- the properties of the substance/s being handled or stored
- the conditions of storage or use
- the quantity involved
- the location with respect to the site boundary
- the surrounding land uses.

3 When does this Planning Scheme Policy apply?

This Policy applies to:

- development with the potential to generate hazards and risks that have the potential for off–site impacts requires assessment under this policy. Any land use involving storage of dangerous goods, as detailed in Chapter 3, Industrial Areas—Schedule 2 is likely to require some level of hazard identification, hazard analysis and risk assessment
- development in an area that is potentially subject to hazards and risks from existing or likely future development, and development proposed to be located within the areas as identified in the **Industrial Areas—Adjacent Development Code**. However, being located within the hazard and risk contour does not automatically mean that a site is subject to hazard or risk. It is simply a screening criterion used to identify when hazard and risk issues require further investigation.

4 How is hazard and risk assessed?

This policy advocates an approach where the level and extent of the analysis should reflect the nature, scale and location of each development. These guidelines propose a graded framework aimed at providing consistency by facilitating the appropriate level of analysis and assessment needed to demonstrate that the proposal being studied will not pose a significant risk to surrounding land uses. The methodology proposes the use of a combination of qualitative and quantitative approaches.

Hazard analysis

Hazard and risk is assessed by a process called Hazard Analysis. The approach considers a development in the context of its location and its technical and safety management controls. The major components of hazard analysis are:

- **hazard identification**—a systematic method is used to identify potential events that could cause harm
- **consequence analysis**—predictions are made of the characteristics, e.g. size, duration and intensity, of the potential incidents and their physical effects
- **frequency analysis**—the likelihood that specified events will occur is determined
- **risk analysis**—an assessment of the consequences and frequencies is used to determine risk levels
- **risk assessment**—risk levels are compared with acceptable criteria to enable decision making.

Preliminary hazard analysis (PHA)

A Preliminary hazard analysis is required to be conducted in the early planning stages of a development. The purpose of a PHA is to:

- identify all potential hazards associated with the proposal
- analyse both their consequences (effects) on people and the environment, and their probability (likelihood or frequency) of occurrence
- estimate the resultant risk to the surrounding land uses and the environment
- ensure that the proposed safeguards are adequate and thus demonstrate that the proposal will not impose an unacceptable level of risk to its surroundings.

Where hazard identification and consequence analysis establish that off–site impacts will not occur, it may not be necessary to continue with the remaining components of the assessment for land use planning purposes. However, where these studies indicate that off–site impacts may occur, further components of the hazard analysis process will need to be conducted.

The PHA can be done either qualitatively and/or quantitatively, depending on the circumstances of the proposal. The level and the extent of qualitative or quantitative assessment will depend on the nature and scale of the development proposal, and its proposed location in relation to surrounding land uses and natural environment. It would be expected that a significant number of PHAs could be done either qualitatively or semi–qualitatively.

Qualitative PHAs

It is considered that a qualitative PHA may be sufficient in the following circumstances:

- where the materials are relatively non–hazardous, e.g. corrosive substances, combustible liquids
- where the quantities of materials used are relatively small
- where there are no worst case major consequences impacting off–site
- where the technical and management safeguards are self–evident and readily implemented
- where the surrounding land uses are relatively non–sensitive.

A sound qualitative PHA could, for some proposals, provide sufficient information to form a judgement about the level of risk involved in a particular proposal.

Quantitative PHAs

For other proposals it is more appropriate to carry out a quantitative PHA, which would include all the matters addressed in a qualitative PHA. In addition, it should proceed to a full risk quantification, by analysing the consequences of hazardous incidents, their frequencies and calculating risk contours.

A quantified risk assessment (QRA) would be required in the following circumstances:

- when the materials used are relatively hazardous and/or are used in relatively large quantities
- when there are likely to be serious potential consequences from a hazardous event, even after obvious safeguards have been put in place.

Further studies

It is important to recognise that the preparation of a PHA is only one element of an integrated planning approach to land use safety planning. Other studies that may be required include HAZOP study, Fire Safety Study, Emergency Plans, Final Hazard Analysis and Construction Safety Study. These remaining components are generally conducted later in the design process after initial land use planning decisions have been made and are described later in this Policy.

5 Hazard and risk criteria

The lead agency in Queensland for the management of dangerous goods is the Chemical Hazards and Emergency Management (CHEM) Unit, a section of the Department of Emergency Services (DES). Queensland legislation does not specify any land use planning criteria for risk and hazard. Such criteria are, however, in use by other authorities in Australia. The criteria used by New South Wales Department of Planning and Urban Affairs contained in *Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 Risk Criterial for Land Use Safety Planning* are considered to be the most comprehensive and are currently used throughout Queensland in the absence of any specific Queensland criteria. The use of these criteria for the purposes of this Planning Scheme Policy is recognised and supported by DES.

The key quantitative risk criteria that are commonly used are:

- **individual fatality risk**—the risk of death to a person at a particular point. Criteria are specified for a range of land uses. The individual fatality risk criteria for residential uses are $1x10^{-6}$ a year
- **injury risk level**—the risk criteria for levels of effects that may cause injury to people, but will not necessarily cause fatality. These are set for physical parameters such as heat radiation, explosion over–pressure and exposure to toxic substances
- **property damage** and accident propagation criteria—risk criteria are set for physical parameters that cause damage to buildings and structures, and may cause an escalation of events (domino effect) by involving adjoining facilities
- **societal risk criteria**—a defined societal risk criteria, i.e. criteria that take into account the number of persons exposed and the likely number of fatalities, is not specified. However, guidance is provided in *HIPAP No. 4* on how to consider societal risk in assessment and decision making
- **biophysical environment risk criteria**—defined biophysical environment risk criteria are not specified. However, guidance is provided in *HIPAP No. 4* on how to consider biophysical risk assessment and decision making.

Irrespective of the numerical value of any risk criteria level for risk assessment purposes, it is essential that certain qualitative principles be adopted concerning the land use safety acceptability of development. These principles include:

- all avoidable risks should be avoided to ensure that risks are not introduced in an area where feasible alternatives are possible and justified
- risk should be reduced wherever practicable, irrespective of the numerical value of the cumulative risk level from the whole installation
- the consequences of events should be contained within the site
- where there is an existing high risk, additional hazardous development should not be allowed.

Other issues, e.g. social and economic factors, may need to be taken into account when using the NSW criteria. Consultation with the community to determine acceptable risk is also recommended. It is important to note that when assessing hazardous facilities, the criteria apply to the risk levels at the receptor from all sources. Accordingly, it is not possible to assess the risk of a single facility in isolation from existing operations on the site or in isolation from other nearby hazardous facilities.

6 How can hazard and risk be managed?

For hazardous industries, safety is improved by reducing the severity of possible events or reducing the frequency of events. Some of the techniques that can be adopted are:

- reducing the quantity of hazardous materials
- adopting better control systems
- using better containment systems.

Identifying risk consideration areas around major hazard facilities and other industrial areas to provide appropriate separation distances from sensitive land uses is often the most effective mechanism available to improve safety.

Where development is proposed near established or likely future hazardous industries there are only a few ways to manage that risk. Options available are:

- providing adequate separation distances from the hazardous industry
- minimising the number of people exposed to the hazard
- adopting design and management measures to improve emergency management, e.g. evacuation plans, adequate access and escape routes.

It is not appropriate to rely on existing lawful industries to reduce their risks and hazards to facilitate development.

7 Information requirements and assessment processes

7.1 Development with the potential to generate hazard and risk

Establish the potential for off–site impacts

Any facility where:

'the storage, handling, use or production of any dangerous goods and/or combustible liquids are to be on the site, aboveground, at any one time, in quantities greater than those set out in Chapter 3 Industrial Areas—Schedule 2'

is an 'impact assessable industry'. This activity is then termed a 'hazard facility'. Hazard facilities are divided into three different levels reflecting their potential for off–site impacts:

- minor hazard facility
- moderate hazard facility
- major hazard facility.

Table 1 summarises the information and assessment requirements for these different facilities.

Minor hazard facilities

Applications for a minor hazard facility will be required to conduct a qualitative preliminary hazard analysis (PHA). A qualitative PHA may be sufficient in the following circumstances:

- where the materials are relatively non–hazardous, e.g. corrosive substances, combustible liquids
- where the quantities of materials exceed the threshold quantities outlined in Chapter 3 Industrial Areas—Schedule 2 by only a relatively small margin
- where there are no worst case major off–site consequences
- where the technical and management safeguards are self–evident and readily implemented
- where the surrounding land uses are relatively non–sensitive.

Information requirements:

In these cases, it may be appropriate for a PHA to be relatively simple. The minimum information required for a PHA would need to address the following:

- identify the types and quantities of all dangerous goods to be used
- describe the storage/processing activities that will involve these materials
- identify accident scenarios and hazardous incidents that could occur
- consider surrounding land uses identifying any nearby uses of particular sensitivity
- identify safeguards that can be adopted (including technical, operational and organisational) and assess their adequacy (having regard to the above matters).

Based on this information, the assessment manager will conduct a simplified consequence analysis. Where off–site impacts are demonstrated to be unlikely, compliance with relevant Australian Standards, industry codes of practice, etc., would be considered adequate control measures.

Note:

- those premises storing various classes of dangerous goods may need to be licensed by the relevant authorities who administer dangerous goods legislation in Queensland, e.g. storage of Class 3 flammable and/or combustible liquids will need to hold a licence with Council and comply with the provisions of the *Dangerous Goods Safety Management Act*
- in addition, some facilities will also fall within the definition of an environmentally relevant activity (ERA) as outlined by the *Environmental Protection Act 1994* and will need to obtain an environmental authority and comply with prescribed conditions.

Moderate hazard facilities

Where a simplified consequence analysis indicates the facility could potentially generate off–site impacts, it is defined as a moderate hazard facility and further hazard analysis will need to be carried out by the applicant. In these cases, it is more appropriate to carry out a quantitative PHA. The level and extent of this analysis should reflect the nature, scale and location of the development.

Generally, a quantitative PHA would be required in the following circumstances:

- when the materials used are relatively hazardous and/or are used in relatively large quantities
- when there are likely to be serious potential consequences from a hazardous event, even after obvious safeguards have been put in place.

Information requirements:

The quantitative PHA would need to include all the matters addressed in a qualitative PHA. In addition, it should proceed to a quantified risk assessment (QRA), by analysing the consequences of hazardous incidents, their frequencies and calculating risk contours.

A PHA involving a quantified risk assessment should be prepared in accordance with *HIPAP No. 6 Guidelines for Hazard Analysis*. This PHA must demonstrate that the risk level performs to the criteria established in *HIPAP No. 4 Risk Criteria for Land Use Safety Planning*. For this reason, both papers should be used together in the preparation and assessment of the PHA. If the methodology differs, full justification, description and assumptions should be stated.

Major hazard facilities

The operation of a major hazard facility (MHF) can create hazards of a scale and type that require special attention. MHFs are defined by, and are subject to, the *Worksafe Australia National Standard Control of Major Hazard Facilities [NOHSC:1014 (1996)]* and its associated *National Code of Practice [NOHSC:2016 (1996)]*.

Information requirements:

Full quantification of impact and risk will need to be prepared for those hazards that could lead to injury/fatality off–site. The risk assessment process detailed in *HIPAP No. 6* also includes reference to 'societal risk'. Societal risk is generally only a relevant consideration for major development proposals in which potential consequences could affect large numbers of people. Where appropriate, consideration of societal risk should be included in the PHA. Guidance from the assessment manager should be sought in reference to this matter.

Further studies

As previously discussed, the preparation of a PHA is only one element of the integrated planning approach to land use safety planning. A progressive assessment process includes a number of studies that need to be carried out at various stages of the assessment process. major hazard facilities and possibly some of the larger moderate hazard facilities will be required to prepare and submit some or all of these studies as appropriate. These are usually required as part of comprehensive conditions of approval set by the assessment manager.

Essentially these other components ensure that adequate design and management measures are adopted so that the facility will achieve and maintain the safety standards specified in the preliminary hazard assessment.

The main components of the remaining studies are as follows:

- **hazard and operability study (HAZOP)**—this study is essentially a hazard identification exercise at a micro scale. The adequacy of safeguards and controls is also assessed. This study should be completed during the detailed design phase and prior to construction
- **fire safety study**—this study ensures that fire prevention, detection, protection and fighting facilities are appropriate. They should be completed prior to substantial construction and certainly prior to commencement of use
- **emergency plans**—off–site and on–site emergency plans and procedures must be developed for all possible incident scenarios. These plans must be completed prior to commencement of use
- **final hazard analysis**—once design is completed and the HAZOP, emergency procedures and plans and fire safety study are complete, the PHA should be updated to ensure that acceptable risk levels are achieved. Generally this study should indicate a reduced risk level from that predicted in the earlier study. This study should be completed prior to commencement of operations
- **construction safety study**—this study should ensure that adequate procedures are in place to prevent incidents that may have off–site impacts from occurring during construction. These studies are particularly important where works are carried out in proximity to existing operations. This study must be completed prior to commencement of construction
- **safety management system/hazard audit**—this system must be developed to ensure ongoing safety management. Regular audits of the facility are an essential component of the safety management system. The system must be finalised before commencement of operations and its implementation is ongoing.

7.2 Development in areas potentially subject to hazard and risk

Risk consideration areas

Risk consideration areas as defined in the **Industrial Areas—Adjacent Development Code** are intended to identify two matters:

- to protect established industrial uses. These areas are usually based on known or estimated hazard or risk data
- to protect sensitive uses likely to be impacted by future uses with the potential to generate hazard and risk. These risk consideration areas have been based on nominal distances designed to protect typical uses that might reasonably be located in an area.

In some areas a risk consideration area may serve both functions. The applicant should determine what function the risk consideration area is intended to perform for the site. Guidance should be sought from Council on this matter.

Risk consideration areas to protect established uses

- if the risk consideration area protects established industry then determine if a publicly available risk study has been completed for that industry
- if a risk study is available then establish the risk and hazard level
- in no risk study is available then a hazard analysis will be requested from the applicant.

Risk consideration areas to protect likely future uses

Where a sensitive development is likely to be impacted by a future development, the risk consideration areas as outlined in **Industrial Areas—Adjacent Development Code** will apply and no technical assessment need be required.

8 What guidelines are available?

Classification of dangerous goods

- *Australian Code for the Transport of Dangerous Goods by Road and Rail (Australian Dangerous Goods Code)* 6th edition, Australian Government Publishing Service.

Hazard analysis and risk assessment

- *Risk Assessment, Hazardous Industry Planning Advisory Paper (HIPAP) No. 3*
- *Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper (HIPAP) No. 4*
- *Guidelines for Hazard Analysis, Hazardous Industry Planning Advisory Paper (HIPAP) No. 6*
- *Applying SEPP 33, Hazard and Offensive Development Application Guidelines*, NSW Department of Planning.

Further information

- *Fire Safety Study Guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No. 2*
- *Hazard Audit Guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No. 5*
- *Construction Safety Study Guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No. 7*
- *HAZOP Guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No. 8*
- *Safety Management—Hazardous Industry Planning Advisory Paper (HIPAP) No. 9*
- *Emergency Planning—Guidelines for Hazardous Industries*, Chemical Hazards and Emergency Management (CHEM) Unit, Queensland Department of Emergency Services
- *Emergency Plans—Guidelines for Major Hazard Facilities*, Chemical Hazards and Emergency Management (CHEM) Unit, Queensland Department of Emergency Services.

Table 1 Summary of assessment requirements

Type of hazard facility	Applicant and action	Assessment manager
Minor: **no potential for off–site impact**	Qualitative preliminary hazard analysis • identify type and quantity of materials • describe storage/process activity • identify accident scenarios and hazardous incidents • consider surrounding land uses • identify operational systems and safeguards • compliance with Australian Standards, industry codes of practice, legislative requirements and licensing with the appropriate authority where required	Conduct simplified consequence analysis to confirm there is no potential for off–site impact
Moderate: **potential for off–site impact**	Semi–quantitative/quantitative preliminary hazard analysisas above plus: • quantified risk assessment: – detailed consequence analysis – determine frequency – calculate risk contours • preparation of further studies as required	Assess: • further hazard and risk studies as required • further safety studies as required
Major: **as defined**	Quantitative preliminary hazard analysis as above plus: • consideration of societal risk as required • preparation of further studies • compliance with Worksafe Standard 'Control of Major Hazard Facilities'	Assess: • quantitative risk analysis (including societal risk as required) • further safety studies as required