Hazardous Industry Planning Advisory
Paper No 10

Land Use Safety Planning

January 2011

HIPAP 10: Land Use Safety Planning

23–33 Bridge Street
Sydney NSW Australia 2000
www.planning.nsw.gov.au

ISBN 978-1-74263-028-1
DOP HAZ_013

Foreword

Since the 1980s, the New South Wales Department of Planning has promoted and implemented an integrated approach to the assessment and control of potentially hazardous development. The approach has been designed to ensure that safety issues are thoroughly assessed during the planning and design phases of a facility and that controls are put in place to give assurance that it can be operated safely throughout its life.

Over the years, a number of Hazardous Industry Advisory Papers and other guidelines have been issued by the Department to assist stakeholders in implementing this integrated assessment process. With the passing of time there have been a number of developments in risk assessment and management techniques, land use safety planning and industrial best practice.

In recognition of these changes, new guidelines have been introduced and all of the earlier guidelines have been updated and reissued in a common format.

I am pleased to be associated with the publication of this new series of Hazardous Industry Advisory Papers and associated guidelines. I am confident that the guidelines will be of value to developers, consultants, decision-makers and the community and that they will contribute to the protection of the people of New South Wales and their environment.

SHaddad

Director General

Contents

Executive Summary

Background

The orderly development of industry and the protection of community safety necessitate the assessment of hazards and risks. The Department of Planning has formulated and implemented risk assessment and land use safety planning processes that account for both the technical and the broader locational safety aspects of potentially hazardous industry. These processes are implemented as part of the environmental impact assessment procedures under the Environmental Planning and Assessment Act 1979.

The Department has developed an integrated assessment process for safety assurance of development proposals, which are potentially hazardous. The integrated hazards-related assessment process comprises:

- a preliminary hazard analysis undertaken to support the development application by demonstrating that risk levels do not preclude approval;
- a hazard and operability study, fire safety study, emergency plan and an updated hazard analysis undertaken during the design phase of the project;
- a construction safety study carried out to ensure facility safety during construction and commissioning, particularly when there is interaction with existing operations;
- implementation of a safety management system to give safety assurance during ongoing operation; and
- regular independent hazard audits to verify the integrity of the safety systems and that the facility is being operated in accordance with its hazards-related conditions of consent.

The process is shown diagrammatically in Figure 1.

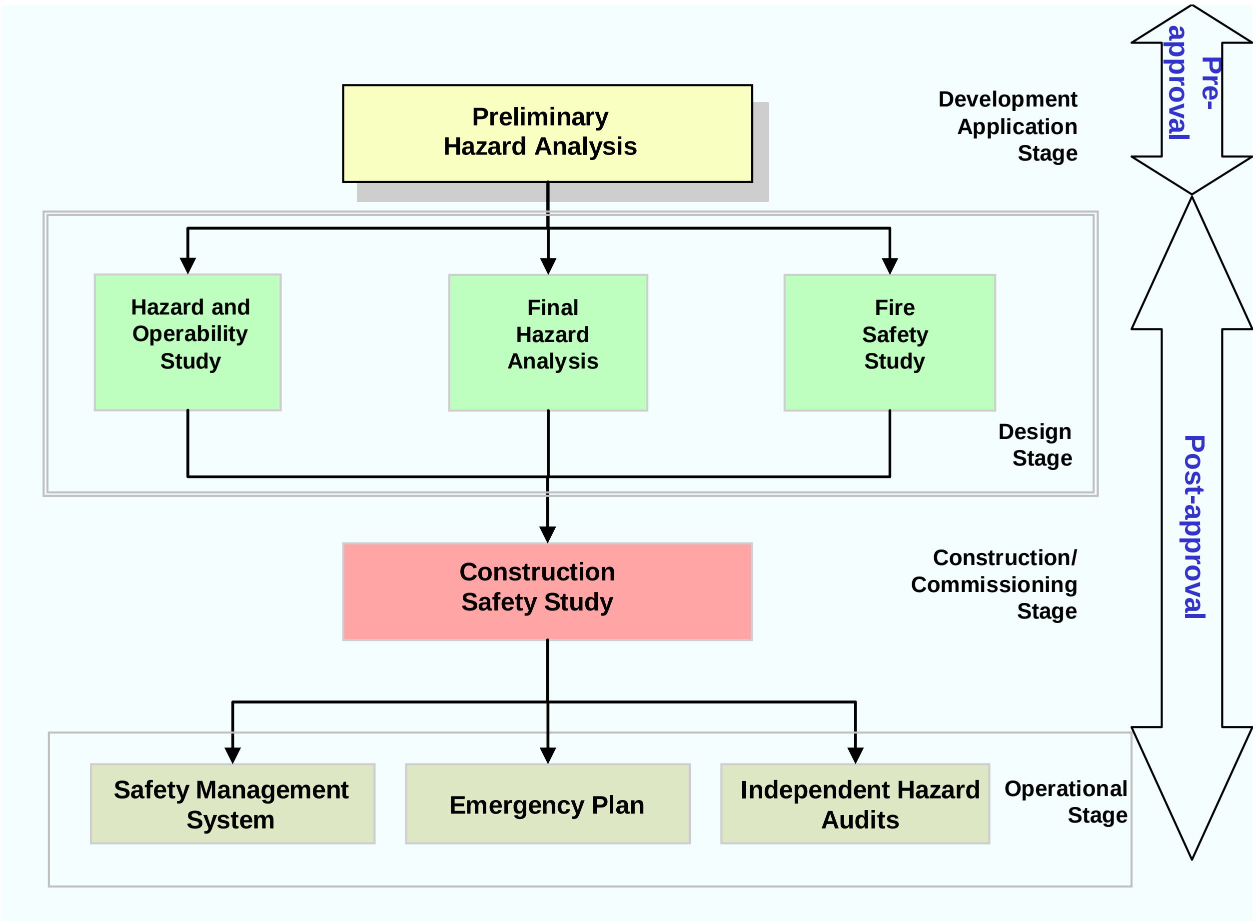
A number *of Hazardous Industry Advisory Papers (HIPAPS)* and other guidelines have been published by the Department to assist stakeholders in implementing the process. All existing HIPAPs have been updated or completely rewritten and three new titles (HIPAPs 10 to12) have been added.

A full list of HIPAPs is found at the back of this document.

The part of the process covered by this guideline is highlighted in Figure 1.

HIPAPs 1 to 9, 11 and 12 cover the assessment and approval process. This guideline focuses on the planning context, covering the overall philosophy of land use safety planning and its application to strategic planning and development control.

Figure 1: The Hazards-Related Assessment Process



The Purpose and Scope of Land Use Safety Planning

Land use safety planning is essentially a mechanism for dealing with actual or potential conflicts between sources of risk, such as potentially hazardous industrial developments, and surrounding land uses.

In a positive sense, its aim is to foster appropriate development in appropriate locations.

It aims to ensure on one hand, that industrial development does not pose an unacceptable risk to the surrounding area and on the other, that exposure to risks from existing industrial development are not increased by changes in land uses surrounding such development.

These guidelines focus on the land use safety implications of industrial hazards, in particular those arising from loss of containment of hazardous materials leading to fires, explosions and toxic releases.

They provide advice to planning authorities and other stakeholders in relation to strategic land use safety planning (section 3) and development assessment and control (section 4). They also discuss risk criteria for land use safety planning (section 5) and cover emergency planning in the context of land use safety (section 6).

A number of ancillary issues are discussed in appendices, most notably, development in the vicinity of potentially hazardous industry (Appendix 2).

Strategic Planning

Land use conflicts usually occur when one land user is perceived to infringe upon the rights, values or amenity of another, since all land uses and activities can be expected to have some level of impact on the environment.

The absence of a soundly based strategic framework creates a potential for actual and potential land use conflict extending, in some cases, to sterilisation of land and actual harm to people, property and the biophysical environment.

Strategic land use safety planning aims to avoid or minimise land use conflicts and the social, economic and environmental costs that inevitably arise from them by considering the issues as early as possible in the planning cycle.

In considering whether potentially hazardous facilities are appropriate in a given location, relevant factors include:

1. permissibility of the proposed land use;
2. the need to avoid environmentally sensitive areas;
3. compatibility with nearby land uses; and
4. results of initial site investigations as to the fundamental suitability of the site.

The evaluation needs to be holistic and not confined to safety-related issues. These guidelines set out a rigorous and systematic process for the evaluation of potential locations, using a precautionary approach.

It is also important to consider possible future changes in the use of land adjacent to areas proposed for potentially hazardous industry. For example, low density housing may change to mid or high density. Rural areas may change to rural residential or industrial purposes. Careful strategic planning will minimise future land use conflict and/or unnecessary sterilisation of land.

Development Control and Assessment

As mentioned earlier, risk-based land use planning approach assists planning authorities in identifying potential land use conflicts at the development approval stage and facilitates decision-making as to whether a development should be approved, subject to appropriate conditions.

The Department of Planning (DoP) has implemented an integrated, which comprises:

- a preliminary hazard analysis undertaken to support the development application by demonstrating that risk levels do not preclude approval;
- a hazard and operability study, fire safety study, emergency plan and an updated hazard analysis undertaken during the design phase of the project;
- a construction safety study carried out to ensure safety during construction and commissioning;
- implementation of a safety management system to give safety assurance during ongoing operation; and
- regular independent hazard audits to verify the integrity of the safety systems and that the facility is being operated in accordance with its hazards-related conditions of consent.

Section 4 provides extensive guidance on the purpose, content and assessment of each element of the hazards-related assessment process (Figure 1), and the setting of appropriate conditions of consent. The depth of analysis and assessment and the way in which conditions of consent are framed should reflect the scale of the hazards and risks associated with the proposed development.

Additional information on these aspects is provided in the appendices, particularly Appendix 3 and Appendix 5.

In addition to the control of potentially hazardous development, chapter 4 covers development in the vicinity of potentially hazardous facilities. It is particularly important that local Councils and other relevant planning authorities have policies and follow procedures for ensuring appropriate zoning and development assessment in areas that could be impacted by major accidents.

Planning authorities should, as a minimum, identify all facilities with a major accident potential in their area so that appropriate controls can be exercised over new developments of a type that could cause risk intensification.

These could include new residential or sensitive use development and recreational areas involving large numbers of people.

The recommended approach is summarised in Figure 10 of section 4.2.2.

Setting Risk Criteria

The systematic evaluation of the acceptability of the risk from a proposed potentially hazardous development requires an agreed set of qualitative and quantitative risk criteria.

Chapter 5 discusses the basis on which risk criteria have been set in NSW and provides guidance on their application.

In recent years, there has been a growing realisation that the tolerability or acceptability of risk is influenced by factors over and above the physical magnitude of that risk. While risk criteria need to have a sound technical basis, they must take serious account of community concerns.

There are two dimensions of risk which should be considered separately, individual and societal. On the one hand, the individual's concern about their own life or safety is mostly independent of whether the risk is from an isolated incident or a large scale disaster. Society's risk perception, however, is mostly influenced by multiple fatality or injury disasters.

When a risk is to be imposed on an individual or a group of people (e.g. by locating a hazardous facility in an area), the concept of 'acceptability' of that risk for the decision-making process is that it should be low relative to other known and tolerated risks.

In assessing the tolerability of risk from potentially hazardous development, both qualitative and quantitative aspects need to be considered.

Relevant general principles are:

- the avoidance of all *avoidable* risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose any incremental risk.

The chapter presents and discusses quantitative risk criteria related to fatality (individual and societal), injury, property and environmental damage.

While there can be some degree of flexibility in the implementation and interpretation of probabilistic risk criteria, where risk levels exceed established criteria, the acceptability of the risk at or from a facility will need to be carefully considered in the light of the economic or social benefits provided by the facility.

Criteria need to be applied in three broad contexts:

1. Strategic Planning (Zoning)
2. Assessment of Development for Potentially Hazardous Development

3. Assessment of Development in the Vicinity of Potentially Hazardous Development

While a number of criteria may be common to more than one context, there is a need to consider each situation on its merits.

Key Messages

- Land use safety planning focuses on managing land use conflicts associated with risks to people, property and the environment from accidents at industrial facilities. It should be regarded an essential part of strategic planning and development control.
- The saying “prevention is better than cure” is particularly true in this context. Land use safety needs to be first considered at the strategic planning stage to avoid later land use conflicts associated with inappropriate zoning and intensification of development.
- The assessment of potentially hazardous development should be holistic, systematic and “fit-for-purpose” (ie both the depth of assessment and the imposition of conditions of consent should represent a proportionate response to the hazards and risks being considered).
- Particular care needs to be taken when assessing rezoning or development around potentially hazardous development to ensure that such development will not introduce or aggravate existing land use safety conflicts.

DoP’s risk criteria for land use safety planning are relevant at every stage of the planning cycle and not only during the assessment of proposals for new facilities or modifications and additions. Both qualitative and quantitative criteria need to be considered.

1 Introduction

SECTION SUMMARY

This document provides guidance on the land use safety issues that should be addressed by proponents of potentially hazardous facilities and the responsibilities of local planning authorities with respect to strategic planning, development assessment, development control and emergency planning in the vicinity of such facilities.

KEY MESSAGE

- Planning authorities should satisfy themselves that risks to the surrounding land uses have been appropriately analysed and assessed before giving approval for a proposed development or rezoning.

1.1 Background

The NSW Environmental Planning and Assessment Act (EP&A Act) 1979 includes among its objects the protection of the environment and ecological sustainable development. The Act covers both broad environmental planning and detailed development assessment, using a merit-based approach.

The Act incorporates provisions for environmental impact assessment with the objective of ensuring that developments are appropriately located and neither create nor are subjected to an unacceptable level of risk.

Of particular relevance is State Environmental Planning Policy (SEPP) No 33: Hazardous and Offensive Development, which links the permissibility of an industrial development proposal to its safety and environmental performance.

For development proposals classified as 'potentially hazardous industry' the policy establishes a comprehensive test by way of a preliminary hazard analysis (PHA) to assess the risk to people, property and the environment in the presence of controls. Should such risk exceed nominated criteria of acceptability, the development is classified as 'hazardous industry' and may not be permissible within most industrial zonings in NSW.

In cases where risks are assessed as being acceptable, a range of hazards-related conditions of consent are typically incorporated in the development consent to ensure risks are appropriately managed throughout the life of the development.

Traditionally, the combination of PHA and subsequent requirements through conditions of consent has been know as the "--stage approval process." This is, however, a misnomer, since the conditions of consent relate to systems as well as studies and, depending on the nature of a particular development, may involve more or fewer than seven stages. In this document, the term "hazards related approval process" will be used.

These assessment principles may also be applied to non-industrial development under Parts 3A, 4 and 5 of the EP&A Act as part of the environmental impact assessment process, even though SEPP 33 may not strictly apply in all cases.

In addition to the assessment of risk in the context of potentially hazardous development, land use safety planning encompasses broader issues of strategic planning to minimise and resolve safety-related land use conflicts and the assessment of proposals for development in the vicinity of potentially hazardous industry.

1.2 Purpose of this Advisory Paper

This document provides guidance on the land use safety issues that should be addressed by proponents of potentially hazardous facilities and the responsibilities of local planning authorities with respect to development assessment and development control and emergency planning in the vicinity of such facilities.

It should be noted that, while the primary responsibility for safe operation lies with a facility's operator, who is responsible for ensuring that safety controls are appropriate to the nature of the facility and its risks, planning authorities should also satisfy themselves that proponents have appropriately analysed and assessed the risks to the surrounding land uses before giving approval for a proposed development. An assessment basis is discussed in the paper, together with suggested risk criteria.

While the paper focuses on development assessment in relation to potentially hazardous facilities, it also provides general guidance on land use safety planning, aimed at minimising safety-related conflicts between such facilities[1] and surrounding land uses.

[1] In this paper, the term 'hazardous facility" is used rather than "hazardous industry", except where specifically otherwise required by the context. This change is made to recognise that land use safety planning principles may be applied more broadly than to particular industrial development situations.

2 Land Use Safety Overview

SECTION SUMMARY

Land use safety planning is essentially a mechanism for dealing with actual or potential conflicts between sources of risk, such as potentially hazardous industrial developments, and surrounding land uses.

It aims to ensure on one hand, that industrial development does not pose an unacceptable risk to the surrounding area and on the other, that exposure to risks from existing industrial development are not increased by changes in land uses surrounding such development.

These guidelines provide advice to planning authorities and other stakeholders in relation to strategic land use safety planning (section 3) and development assessment and control (section 4). They also discuss risk criteria for land use safety planning (section 5) and cover emergency planning in the context of land use safety (section 6).

KEY MESSAGES

- Risks can never be completely eliminated.
- Systematic strategic planning and the assessment of individual development proposals against recognised risk criteria is designed to ensure that hazards are identified and risks are controlled to a tolerable level.

2.1 Land Use Safety Fundamentals

Land use safety planning is essentially a mechanism for dealing with actual or potential conflicts between sources of risk, such as potentially hazardous industrial developments, and surrounding land uses. It aims to ensure on one hand, that industrial development does not pose an unacceptable risk to the surrounding area and on the other, that exposure to risks from existing industrial development are not increased by changes in land uses surrounding such development.

Effective implementation requires an understanding of the nature and sources of risk, the use of criteria for assessing the tolerability of that risk and a sound policy approach to the prevention and resolution of land use safety conflicts. It is also important that land use safety planning be seen as an integral part of the planning and development control decision-making process.

Accordingly, these guidelines approach land use safety planning in the broader context of managing land use conflict. They cover conflict avoidance through planning at the strategic level, the development control process (including risk analysis, assessment and management) and the use of risk criteria in decision making. The guidelines also discuss the role of councils in the emergency planning process.

2.1.1 Historical Background

Since the 1970's, environmental and safety awareness has been raised by a number of reported industrial accidents and incidents with major consequences. There has also been a fundamental recognition of the practical, economic and technological constraints and limitations of engineering safety controls when applied in isolation. As a result, tools, such as hazard analysis and quantified risk assessment have been developed as decision making tools for land use planning. Their use involves a formal identification of the relevant hazards and an estimation of the risk level through consideration of the likelihood and possible consequences of hazardous incidents.

The approach acknowledges that risks can never be eliminated completely. However, an understanding of the nature and extent of risks can provide a basis for the development of land use strategies and controls that will ensure that risks are appropriately managed. The techniques also enable an educated debate and judgements as to the tolerability of the residual risk to the broader community.

Since the early to mid 1980's, DoP and its forbears have developed, implemented and maintained leadership, both nationally and internationally, in risk assessment and management. This has been applied through the planning and assessment process and in regional risk studies for major industrial areas such as the Botany/Randwick industrial complex, Port Botany, Kurnell and Kooragang Island. Proposals for new development are subject to a comprehensive assessment of off-site risks and of the adequacy of safety management systems and emergency plans and procedures. This has been implemented through a hazards-related assessment process, which has been in place since the 1980's.

While the main emphasis has been on the control of potentially hazardous development, there is a growing understanding of the need for land use planners to also control development in the vicinity of such facilities, through strategic planning and assessment of individual proposals.

2.1.2 Scope and Objectives of Land Use Safety Planning

The compatibility of a proposal with existing or proposed surrounding land uses is an important issue that needs to be considered in environmental impact assessment. Conflicts often arise when the community believes its amenity is threatened by health and/or safety impacts.

Land use safety planning has as its central elements the fostering of appropriate developments in appropriate locations and the protection of the health and safety of people and the environment. Such planning may involve both new and existing industrial sites in proximity to existing residential areas and new urban development projects near existing industrial sites.

While in its broadest sense, land use safety planning needs to consider both natural and technological hazards, these guidelines focus on the impacts of industrial hazards, in particular those arising from loss of containment of hazardous materials leading to fires, explosions and toxic releases.

2.1.3 Elements of Land Use Safety Planning

The minimisation of risk typically involves a hierarchy of measures, ranging from avoidance of the risk altogether to mitigation measures following an accident. The applicability and effectiveness of the various measures vary, depending on the stage of development. For example, risk avoidance can be achieved at the conceptual stage of a new development through appropriate siting, guided by zoning and local government controls over permissible uses.

For established industry surrounded by residential development, risk minimisation opportunities may be highly constrained and a greater emphasis may be needed on emergency planning and response measures.

Clearly, the earlier in the process risk measures can be identified and implemented, the more likely they are to be effective. Accordingly, these guidelines provide advice in relation to:

- strategic land use safety planning – see section 3;
- development assessment and control – see section 4;
- risk criteria for land use safety planning – see section 5; and
- emergency planning and response – see section 6.

Appendices provide additional contextual information in relation to risk criteria and recommended conditions of consent for potentially hazardous industrial developments, together with notes on the appropriate preparation and assessment of land use safety studies.

3 Strategic Land Use Safety Planning

SECTION SUMMARY

The principles and practices of strategic land use safety planning aim to The principles and practices outlined in this strategy aim to avoid or minimise land use conflicts and the social, economic and environmental costs that inevitably arise from those conflicts.

The chapter discusses the causes of land use conflicts and how they can be addressed at varoius stages of the planning cycle. DPINR's *Chemical Facilities* EIS Practice Guidelines are used to illustrate sources of potential environmental and safety impacts.

A systematic approach to site selection is presented and other locational considerations are discussed, including:

- permissibility of the proposed land use;
- the need to avoid environmentally sensitive areas;
- compatibility with nearby land uses; and
- results of initial site investigations as to the fundamental suitability of the site.

Finally, there is a reminder of the importance of considering the possibility of changes in land use with time and the potential these have to create incompatibilities.

KEY MESSAGES

- Land use safety conflicts can be avoided or managed most effectively by decision making at the strategic level.
- The strategic assessment needs to address the same issues as would be considered in assessing a development application, but on a broader scale.
- A systematic and rigorous approach to site evaluation is vital.

3.1 Introduction

Land use conflicts usually occur when one land user is perceived to infringe upon the rights, values or amenity of another. All land uses and activities can be expected to have some level of impact on the environment. The principles and practices outlined in this strategy aim to guide industry, government and the community to avoid or minimise land use conflicts and the social, economic and environmental costs that inevitably arise from these conflicts. Where conflicts already are occurring or are unavoidable, this strategy provides principles and practices to assist in managing and reconciling these conflicts. This section discusses land use safety planning in the broader context of planning to minimise land use conflicts.

3.2 The Need for Strategic Land Use Safety Planning

Land use safety decision making on individual development proposals cannot take place in isolation. The absence of a soundly based strategic framework creates a potential for actual and potential land use conflict extending, in some cases, to sterilisation of land and actual harm to people, property and the biophysical environment.

Figure 2 summarises a number of the factors that can lead to such conflict, while Figure 3 sets out a number of the timing issues associated with such conflicts. Conflicts can be avoided or managed most effectively by decision making at the strategic level.

Figure 2: Sources of Land Use Conflict

Why land use conflicts occur

- All land uses have some **"Residual" impacts**
  - On-site and Off-site
  - If nearby land users, they may be affected
- Off-site impacts should be managed to a level which is **"Acceptable"**

  "Acceptable" defined by "criteria", "goals" or "standards" based on **health, safety, environmental or amenity criteria**
- Impacts go beyond **Acceptable** when:
  - lack of knowledge or experience or bad management;
  - old approvals based on past best practice;
  - approvals which do not recognise rights of neighbours;
  - receptors move too close to the source of the impacts

Conflict occurs when one land owner is perceived to infringe on the rights, values or amenity of another beyond what is **"Acceptable"**

Figure 3: Timing of Land Use Conflicts

When do conflicts occur?

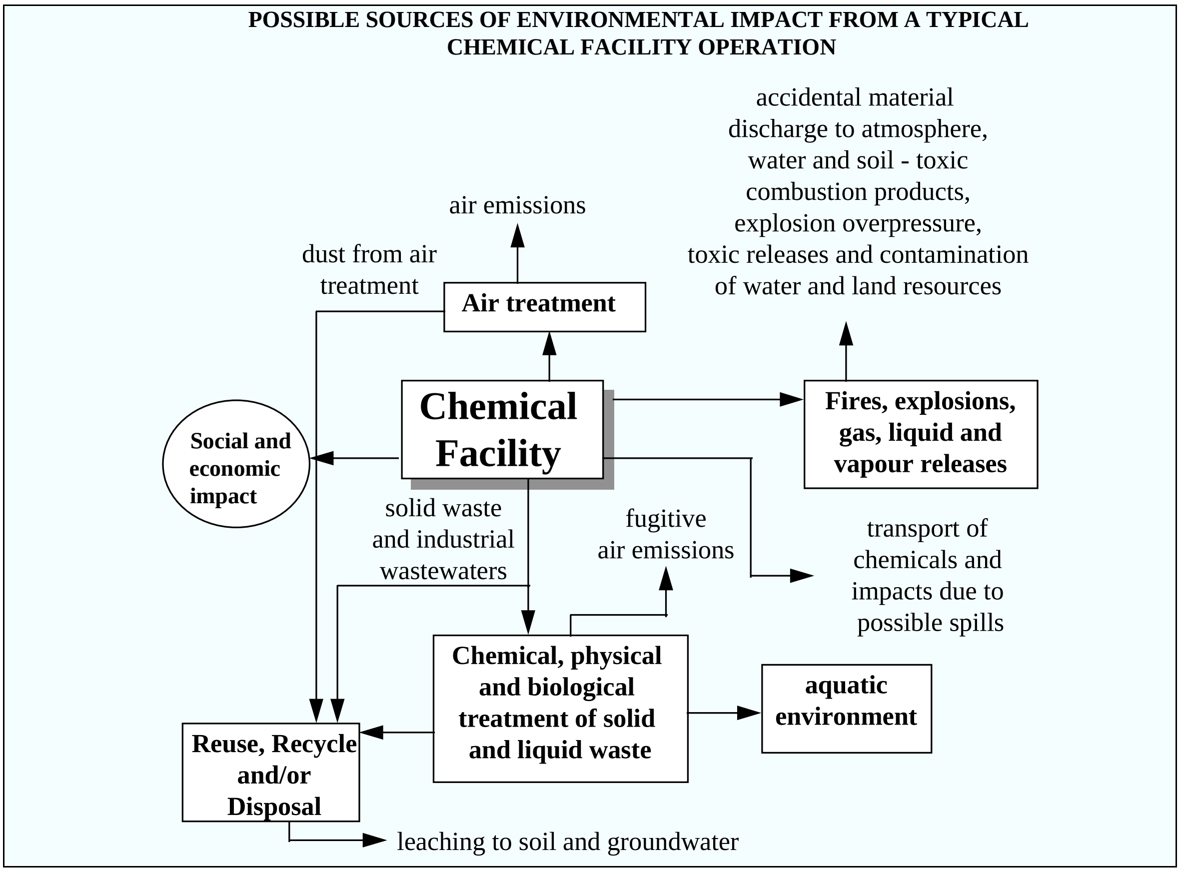
- As a result of **Policies - Plans**
  - resource allocation – process industry, farming, residential - water availability
  - infrastructure planning/programs
  - performance goals - risk goals
- At the **Rezoning stage**
  - in anticipation e.g. low to high density housing, heavy industry to mixed use
- At the **Development Application stage**
  - perceptions of incompatibility - change in character of the area, fear of impacts/change
- At the **Operational stage**
  - when there are potential or actual impacts – potential for accidents with off-site impacts, pollution, amenity.

3.3 Application of Strategic Land Use Safety Planning

Strategic land use safety planning is embedded in a number of existing regulatory mechanisms and industry practices. For example, under the *Environmental Planning and Assessment Act 1979* an Environmental Impact Statement (EIS) must be accompany any development application (DA) for facilities identified as *designated development* under the Environmental Planning and Assessment regulation 2000. Such facilities include chemical industries and works; chemical storage facilities and petroleum works, which meet certain criteria of scale, type and/or location. Land use safety is a significant consideration with such facilities.

DoP has issued a number of EIS Practice Guidelines. The *Chemical Facilities* guideline, while relating specifically to preparation of EISs for such facilities, provides valuable information on the impacts that may be expected and how they can be mitigated through careful site selection, sound design and operational controls. A broad understanding of these issues is invaluable for planning authorities at the strategic planning stage, particularly when considering preferred land uses. Figure 4, taken from the guideline, demonstrates a range of safety issues which should be considered in principle at the strategic planning stage and in detail when assessing the impacts of specific development proposals.

Figure 4: Potential Safety and Other Impacts - Chemical Facilities



Where potentially hazardous industry is considered, on the basis of strategic assessment, to be an appropriate land use in a particular area, it is important that other land uses, which may be incompatible with such development, are clearly identified in the strategy. Decisions at the project level should support this strategic framework.

3.4 Locational Considerations

In considering whether potentially hazardous facilities are appropriate in a given location, the following factors are relevant:

1. permissibility of the proposed land use;
2. the need to avoid environmentally sensitive areas;
3. compatibility with nearby land uses; and
4. results of initial site investigations as to the fundamental suitability of the site.

The consideration needs to be holistic and not confined to safety-related issues.

3.4.1 Site selection

Operational and engineering considerations are important factors in selecting sites for new potentially hazardous facilities. For example, the proximity to transport, raw materials, markets and waste disposal options need to be considered. However the environmental and social characteristics of the location also need to be considered. The greater the potential for adverse effects, the more important is the site selection process.

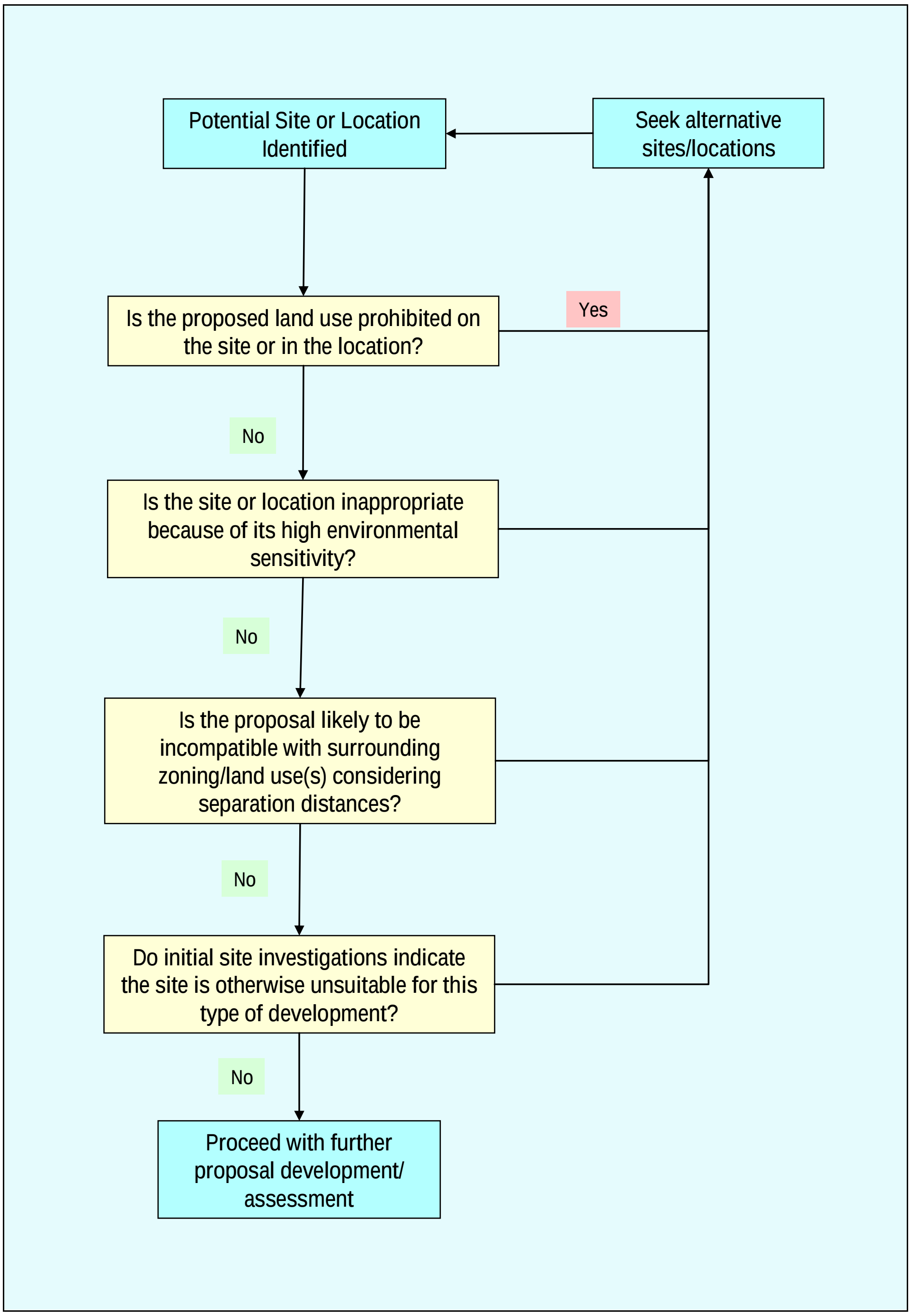
Site selection principles may also need to be considered where a development is proposed for modifications or additions to an existing facility.

Careful site selection for smaller facilities may remove the need for an EIS or otherwise will help minimise the environmental impacts and reduce the need for expensive infrastructure or technically complex treatment facilities. Appropriate site selection can avoid or reduce many of the environmental problems inherent with potentially hazardous facility proposals and:

- reduce the need for technically based environmental and health risk mitigation measures and costly on going management measures
- result in substantial savings in establishment and operating costs;
- reduce levels of public concern; and
- avoid potential delays in approval processes

A systematic and rigorous approach to site evaluation is therefore recommended, as set out in Figure 5.

Figure 5: Site Selection



The potential for potentially hazardous facility proposals to generate impacts requires a precautionary approach to site selection be adopted. In general, if a facility with potential for pollution or accidental off-site impact incorporates mitigation measures with high levels of certainty of performance in the design, there will be wider site selection options. Environmental impacts may be minimal where wastes, spills, contaminated water and emissions are further processed on or off site to reduce the impact. Subsequent disposal according to approved procedures will also contribute towards minimising any impact.

3.4.2 Permissibility of land use

At a very early stage in the site selection process it is essential for a developer to check with the local council to determine if the proposed land use is permissible on a particular site under the provisions of the LEP, other planning instruments or government policy. If the proposal is not permissible, discussions should be held with Council to determine its attitude towards rezoning the site.

3.4.3 Environmentally sensitive areas

At an early stage, the site selection process should also determine whether a potential site is likely to adversely affect areas of such high environmental value that the site should be considered to be unsuitable for the development. Examples of high environmental sensitivity include, but are not limited to:

- national parks, world heritage areas, historic and heritage areas, wilderness areas;
- areas reserved for environmental conservation (e.g. aquatic, nature, karsts);
- areas mapped under LEPs, REPs and SEPPs for protection;
- areas under conservation agreements or identified as critical habitat under the Threatened Species Conservation Act 1995, the Fisheries Management Act or the Environment Protection Biodiversity Conservation Act 1999 (Commonwealth);
- drinking water catchments or areas overlying aquifers which contain drinking water quality groundwater which is vulnerable to pollution;
- areas within 40 metres of a permanent or intermittent waterbody (rivers, bays, lakes or wetlands);
- areas prone to subsidence or land slippage; and
- areas close to sensitive land uses such as schools, nursing homes and hospitals.

3.4.4 Compatibility with land uses

Another important consideration is the compatibility of the proposal with existing or proposed surrounding land uses. Conflicts often arise when the community's amenity is threatened by health, safety, noise, water or air quality impacts. Any potential conflicts and possible options for reducing or preventing conflicts should be considered, in particular, the adequacy of buffer zones and the potential land uses within the buffer zones. In this context, buffer zones do not necessarily imply total sterilisation of land use. Rather, the objective is to identify a range of beneficial land uses which can form a buffer between potentially hazardous industry and sensitive land uses, such as residential development. For example, the DoP 2001 Botany/Randwick Land Use Safety Study specifically recommended:

> Future development within the Botany/Randwick industrial area should generally provide a buffer between the industrial area and surrounding residential zones.

The extent of "buffer" areas should be determined on a case specific basis. Factors to consider include the size of the facility, the type of chemicals and the level of risk associated with the facility's operation. Table 1 suggests land uses which might require separation from nearby potentially hazardous facilities, such as chemical manufacture or storage, and suggests performance objectives which could be used to determine an appropriate separation distance for planning purposes.

If a proposal is potentially incompatible with surrounding land uses and there is no feasible more suitable alternate location, consideration should be given to acquiring sufficient land to provide adequate on-site separation from nearby land uses. Where possible, the "buffer" area should be owned or controlled by the owner of the facility.

As the establishment of "buffer" areas around such facilities can lead to unacceptable land sterilisation, separation distances should not be viewed as a primary means of ameliorating impacts. Instead, separation distances should be seen as a back-up to ensure that the amenity of existing land uses can be maintained. The role of site separation as an impact mitigation measure should simply reinforce the impact mitigation measures provided by other means.

Table 1: Separation Distance Considerations

<table>
<tr><th>LAND USE</th><th>PERFORMANCE OBJECTIVES</th><th>FACTORS FOR DETERMINING APPROPRIATE SEPARATION DISTANCES</th></tr>
<tr><td>residential areas, hospitals or schools</td><td>• protect residential amenity and health: odour, fumes, noise, dust, seepage, visual amenity</td><td rowspan="4">• what is the likelihood of the performance objectives being achieved by the mitigation measures alone?
• what is the likelihood of the mitigation measures failing?
• what is the likelihood of an “incident” (e.g. accident, system failure, natural disaster) which will result in a failure to meet the performance objectives?
• what “back-up” mitigation measures are available?
• what is the likely geographic extent of impacts taking into consideration the proposed performance of mitigation measures and the local environment (topography, climate etc)?
• what is the likely geographic extent of the impacts if mitigation measures fail or an “incident” occurs, taking into consideration the local environment (topography, climate etc)?
• what separation distances are required to achieve the performance objective:
∗ under normal operational and mitigation performance conditions
∗ if mitigation measures fail or an “incident” occurs?</td></tr>
<tr><td>surface waters</td><td>• ensure that surface waters are protected from pollutants
• ensure that no existing or likely future uses of surface waters are compromised</td></tr>
<tr><td>groundwater recharge zones</td><td>• ensure that there is no deterioration in the quality of the groundwater
• ensure that no existing or likely future uses of groundwater are compromised</td></tr>
<tr><td>environment ally sensitive areas</td><td>• ensure that environmental qualities of the particular area are not compromised</td></tr>
</table>

3.4.5 Initial site investigations

The purpose of initial preliminary site investigations is to provide an early indication of the suitability of the proposed site. The initial investigations can help provide confidence about a potential site’s fundamental suitability for a facility prior to proceeding with a more detailed assessment in an EIS. Factors to be considered are listed in the DoP EIS Practice Guidelines.

The initial investigations can provide a basis for the comparative evaluation of a number of potential sites and can help substantiate the feasibility of the proposal at a particular site. These investigations can serve as a cost effective sieve to determine if any particular sites should be excluded from further consideration based on environmental factors.

In addition to assessment of the suitability of new sites, site feasibility studies should be undertaken to assess the acceptability of any existing chemical facilities being extended or altered. In these cases, investigations should consider any monitoring results from the existing facility.

The level of detail at the initial investigation stage should be commensurate with the scale of the proposal, the potential environmental risks associated with the proposal and the potential sensitivity of the location.

3.5 Allowing for Existing facilities

Land users need to be aware of the likelihood of adjacent land uses changing in the future. For example, low density housing may change to mid or high density. Rural areas may change to rural residential or industrial purposes.

As the preferred land use transitions over time to another preferred land use, non-compatible land uses may be located close together. For example in the redevelopment of an "old" inner city industrial area being vacated by industry, for a period of time the remaining industry and new residential uses may be side by side so that the off-site residual impacts of old industry could affect the new residential neighbours leading to land use conflicts.

In the past, many industries or infrastructure facilities used "vacant" neighbouring land to provide separation distances or so-called "buffers" to dilute or mitigate residual impacts. However because of changing land use patterns, industry or infrastructure facilities are increasingly deprived of the opportunity to use their neighbour's land to provide the separation distance to mitigate impacts to an acceptable level.

The impacts of existing facilities on adjoining land uses cannot be ignored when considering development proposals in areas possibly affected by those facilities as discussed in section 4.2, which covers development control in the vicinity of potentially hazardous facilities.

Note 1: Allowing for existing facilities – broad principles

Existing facility operators should:

- have realistic expectations - a project approval does not give freedom to operate without constraint;
- operate to best practice - incorporate continuous improvement;
- respect their neighbour's rights;
- if the facility is no longer consistent with preferred land uses - consider an exit strategy; and
- anticipate changes in land use in the area and become involved;

Existing land users should:

- expect "residual" impacts and have realistic expectations;
- develop an understanding of the facility's operation; and
- and be willing to develop/agree on protocols to mitigate impacts.

New land users to an area where facilities are located should:

- expect "residual" impacts and have realistic expectations; and
- make their own arrangements if higher amenity standards are required.

4 Development Control

SECTION SUMMARY

In NSW, risk assessment has long been an integral part of land use safety planning and management.

The chapter describes the risk-based approach to development control adopted by DoP, which comprises:

- a preliminary hazard analysis undertaken to support the development application by demonstrating that risk levels do not preclude approval;
- a hazard and operability study, fire safety study, emergency plan and an updated hazard analysis undertaken during the design phase of the project;
- a construction safety study carried out to ensure safety during construction and commissioning;
- implementation of a safety management system to give safety assurance during ongoing operation; and
- regular independent hazard audits to verify the integrity of the safety systems and that the facility is being operated in accordance with its hazards-related conditions of consent.

Extensive guidance is provided on the purpose and scope of each component of the process. Information is also included to assist consent authorities in the setting of appropriate conditions of consent and assessing the various reports typically required by the conditions of consent.

In addition to the control of potentially hazardous development, the chapter covers development in the vicinity of potentially hazardous facilities. Planning authorities should, as a minimum, identify all facilities with a major accident potential in their area so that appropriate controls can be exercised over new developments of a type that could cause risk intensification.

KEY MESSAGES

- An integrated approach must be used in the control and assessment of potentially hazardous development.
- The depth of analysis and assessment and the way in which conditions of consent are framed should reflect the scale and nature of the hazards and risks associated with the proposed development.
- It is particularly important that local Councils and other relevant planning authorities have policies and follow procedures for ensuring appropriate zoning and for development assessment in areas that could be impacted by major accidents.

4.1 Assessment of Development for Potentially Hazardous Facilities

In NSW, risk assessment has long been an integral part of land use safety planning and management. Typically, the proponent of a development for potentially hazardous industry will be required to prepare a Statement of Environmental Effects (SEE) or in the case of 'designated development', an environmental impact statement (EIS), in which the proposed project will be described, direct and indirect impacts to human safety and the biophysical environment evaluated, and in which necessary mitigation measures will be outlined.

Development applications for potentially hazardous industry are required by SEPP 33 to specifically include a preliminary hazard analysis, in which risks are analysed and assessed against acceptability criteria. This analysis ensures that the risks from any incident posed by the proposed development are thoroughly and systematically addressed, taking into account the characteristics of both the development and its location.

Such a risk-based land use planning approach assists planning authorities in identifying potential land use conflicts at the development approval stage and facilitates decision-making as to whether a development should be approved, subject to appropriate conditions. In making its decision, the planning authority will need to form a view as to the adequacy of the risk analysis and assessment in the PHA, as well as the risk implications of the PHA's conclusions.

Recognising that initial development consent is only the first step in ensuring safe operation over the life of a facility, an integrated hazards-related assessment process is used. This balanced and progressive approach is designed to ensure ongoing project safety through the design, construction, commissioning and operational phases of a development.

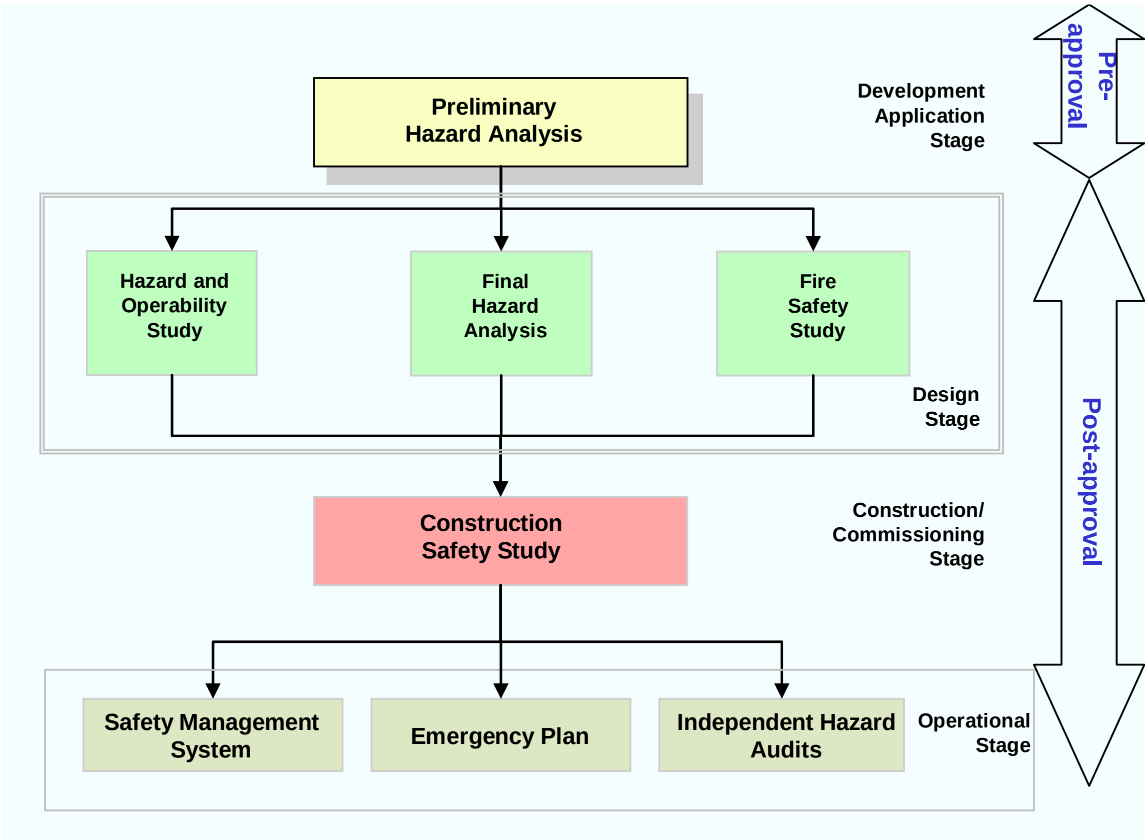
4.1.1 The Hazards-Related Assessment Process

The integrated hazards-related assessment process comprises:

- a preliminary hazard analysis undertaken to support the development application by demonstrating that risk levels do not preclude approval;
- a hazard and operability study, fire safety study, emergency plan and an updated hazard analysis undertaken during the design phase of the project;
- a construction safety study carried out to ensure safety during construction and commissioning;
- implementation of a safety management system to give safety assurance during ongoing operation; and
- regular independent hazard audits to verify the integrity of the safety systems and that the facility is being operated in accordance with its hazards-related conditions of consent.

The process is shown diagrammatically in Figure 6 and described in the sections that follow.

Figure 6: The Hazards-Related Assessment Process



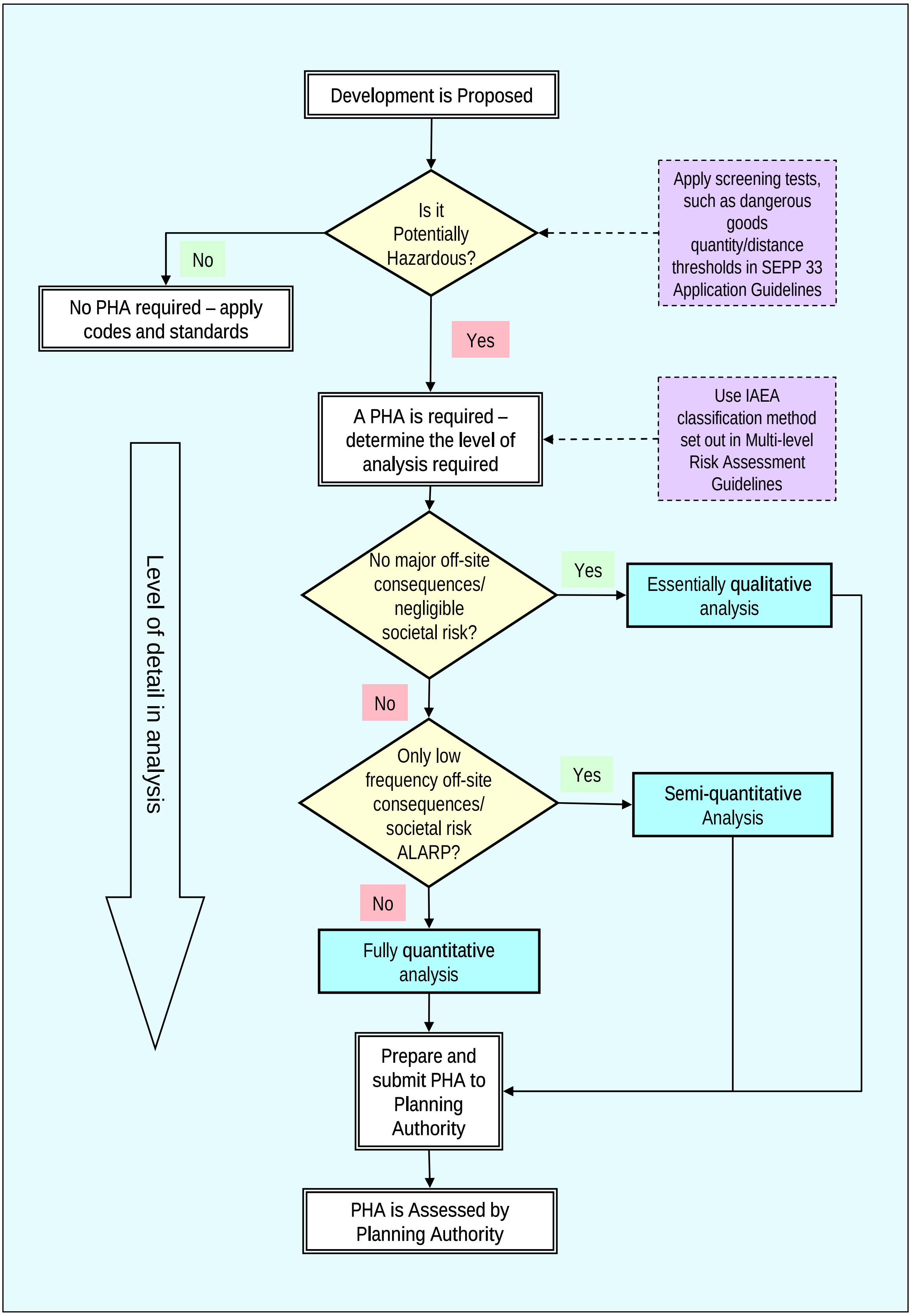
4.1.1.1 Development Application (Pre-approval) Stage

At the development application stage, four levels of evaluation are carried out:

1. preliminary screening to determine whether or not a development is potentially hazardous and thus requires a PHA to be prepared;
2. classification to determine the appropriate methodology and level of detail in the PHA;
3. preparation of the PHA, incorporating hazard identification, risk assessment and recommended risk controls; and
4. assessment by the planning authority to determine the adequacy of the PHA and the acceptability of the risk.

Figure 7 outlines this evaluation process, which is further discussed below.

Figure 7: Hazards Evaluation at the Development Application Stage



The Preliminary Hazard Analysis

As indicated, having determined from a preliminary screening that a development is potentially hazardous, a preliminary hazard analysis (PHA) will need to be undertaken before a development application is submitted. The purpose of the PHA is to:

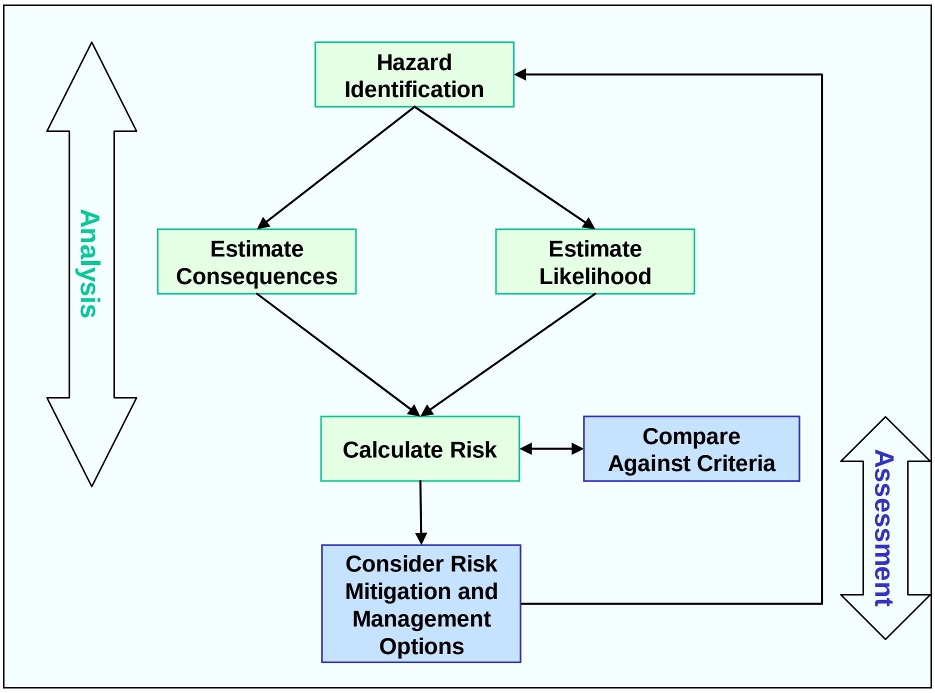
- identify all potential hazards associated with the proposal;
- analyse all hazards in terms of their consequences (effects) to people and the biophysical environment and their likelihood of occurrence;
- quantify the analysis and estimate the resultant risks to surrounding land uses and the environment; and
- assess the risks in terms of the location, land use planning implications and existing criteria and ensure that the proposed safeguards are adequate and thus demonstrate that the operation will not impose an unacceptable level of risk.

The term "preliminary hazard analysis" is sometimes mistakenly interpreted as representing a shallow or sketchy analysis. Rather, the PHA is an in-depth risk investigation which is preliminary only in the sense that it is based on the preliminary information available at the time the analysis is carried out (typically prior to detailed design). The approach needs to be consistent with that outlined in Figure 7. A need for a further in-depth analysis may arise depending on any substantial changes that occur during design.

The process of risk analysis and risk assessment is shown in Figure 8. Criteria for land use safety planning are discussed in section 5.

The techniques used in carrying out a hazard analysis are described in greater detail in *Hazardous Industry Planning Advisory Paper (HIPAP) No. 6*.

Figure 8: The Risk Analysis and Assessment Process



Multi-level Approaches to Risk Assessment

As shown in Figure 7, the level and extent of a risk analysis should reflect the nature, scale and location of each development.

DoP has developed Multi-level Risk Assessment Guidelines, which provide a graded or multi-level framework aimed at providing consistency and an appropriate level of analysis and assessment. In each case, the objective is to progress the analysis and its assessment only as far as is needed to demonstrate that the operation being studied does not or will not pose a significant risk to surrounding land uses. This may be achieved by using a combination of qualitative and quantitative approaches.

The multi-level approach is built around a consequence-based screening method set out in DoP's *Applying SEPP 33* guidelines and a rapid risk classification technique described in the United Nations *Manual for the classification and prioritization of risks due to major accidents in process and related industries* (the IAEA method)

The guidelines set out criteria for using the results of the screening, classification and prioritisation steps to determine which of the three levels of analysis is appropriate.

Level 1 is an essentially qualitative approach based on comprehensive hazard identification to demonstrate that the activity does not pose a significant risk.

Level 2 supplements the qualitative analysis by sufficiently quantifying the main risk contributors to show that risk criteria will not be exceeded.

Level 3 is a full quantitative analysis.

A ***qualitative*** assessment may suffice provided all or most of the following conditions are met:

- screening and risk classification and prioritisation indicate there are no major off-site consequences and societal risk is negligible;
- the necessary technical and management safeguards are well understood and readily implemented; and
- there are no sensitive surrounding land uses.

If the qualitative analysis cannot demonstrate there will be no significant risk, a further level of analysis will be required.

Partial quantification would normally be applied to developments where screening, hazard identification and/or risk classification and prioritisation has identified one or more risk contributors with consequences beyond the site boundaries but with a low frequency of occurrence. Otherwise, a full ***quantitative analysis*** should be carried out.

On a large site, it is likely that the risk assessment will employ a combination of techniques. This ensures that analysis effort is concentrated on areas of greatest hazard.

Some of the elements that need to be considered at each level, and the tests of adequacy that may be applied by a planning authority in assessing the adequacy of a PHA and the acceptability of the risks, are outlined in Table 2.

Table 2: Levels of Analysis and Assessment

Key Elements	Assessment Basis
Level 1 – Essentially Qualitative	
• hazard identification using summary diagram, FMEA, fault and event trees, HAZOP etc. • identification of key scenarios and qualitative estimate of risks • comparisons with qualitative criteria. • thorough discussion of protective technical and management measures, including codes and standards	• appropriate methods used for identification • all key scenarios thoroughly examined • realistic estimates of risk • relevant qualitative criteria met • proposed measures appropriate and sufficient • compliance with all relevant codes and standards
Level 2 – Partially Quantitative	
• qualitative elements as for level 1 • rigorous quantification of consequences of all events with significant off-site effects • quantification of the likelihood of events with significant off-site' consequences • indicative estimate of risk vs criteria • thorough discussion of technical controls, risk reduction and management measures	• qualitative elements as for level 1 • sound consequence methodology used and appropriate failure data used • technical methods and results appropriately documented • relevant criteria shown to be met • appropriate controls and safeguards
Level 3 – Fully Quantitative	
• qualitative elements as for level 1 • comprehensive quantification of significant consequences and their likelihood • evaluation of risk against all relevant criteria • thorough discussion of technical controls, risk reduction and management measures	• qualitative elements as for level 1 • sound consequence methodology used • appropriate failure data used • technical methods and results well-documented • all relevant criteria met • ALARP principles followed • appropriate technical and procedural controls and safety management system

These assessment bases may be used when considering risks from new facilities and additions and/or modifications to existing facilities. They may also be used in the analysis and assessment of the risk from existing facilities and in making comparative studies of alternate processes and locations.

Conditions of Consent

It is essential that the safety assessment process continues throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval/ environmental risk assessment process. There also need to be measures to ensure the ongoing integrity of the safety systems throughout the life of a facility.

These requirements are systemised through conditions attached to the development consent. Typical requirements are set out in Appendix 3. Each development should be considered on its merits and only relevant conditions applied. As an example, it would not be appropriate to require a fire safety study in cases where there are essentially no flammable materials used as part of the development.

4.1.1.2 Post-Approval Design Stage requirements

Four studies should be done at the detailed design stage:

a) the hazard and operability study

b) the fire safety study

c) the preparation of an emergency plan and procedures

d) the final (updated) hazard analysis.

These studies are best carried out at the design stage to optimise the safety of the final development. Ideally, they should be carried out concurrently and interactively; that is, the output of one study should be used as an input to the others and all in turn as inputs to the design refinement process.

Hazard and Operability Study (HAZOP)

At the design stage of the development project, when detailed design information is available, hazard and operability (HAZOP) studies are required as an integral part of the design process.

HAZOP studies are one particular form of hazard identification. They involve the comprehensive and systematic examination of the facility, section by section (usually on the basis of the flow/piping and instrumentation diagrams), using 'guide words'.

HAZOP studies are carried out by a team which should be chaired and coordinated by an independent qualified person. Design engineers and personnel who will operate the facility should form part of the HAZOP study team.

This examination identifies possible deviations from normal operating conditions which could lead to hazardous occurrences. The consequences and likelihood of such deviations are examined. Also, the adequacy and relevancy of available safeguards to detect such deviations ane prevent/ or protect against their resultant effects are evaluated in detail. This process enables a comprehensive evaluation of hazard control systems and produces recommendations for any necessary modifications.

It is essential that the HAZOP takes into account the results of the preliminary hazard analysis and risk assessment undertaken at the development approval stage. Information from the hazard analysis, particularly in relation to identified hazards and their consequences, is a valuable input to the HAZOP process. Where appropriate, the input should also be drawn from the fire safety study and emergency plan preparation.

HAZOP studies should be completed and approved prior to the commencement of substantial construction on-site and certainly before the completion of design. Guidelines for HAZOP studies are provided in *Hazardous Industry Planning Advisory Paper No. 8 – HAZOP Guidelines.*

Fire Safety Study

A fire safety study's objective is to ensure that the proposed fire prevention, detection, protection and fighting measures are appropriate for the specific fire hazard and adequate to meet the extent of potential fires for the development at the particular location.

These studies involve case specific hazard analysis and design of fire safety arrangements that respond to the specific hazards and risks associated with the development as well as meeting relevant codes and regulatory requirements. The case specific approach offers the benefit that fire safety measures can be tailor-made and cost effective.

The fire safety study should be concerned with all the effects of fire. It therefore should not only address the direct effects of flame, radiant heat and explosion but also the potential for the release of toxic materials and combustion products in the event of fire and the potential for the release of contaminated fire fighting water.

The results of HAZOP, PHA and updated hazard analysis should provide the basis for fire safety requirements. The relationship between fire safety systems and emergency plans and procedures should be clear. The *Hazardous Industry Planning Advisory Paper No. 2 - Fire Safety Study Guidelines*, published jointly by DoP and Fire and Rescue NSW, details the relevant scope, content and procedures.

Fire safety studies should be prepared and approved by the Fire Prevention Unit of Fire and Rescue NSW in liaison with the relevant local council. They should be done at an early stage - prior to substantial construction on-site and certainly well before the start of operations.

Emergency Procedures and Plans

The ongoing safety of a development of a potentially hazardous nature necessitates the preparation of plans and procedures to deal with emergencies.

Emergency planning can both reduce the likelihood and the magnitude of potentially hazardous incidents and reduce the consequences of incidents which do occur. The range of possible incidents involving potentially hazardous industries can be large. The smallest, if promptly detected and dealt with, will have virtually no adverse effects. If allowed to grow, however, incidents may have serious consequences both on and off the site.

Emergency planning can reduce the likelihood of incidents by ensuring that when potentially dangerous situations develop the response is both quick and appropriate. The magnitude can be reduced through early control which, for example, limits the size of a spill or fire. The consequences of any given incident can be reduced by such measures as control, evacuation and clean up.

It is essential that emergency procedures and plans not be of a generalised nature, but be specifically developed and tailored to the needs and hazards at each facility, and at each locality. Hazard analysis and HAZOP should provide the basis of hazard identification and the nature and extent of consequences for the formulation of relevant emergency procedures; and, resource requirements and their implications. The results of the fire safety study should also be used as an input.

Hazardous Industry Planning Advisory Paper No. 1 – Emergency Planning published by DoP provides a comprehensive outline of the scope and content of emergency plans and guidance for their preparation by industry.

Formalised emergency plans should be prepared and approved before the commencement of operations.

Updated Hazard Analysis and Risk Assessment (Final Hazard Analysis)

Throughout the detailed design phase, regard should be given to the effect of design and procedures decisions and modification on hazard and risk as assessed in the preliminary hazard analysis.

When detailed HAZOP, fire studies and emergency plans are completed, the design finalised, and the safety control systems determined to a final stage, the preliminary hazard analysis and risk assessment should be updated. The final hazard analysis and risk assessment should follow the same principles as the preliminary studies, but assumptions and results reworked to fully account for the detailed design information and precise safeguards. The principles of multi-level risk assessment apply to the final hazard analysis, as with the preliminary studies.

The final hazard analysis should determine risk levels to be used as the basis for future plant operations, updates, extensions, etc. Refinement to earlier safety control commitments should result in improvements to the risk levels. The risk impact should improve upon that predicted as part of the decision making process to approve the whole plant, and should in all cases not be significantly worse.

The updated (final) hazard analysis and risk assessment studies should be finalised and approved before the commencement of any operations.

4.1.1.3 Post-Approval Construction/Commissioning Stage Requirements

Construction Safety

A construction safety study should result in formalised arrangements which ensure during the construction phase the safety of workers and of surrounding land uses. These studies should focus on the potential for hazardous materials incidents.

Construction safety codes and regulations are available and must be complied with. Company procedures covering hot and cold work permits are also governed by regulations.

In terms of land use safety planning, however, more specific procedures are appropriate, particularly for cases where construction involves the modification of existing facilities or the construction of new plants near existing operating hazardous facilities. In such cases in particular, formal procedures should be established and documented to account for potentially hazardous incidents and interaction.

Provision should be made, for example, to ensure atmospheric testing before certain construction activities involving welding or cutting take place. The study should cover commissioning operations, as outlined in *Hazardous Industry Planning Advisory Paper No. 7 - Construction Safety*.

For larger projects with an extended construction period, it is permissible for the commissioning component of the study to be submitted subsequent to commencement of construction. However, commissioning should not commence until the commissioning study has been approved.

4.1.1.4 Post Approval Operating Stage Requirements

It is essential that the continuing safety of the plant and its operations be ensured through a comprehensive safety management system and periodic independent hazard auditing during ongoing operation of the facility. These requirements should be included in the conditions of consent.

The safety management system should include safety policy, organisational structure and responsibilities, emergency and operating procedures, document control, change management procedures and performance auditing.

Hazard audits are most efficient and reliable when undertaken by an independent third party. The frequency of auditing would vary depending on the nature of the plant, its location and the corporate safety philosophy and performance of the organisation. In all cases, however, it is essential that the first safety audit be undertaken towards the end of the first year of operation. It is advisable that subsequent safety audits be undertaken at least every second year.

Other post-operation safety requirements which are also inputs to the audits include: monitoring of the operation's critical safety parameters and maintaining adequate records of monitoring outputs; documented maintenance programs and maintenance records; and recording and analysis of hazardous incidents, accidents and near-misses in a readily accessible format. Further details of safety management systems can be found in *Hazardous Industry Planning Advisory Paper No. 9 – Safety Management*.

The regular review, revision and update of operating and maintenance procedures, emergency plans and procedures and other documentation relevant to safety is also essential.

4.1.2 The Appropriate Preparation and Assessment of Land Use Safety Studies

The effective implementation of the hazards-related assessment process approval process depends on the various studies being prepared and assessed by people with appropriate competencies.

The Department’s experience in peer reviewing and assessing safety studies is that those carrying out and reporting on the studies often underestimate the level of competency required, particularly in dealing with hazards associated with processing facilities. In some cases, a general appreciation of the Department's guideline publications has been assumed to provide an appropriate level of competency. This is not necessarily so. A considerable depth of detailed knowledge and understanding, combined with relevant experience, will be required when conducting studies on complex facilities. The purpose of the guidelines is to provide a basis for determining what needs to be done and the level of expertise required.

Similarly, those involved in assessing the various studies must have analytical skills and an understanding of the technical issues sufficient to allow deficiencies in the studies to be identified and a judgement to be made on their overall adequacy.

Appendix 6 sets out broad principles for establishing that studies are prepared and assessed in a 'fit-for-purpose' manner.

4.2 Control of Development in the vicinity of Potentially Hazardous Facilities

4.2.1 The Need for Development Controls

Ideally, the risk from potentially hazardous facilities, especially those with a potential for a major accident, should be controlled to such a degree that there need be no restriction on surrounding development on safety grounds. In practice, however, elimination of risk is seldom possible and development controls need to be established to ensure that new development in the vicinity does not increase overall risk by increasing the degree of exposure to the consequences of major accidents.

It is particularly important that local Councils and other relevant planning authorities have policies and follow procedures for ensuring appropriate zoning and development assessment in areas that could be impacted by major accidents.

4.2.2 Planning and Development Controls

The first necessary requirement is that planning authorities should, as a minimum, identify all facilities with a major accident potential in their area so that the appropriate controls can be exercised. Ideally, all potentially hazardous facilities should be identified. This step is likely to require communication and liaison with the Major Hazards Unit of DoP.

The next task is to ensure that the appropriate controls are exercised on new developments of a type that could cause risk intensification, such as new residential or sensitive use development and recreational areas involving large numbers of people.

The third basic task is to establish procedures which ensure that the above controls are exercised when dealing with new developments in the vicinity' of existing facilities. It is highly likely that planning authorities will need to establish clear rules which identify when a proposal is considered to be 'in the vicinity' of a facility with a major accident potential. For example, this could be provided by planning consultation arrangements based on 'zoning' (e.g. industrial and residential zones) practices so that it is clear when a new development is proposed in an industrial zone and is in the vicinity of a facility with a major accident potential. Alternatively, it may be necessary to develop a 'consultation zone or distance' around identified facilities so that the appropriate procedures are implemented for proposals within this zone or distance.

An example of this approach is found in the report of the Botany Randwick Land Use Safety Study, completed by DoP in 2000. The study recommended the application of planning controls in certain areas in the vicinity of the study area, based on assessed risks, as shown in Figure 10.

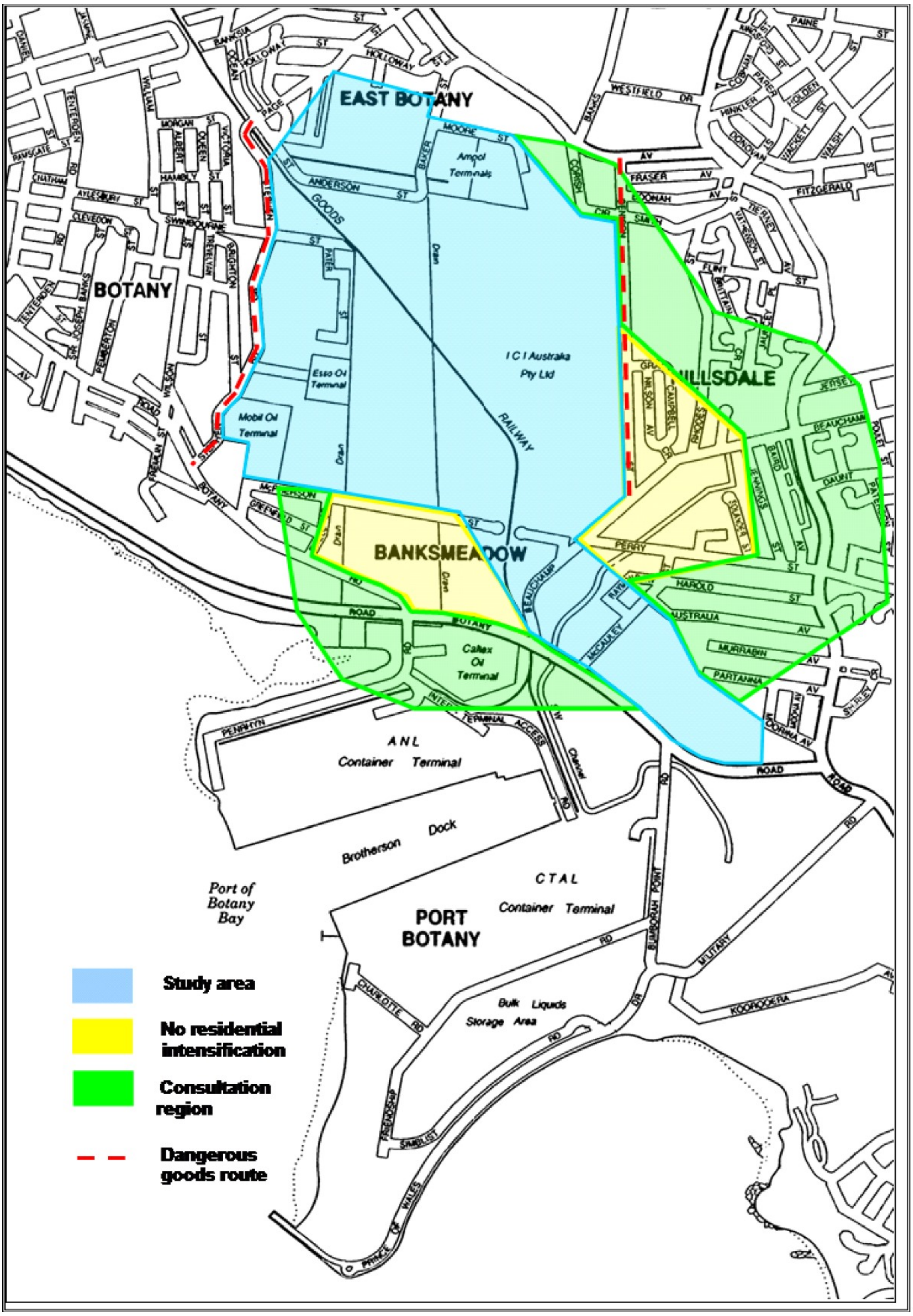
Specifically, the study recommended:

> Any future development in the vicinity of the Botany/ Randwick industrial area should generally provide a buffer between the industrial area and surrounding

residential zones. In assessing a proposed development, residential intensification should not be considered in the shaded region of [Figure 10] until the new Orica chlorine plant is operational and bulk chlorine storage on the site has ceased. DoP should be consulted regarding proposed development within the "consultation region" of [Figure 9].

This recommendation was acted on by the relevant councils.

Figure 9: Example of Recommended Planning Controls



In summary, if a development is proposed, the planning authorities must be able to show that:

- the location of all facilities with a major accident potential is known;
- there is a clear understanding of when a development is considered to be ‘in the vicinity’ of a such facilities;
- there is a clear understanding of the type of developments for which advice must be taken on the risks of major accidents.

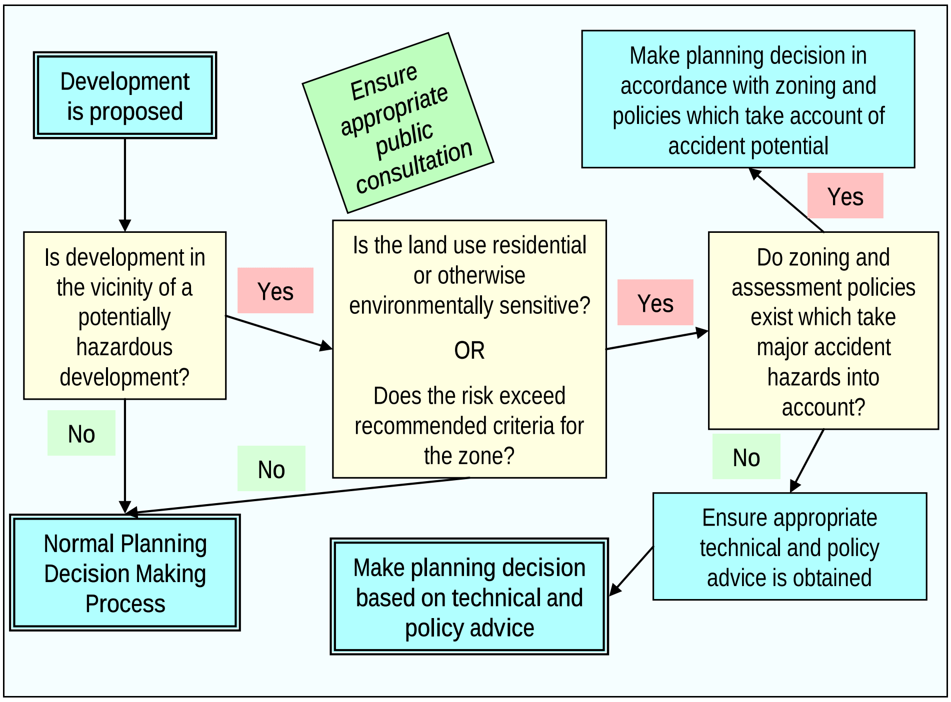
Note 2: First steps for local councils planning in the vicinity of potentially hazardous facilities

Key prerequisites are

- Identification of all facilities with a major accident potential in the LGA – ideally, **all** potentially hazardous facilities should be identified
- Identification of planning areas around the facilities where technical and/or policy advice must be sought
- If appropriate, defined ‘zones’ where certain types of developments will or will not be permitted
- Definition of the type and source(s) of technical advice (see section 4.2.3)
- Define to whom advice should be addressed (eg developers, assessors)
- Define how advice should be used, e.g. criteria for decision making (see section 5.5)

The planning approval process is shown diagrammatically in Figure 10. Decisions should take account of the risk criteria set out in section 5.5. The guidance in section 4.2.4 on minimising sterilisation of land is also relevant.

Figure 10: Process for Planning Approvals in the Vicinity of Potentially Hazardous Facilities



4.2.3 Development of a Systematic Approach

The UK Health and Safety Executive's (HSE) Hazardous Installations Directorate (HID) has developed a land use planning methodology in the form of Planning Advice for Developments near Hazardous Installations (PADHI) using a consultation distance (CD) with three zones. PADHI uses 2 inputs to a decision matrix:

- The zone in which a development is proposed; and
- The sensitivity level of the proposed development.

The methodology provides a basis for the HSE decision to 'Advise Against' or 'Don't Advise Against' a proposed development that falls within a consultation distance around a hazardous installation.

The 'risk-based' PADHI methodology is proposed as the basis of a framework for locational guidance for developments in the vicinity of existing potentially hazardous industry (PHI).

Broadly the steps of this proposed approach are:

1. Identify any potentially hazardous industries (PHIs) in the vicinity of the proposed development
2. Confirm or establish the consultation distance (CD) associated with each PHI
3. Check if the development is within the CD of a PHI
4. If the development is within the CD of a PHI, check if the development is of a type that requires consultation
5. Determine which CD zone applies
6. Determine the development type into which the proposed development falls
7. Determine the sensitivity level
8. Apply the CD zone and sensitivity level to the decision matrix
9. Communicate decision: Advise Against (AA) or Don't Advise Against (DAA)

It is proposed that DoP would develop the PHI framework and progressively establish the consultation distances and zones associated with potentially hazardous industrial developments that are State significant. Initially, the consultation distances could be based on the results of the Preliminary Hazard Analysis (PHA). In general, consent authorities would implement the framework based on information from the proponent of the proposed development and historical data from previous PHAs (or Final Hazard Analyses [FHAs], if available) undertaken as part of the development approval process for PHI.

Available PHAs and FHAs span a considerable period and represent a range of risk assessment methodologies. Hence, there will probably be a need for DoP to check the studies and perhaps carry out some normalisation of the results to ensure consistency in setting the CDs.

In some cases the Department's own land use safety studies may form the basis for establishing the CDs.

Figure 10, which is provided for stakeholder comment, summarises some of the technical considerations that need to be taken into account in establishing the framework.

4.2.4 Minimising Sterilisation of Land

There will be sometimes be situations in which current zoning would permit development in locations which would be exposed to a risk from existing facilities higher than the recommended criteria for the particular land use, as illustrated in Figure 9. This can create a dilemma for planning authorities. On the one hand, there is an expectation from land owners that they should be able to carry out development in accordance with the zoning. On the other hand, there is a statutory requirement that planning authorities must take into account the suitability of land for its proposed use before an approval is given.

In dealing with potential or actual land sterilisation three factors should be considered:

1. *The primary responsibility for resolving a conflict should lie with the source of that conflict.*

   If the conflict arises from an industrial facility that imposes a risk on established surrounding land-uses, which is significantly above the recommended criteria for those uses, the facility should be encouraged to take action to reduce off-site risks to below the criteria by such means as inventory reduction, process and equipment improvements, procedural changes and/or other mitigation measures.

   Where the risk level remains significantly above recommended criteria, even after practical risk reduction, management and mitigation measures have been taken, consideration should be given to other measures, such as plant closure, relocation or acquisition of risk affected properties.

   Where the conflict arises from a rezoning, which has resulted in risk criteria for the new zone to be exceeded, the parties to the rezoning should bear the responsibility for resolving the conflict. Possible approaches include:

   (a) Rezoning of risk affected portions of the land to a less sensitive use;

   (b) Placing conditions of consent on new development that will reduce risk exposure to people within the development to less than the relevant risk criteria. It should be noted that, while this approach may be feasible for industrial or commercial land uses, it is not appropriate for sensitive uses. As noted below, a conservative approach needs to be taken in assessing the effectiveness of proposed mitigation measures, particularly for residential development; and

   (c) Negotiation with the industrial facility, which is the risk source, to carry out risk reduction measures.

2. *Consent authorities must adopt a conservative approach to decision making based on risk exposure*.

   While it is important to avoid unnecessary sterilisation of land, development should only be approved on the basis of a systematic assessment of the risks, taking into consideration the nature of those risks and the degree of confidence in the results of the assessment.

   It should be noted that it is generally more difficult to accurately model the risk impacts of toxic gas releases and to mitigate those impacts than to estimate and mitigate against fires and explosions.

3. *Effective conflict resolution requires consultation between all affected stakeholders*.

   An important principle of land use conflict resolution, as noted in section 3.3, is that all stakeholders share a responsibility to avoid or minimise land use conflicts and, where conflicts already exist or are inevitable, to equitably reconcile those conflicts.

It is important that a precautionary approach be taken. Planning decisions that could result in an intensification of risk should not be made in advance of conflict resolution measures being implemented and demonstrated to be effective.

4.2.5 Information Sources

Possible sources of information for planning authorities seeking to establish possible areas of affectation by facilities with a major accident potential and other potentially hazardous facilities include:

- Land Use Safety Studies published by DoP;
- PHAs and EISs prepared in support of development applications; and
- Direct consultation with DoP

5 Risk Criteria for Land Use Safety Planning

SECTION SUMMARY

In recent years, there has been a growing realisation that the tolerability or acceptability of risk is influenced by factors over and above the physical magnitude of that risk. While risk criteria need to have a sound technical basis, they must take serious account of community concerns.

Relevant general principles are:

- the avoidance of all *avoidable* risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose any incremental risk.

The chapter summarises the Department's risk criteria related to fatality, injury, property and environmental damage. A more extended discussion of the criteria and their derivation is found in *HIPAP 4: Risk Criteria for Land Use Safety Planning*.

KEY MESSAGES

- DoP's risk criteria for land use safety planning are relevant at every stage of the planning cycle and not only during the assessment of proposals for new facilities or modifications and additions. Both qualitative and quantitative criteria need to be considered.
- Particular care needs to be taken when assessing rezoning or development around potentially hazardous development to ensure that such development will not introduce or aggravate existing land use safety conflicts.

5.1 The Setting of Risk Criteria

The systematic evaluation of the acceptability of the risk from a proposed potentially hazardous development requires an agreed set of qualitative and quantitative risk criteria.

Hazards give rise to concerns which can be put into two broad categories:

- **Individual concerns** or how individuals see the risk from a particular hazard affecting them and things they value personally.
- **Societal concerns** or the risks or threats from hazards which impact more broadly on society e.g. the risk of events causing widespread or large scale detriment or the occurrence of multiple fatalities in a single event. Societal concerns due to the occurrence of multiple fatalities in a single event are reflected in the term **societal risk**.

Criteria for individual and societal risk are summarised in sections 5.4.1 and 5.4.2 respectively.

5.1.1 Factors in Setting Criteria

In order to make informed land use safety planning decisions, the results of any risk evaluation need be assessed against appropriate qualitative and quantitative risk criteria. The approach adopted in NSW is risk-based, based on the following considerations:

(a) The suggested risk criteria should be probabilistic in nature. That is, they should account for both the consequences (effects) and likelihood (probability) of hazardous events.

(b) All activities have an associated level of risk. It is not possible to eliminate that risk unless the activity itself is eliminated.

(c) Acceptability of a level of risk involves many considerations. Certain risks may only be acceptable when they are outweighed by certain advantages which people associate with the considered activity.

When a risk is to be imposed on an individual or a group of people (e.g. by locating a hazardous facility in an area), the concept of 'acceptability' of that risk is that it should be low relative to other known and tolerated risks.

(d) There are two dimensions of risk which should be considered separately, individual and societal.

5.1.2 The Application of Criteria

Because of the uncertainties in the numerical outputs from a risk analysis, there needs to the degree of flexibility in the implementation and interpretation of probabilistic risk criteria. However, while quantitative risk criteria should not be used as absolute numbers, where risk levels exceed established criteria, the acceptability of the risk at or from a facility will need to be carefully considered in the light of the economic or social benefits provided by the development.

Criteria need to be applied in three broad contexts:

1. Strategic Planning (Zoning)
2. Assessment of Development for Potentially Hazardous Development
3. Assessment of Development in the Vicinity of Potentially Hazardous Development

While a number of criteria may be common to more than one context, there is a need to consider each situation on its merits, as noted in sections 5.3 to 5.5.

5.2 Qualitative Risk Criteria

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. The following qualitative criteria are appropriate in all three contexts:

(a) All 'avoidable' risks should be avoided.

(b) The risk from a major hazard should be reduced wherever practicable.

(c) The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.

(d) Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.

5.3 Risk Criteria for Strategic Planning

When considering strategic planning, the primary emphasis needs to be on the suitability of land for the proposed range of uses, having regard to existing risk exposure and the sensitivity of the current land use.

For example, it would be inappropriate for land to be zoned for residential or more sensitive uses if there was already a significant risk exposure from nearby industrial activities. Similarly, zoning for the purpose of industry with a potential for accidental release of ecotoxic materials would be inappropriate in an environmentally sensitive area, such as in proximity to threatened species habitat or near a natural watercourse or waterbody.

The criteria set out in section 5.5 (Risk Criteria for Development in the Vicinity of Potentially Hazardous Facilities) are relevant to strategic planning as well as for the assessment of specific development proposals.

5.4 Risk Criteria for Potentially Hazardous Development

In assessing the tolerability of risk from potentially hazardous development, both qualitative and quantitative aspects need to be considered.

The main quantitative criteria considered are fatality, injury property and environmental damage. The most relevant criteria are discussed below.

5.4.1 Individual Risk

5.4.1.1 Fatality

'Individual fatality risk' is the risk of death to a person at a particular point.

The following risk assessment criteria are suggested for the assessment of the safety of location of a proposed development of a potentially hazardous nature, or the land use planning in the vicinity of existing hazardous installations:

(a) Hospitals, schools, child-care facilities and old age housing development should not be exposed to individual fatality risk levels in excess of half in one million per year ($0.5x\ 10^{-6}$)

(a) Residential developments and places of continuous occupancy, such as hotels and tourist resorts, should not be exposed to individual fatality risk levels in excess of one in a million per year (1×10^{-6} per year).

(b) Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres, should not be exposed to individual fatality risk levels in excess of five in a million per year (5×10^{-6} per year).

(c) Sporting complexes and active open space areas should not be exposed to individual fatality risk levels in excess of ten in a million per year (10×10^{-6})

(d) Individual fatality risk levels for industrial sites at levels of 50 in a million per year (50×10^{-6} per year) should, as a target, be contained within the boundaries of the site where applicable.

Table 3 summarises the preceding criteria for the various categories of land use.

Table 3: Individual Fatality Risk Criteria

Land Use	Suggested Criteria (risk in a million per year)
Hospitals, schools, child-care facilities, old age housing	0.5
Residential, hotels, motels, tourist resorts	1
Commercial developments including retail centres, offices and entertainment centres	5
Sporting complexes and active open space	10
Industrial	50

5.4.1.2 Injury Risk

Relying entirely upon fatality risk criteria may not account for the following factors:

- Society is concerned about risk of injury as well as risk of death.

- Fatality risk levels may not entirely reflect variations in people's vulnerability to risk. Some people may be affected at a lower level of hazard exposure than others.

It is therefore appropriate that risk criteria also be set in terms of injury, i.e. in terms of levels of effects that may cause injury to people but will not necessarily cause fatality.

The suggested injury risk criteria are:

- Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2 at a frequency of more than 50 chances in a million per year.
- Incident explosion overpressure at residential and sensitive use areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year.
- Toxic concentrations in residential and sensitive use areas should not exceed a level which would be seriously injurious to sensitive members of the community following a relatively short period of exposure at a maximum frequency of 10 in a million per year.
- Toxic concentrations in residential and sensitive use areas should not cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year.

5.4.1.3 Risk of Property Damage and Accident Propagation

The siting of a hazardous installation must account for the potential of an accident at the installation causing damage to buildings and propagating to a neighbouring industrial operations and hence initiating further hazardous incidents - the so-called 'domino effect'. The siting process must also account for existing risk conditions at the proposed site.

The criteria for risk of damage to property and of accident propagation are as follows:

- Incident heat flux radiation at neighbouring potentially hazardous installations or at land zoned to accommodate such installations should not exceed a risk of 50 in a million per year for the 23 kW/m^2 heat flux level.
- Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed a risk of 50 in a million per year for the 14 kPa explosion overpressure level.

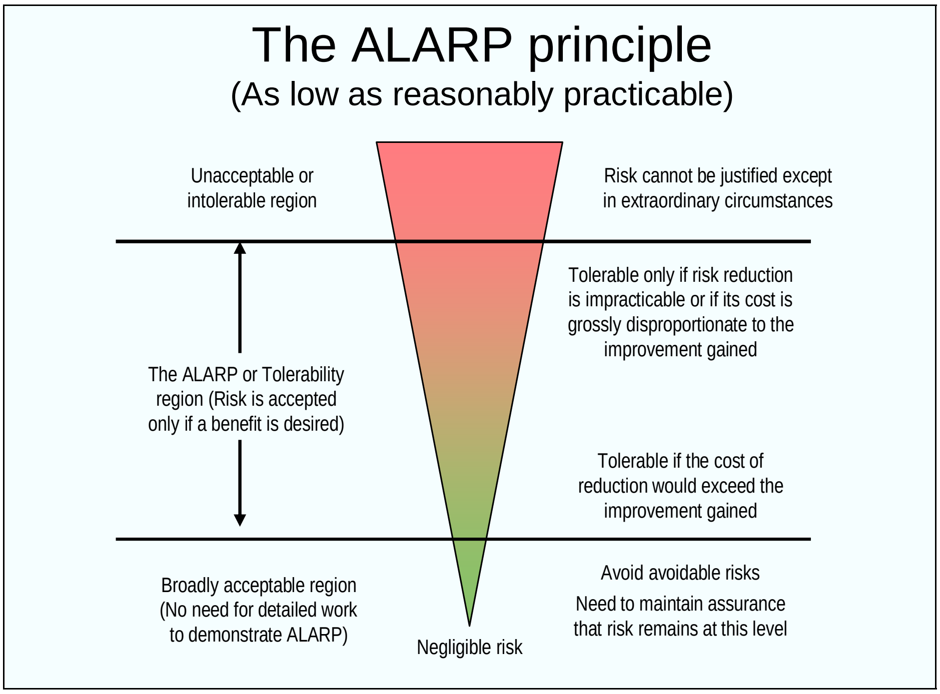
These criteria do not remove the need to consider higher consequence levels at lower frequencies. The hazard analysis should consider the whole picture, not just the nominated quantitative criteria.

5.4.2 Societal Risk

The suggested criteria, which follow, take into account the fact that society is particularly intolerant of accidents, which though infrequent, have a potential to create multiple fatalities. The criteria are broadly consistent with those adopted in a number of other jurisdictions and have been refined by consideration of the results from land use safety studies conducted by DoP in and around the industrial installations in the Port Botany and Botany/Randwick industrial areas and at Kurnell.

The societal risk criteria incorporate an ALARP (As Low As Reasonably Possible) approach. The concept is illustrated in Figure 11.

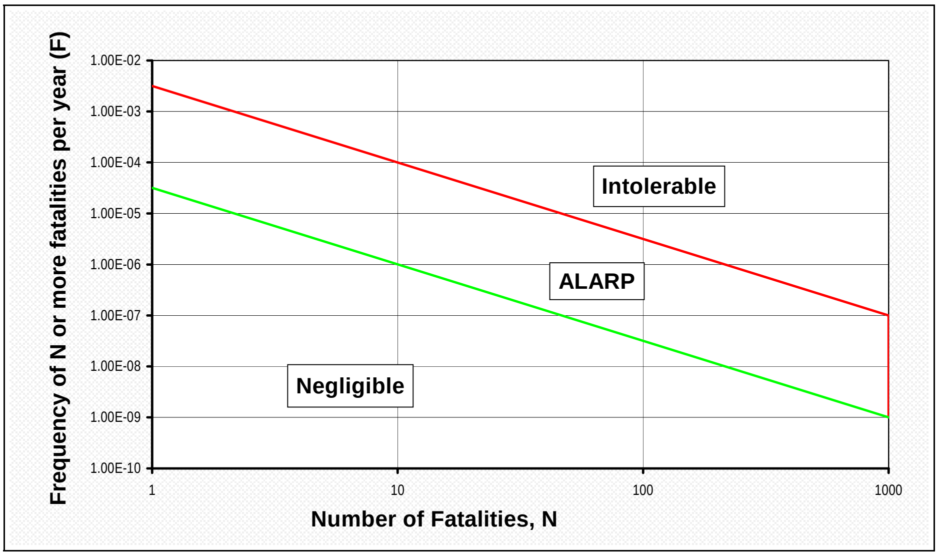
Figure 11: Applying ALARP

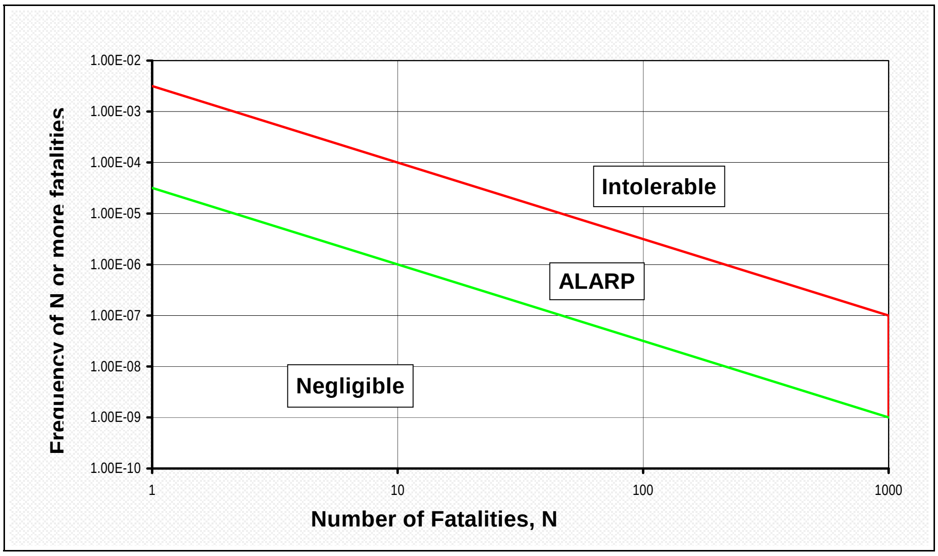


The societal risk criteria reflect these regions as three societal risk bands: negligible, ALARP and intolerable, as shown in Figure 12. It should be emphasised that these criteria are indicative only and do not represent a firm requirement in NSW.

It should further be noted that, irrespective of numerical risk criteria, the broad aim should be to 'avoid avoidable risk.'

Figure 12: Indicative Societal Risk Criteria





Below the negligible line, provided other individual criteria are met, societal risk is not considered significant. Above the intolerable level, an activity is considered undesirable, even if individual risk criteria are met. Within the ALARP region, the emphasis is on reducing risks as far as possible towards the negligible line. Provided other quantitative and qualitative criteria of HIPAP 4 are met, the risks from the activity would be considered tolerable in the ALARP region.

5.4.3 Environmental Risk

In addition to the risk to people and property, the siting and impact assessment process for potentially hazardous installations must consider the risk from accidental releases to the biophysical environment.

Because of the complexities in assessing risk to the biophysical environment and case-to-case differences, it is inappropriate to specify hard and fast criteria. The acceptability of the risk will ultimately depend on the value of the potentially affected area or system to the local community and wider society.

5.4.3.1 Wright's Criteria

Wright (1993) describes several factors which need to be recognised

- ecosystems are complex, open and dynamic;
- the time-scale to cause measurable impact or recovery from impacts may be longer than human life;
- persistent materials which are bio-available, and have the potential to bio-accumulate should be avoided, discharge will cause irreversible net change;
- the relative scale of the environmental impact must be considered in all environmental dimensions (spatial, temporal etc.);
- the ecosystem has inherent or built-in variability and recoverability;
- cause and effect relationships are often difficult to measure;
- interdependency exists between different eco-sub-systems; and
- acceptability of risks to the environmental resources is dependant on human values..

There is also the problem of synergistic effects. This means, for example, that two chemicals which are individually inert in the environment, interact to create major difficulties.

On the basis of these considerations, DoP suggests the following criteria:

- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the effects (consequences) of the more likely accidental emissions may threaten the long-term viability of the ecosystem or any species within it.
- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the likelihood (probability) of impacts that may threaten the long-term viability of the ecosystem or any species within it is not substantially lower than the background level of threat to the ecosystem.

5.5 Risk Criteria for Development in the Vicinity of Potentially Hazardous Facilities

5.5.1 General Principles

The suggested risk assessment criteria in section 5.4.1 apply when assessing the land use safety implications of industrial development of a potentially hazardous nature. However, they are equally relevant and applicable to the considerations of land use planning and development in the vicinity of potentially hazardous facilities.

The following criteria should be read in conjunction with section 4.2.

5.5.2 Individual Fatality Risk

5.5.2.1 Residential and Sensitive Land Uses

The individual risk criteria in section 5.4.1 relating to risks to residential and sensitive land uses from new industry proposals are significantly more stringent than those which apply to less sensitive uses, such as industrial and commercial activities.

Consequently, while existing industry should ideally meet the same residential and sensitive land use criteria as new proposals, it is recognised that this may not be possible in practice. The following principles apply to residential and sensitive use development in the vicinity of existing industry:

- the half in a million per year individual fatality risk level is an appropriate criterion above which no intensification of sensitive use development should take place;
- the one in a million per year individual fatality risk level is an appropriate criterion above which no intensification of residential development should take place;
- residential intensification may be appropriate where mitigating measures can be implemented to reduce risk exposure to less than the one in a million per year individual fatality risk level, provided the pre-mitigation residual risk levels are below the 10 in a million per year individual fatality risk level; and
- no residential intensification should take place where pre-mitigation residual risk levels are in excess of the 10 in a million per year individual fatality risk level.

5.5.2.2 Other Land Uses

Table 4 sets out the recommended individual risk level above which development of the types specified would not be appropriate.

Table 4: Individual Fatality Risk Criteria – Other Land Uses

Land Use	Suggested Criteria (risk in a million per year)
Commercial developments including retail centres, offices and entertainment centres	5
Sporting complexes and active open space	10
Industrial	50

Where these criteria are initially exceeded, commercial and industrial land development may be appropriate where mitigating measures can be implemented to reduce risk exposure to less than the target individual fatality risk level.

5.5.3 Individual Injury Risk

In the case of proposed development for residential and sensitive uses, possible injury and irritation impacts should also be considered. The suggested criteria are as for new industrial development set out in section 5.4.1.2:

- Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2 at a frequency of more than 50 chances in a million per year.
- Incident explosion overpressure at residential and sensitive use areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year.
- Toxic concentrations in residential and sensitive use areas should not exceed a level which would be seriously injurious to sensitive members of the community following a relatively short period of exposure at a maximum frequency of 10 in a million per year.
- Toxic concentrations in residential and sensitive use areas should not cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year.

5.5.4 Societal Risk

Societal risk criteria particularly focus on multiple fatality situations. Hence, it is generally not meaningful to address societal risk when considering development applications for single dwellings in the vicinity of a potentially hazardous facility. However, where a development proposal involves a significant intensification of population in the vicinity of such a facility, the change in societal risk needs to be taken into account, even if individual risk criteria are met.

Examples of such situations would include medium to high density residential development (although this would not normally be considered to be appropriate in such a location), sporting facilities where large numbers of spectators are likely to be present and shopping complexes.

In such instances, the incremental societal risk should be compared against the indicative criteria of Figure 12. Provided the incremental societal risk lies within the negligible region, development should not be precluded. If incremental risks lie within the ALARP region, options should be considered to relocate people away from the affected areas. If, after taking this step, there is still a significant portion of the societal risk plot within the ALARP region, the proposed development should only be approved if benefits clearly outweigh the risks.

6 Emergency Planning and Response

SECTION SUMMARY

Every potentially hazardous facility should have on-site and off-site emergency plans. These are typically required by conditions of consent. This chapter highlights emergency planning issues that have land use safety implications for planning authorities, particular local councils, which have responsibilities through the Local Emergency Planning Committee (LEMC).

Off-site emergency plans need to be developed in collaboration with the LEMC. The chapter provides guidance to councils on their role in the consultation process with the various stakeholders.

KEY MESSAGE

- Local councils should have an understanding of the potentially hazardous facilities in their area and ensure that emergency planning issues that affect the community are considered and communicated.

6.1 Emergency Planning in a Land Use Safety Context

Every potentially hazardous facility should have on-site and off-site emergency plans. This is a specific requirement for all new potentially hazardous developments falling within SEPP 33, as noted in section 4.1.1.2.

HIPAP No 1: Industry Emergency Planning Guidelines provides detailed guidance on the requirements, which will not be duplicated here. The purpose of this section is to highlight emergency planning issues that have land use safety implications.

In particular, Local Government chairs the LEMC, which is responsible for identifying hazards and threats in its area and developing and implementing plans to address these hazards. This is usually achieved by an inter-agency committee. The facility operator should liaise closely with this committee so that measures developed to respond to a major emergency at the facility are incorporated into the Local Government's regional plan and are complementary with arrangements made for other types of hazards.

An understanding of the types of emergencies that can arise in the locality and their impacts is also important to strategic planning, particularly in identifying potential land use conflicts and preferred land uses and in developing development controls.

While preparation of the off-site emergency plan is the responsibility of the operator of a facility, the plan must recognise and be consistent with the NSW statutory framework for emergency response. Hence, the off-site emergency plan needs to be developed in collaboration with the Local Emergency Management Committee (LEMC). It should cover:

- defined roles and responsibilities during emergencies with off-site impacts;
- arrangements for warning systems and off-site notification;
- arrangements for coordinating activities and resources for off-site emergency response;
- arrangements for providing assistance to, and cooperating with, emergency services;
- arrangements for off-site actions to mitigate the impact of the accident;
- arrangements for the provision of information to the public and the neighbours.

6.2 The Consultative Emergency Planning Process

Note 3: Consultation in Emergency Planning

Consultation is a key element of an effective emergency plan and should be conducted during all phases of the planning and management process (i.e. during initial preparation, testing, review and update). All stakeholders affected by the plan (including facility personnel, the community, and external agencies) should be consulted to ensure that each group knows what to expect of the other and what their requirements are.

A coordinated and effective response to any emergency requires an understanding between the different parties involved. Consultation when developing the emergency plan enables the development of this understanding before an incident occurs. It ensures that the roles, responsibilities, functions and needs of all agencies and groups are understood and accurately incorporated into the emergency plan. Once the plan is implemented, consultation during the management of the plan allows all stakeholders to contribute to the testing, monitoring and review, and updating of the plan.

To ensure that consultation is comprehensive, the key stakeholders in the emergency planning process should be identified and on-going relationships with these groups developed. One method of achieving this is by forming an emergency planning working group that includes representatives from all interested parties. While much of the work in developing and managing the emergency plan can be performed by facility personnel, this working group can assist in developing concepts and ideas, and also in verifying that the emergency plan adequately addresses their particular concerns.

The stakeholders and issues identified below are not exhaustive; a specific facility may need to consider other groups or issues.

6.2.1 Facility Personnel

All employees (including employee representatives) should be consulted extensively during the emergency planning process. Not only does this ensure that their intimate knowledge of the facility and its operations is incorporated into the development of the emergency plan; it also generates a sense of commitment and ownership. Each person within the organisation has a responsibility to ensure that they are capable at all times of fulfilling their role in the event of an emergency.

Ongoing consultation with facility personnel should be actively pursued. For example, staff should be involved in preparing and conducting exercises in order to test the capability of the plan. Debriefings following these exercises can allow participants to indicate the problems encountered and suggest possible solutions.

Appendix 1

Additional Reference Material

The following material is additional to the publications listed at the end of this guideline.

1. Health and Safety Executive, 2001, *Reducing Risks, Protecting People: HSE's Decision Making Process*, ISBN: 0 7176 2150 0
2. Hutchison R.B., Perera J., Witt H.H., 1996, *Preliminary Environmental Risk Ranking*, ANSTO Safety and Reliability, Risk Engineering Seminar, Munro Centre for Civil and Environmental Engineering, University of New South Wales
3. International Atomic Energy Agency, December 1993 and December 1996 (Rev.1), *Manual for the Classification and Prioritisation of Risks Due to Major Accidents in Process and Related Industries*, International Atomic Energy Agency, Inter-Agency Programme on the Assessment and Management of Health and Environmental Risks from Energy and Other Complex Industrial Systems, IAEA-TECDOC-727 and IAEA-TECDOC-727 (Rev.1), Vienna, 73 pages
4. International Atomic Energy Agency, 1998, Guidelines for Integrated Risk Assessment and Management in Large Industrial Areas, IAEA-TECDOC-994, IAEA Vienna
5. *Management of Land Use Conflicts*. Presentation by DoP to NSW Minerals Council, 2002.
6. National Occupational Health and Safety Commission, September 1996, *National Standard for the Control of Major Hazard Facilities*, [NOHSC:1014(1996)], AGPS, [AusInfo Cat.No.96 0172 4], ISBN:0 644 45926 3
7. National Occupational Health and Safety Commission, September 1996, *National Code of Practice for the Control of Major Hazard Facilities*, [NOHSC:2016(1996)], AGPS, [AusInfo Cat.No.96 0172 4], ISBN:0 644 45926 3
8. New South Wales Department of Planning, 1996, *Chemical Facilities*, EIS Practice Guideline, Sydney
9. Sandman, Peter M *Smallpox Vaccination: Some Risk Communication Linchpins*, Paper delivered at the Center for Disease Control and Prevention (CDC), Atlanta, 17-18 December 2002.
10. Standards Australia, 1999, *Risk Management*, AS/NZS 4360:1999, ISBN 0 7337 2647 X
11. Wright N H (1993) *Development of Environmental Risk Assessment (ERA) in Norway*. Norske Shell Exploration and Production.

Appendix 2

Development in the Vicinity of Potentially Hazardous Industry

Historically, the department has addressed the nature of land use in the vicinity of potentially hazardous facilities through area land use safety or risk assessment studies. An example is the Botany/Randwick industrial area land use safety study, which included the identification of risk reduction (no residential intensification) and consultation regions.

However, a more generally applicable framework for development around existing facilities, consistent with the current framework for industrial development proposals, will contribute to streamlining the planning processes. This is especially important in the Sydney Basin, where there has been a decline in new industrial development and increasing pressure for residential development.

Ideally, a methodology for examining the siting of new development should consider its exposure to risk from all sources. In the first instance, however, it is intended to focus on risks from potentially hazardous industry. This is consistent with the approach taken in other jurisdictions and recognises the need to concentrate efforts on an area where there is already a risk-based assessment regime.

The following discussion sets out a proposed systematic approach, based on that used by the UK Health and Safety Executive (HSE). It is presented to promote stakeholder framework and does not, at this stage, represent a firm proposed framework.

UK HSE LAND USE PLANNING METHODOLOGY

The UK Health and Safety Executive's (HSE) Hazardous Installations Directorate (HID) has developed a land use planning methodology in the form of Planning Advice for Developments near Hazardous Installations (PADHI) using a consultation distance (CD) with three zones. PADHI uses 2 inputs to a decision matrix:

- The zone in which a development is proposed; and
- The sensitivity level of the proposed development.

The methodology provides a basis for the HSE decision to 'Advise Against' or 'Don't Advise Against' a proposed development that falls within a consultation distance around a hazardous installation.

The 'risk-based' PADHI methodology is proposed as the basis of a framework for locational guidance for developments in the vicinity of existing potentially hazardous industry (PHI).

Broadly the steps of this proposed approach are:

1. Identify any potentially hazardous industries (PHIs) in the vicinity of the proposed development
2. Confirm or establish the consultation distance (CD) associated with each PHI
3. Check if the development is within the CD of a PHI
4. If the development is within the CD of a PHI, check if the development is of a type that requires consultation
5. Determine which CD zone applies
6. Determine the development type into which the proposed development falls
7. Determine the sensitivity level

8. Apply the CD zone and sensitivity level to the decision matrix
9. Communicate decision: Advise Against (AA) or Don't Advise Against (DAA)

It is proposed that DoP would develop the PHI framework and progressively establish the consultation distances and zones associated with existing potentially hazardous industrial developments that are State significant. Initially, the consultation distances could be based on the results of the Preliminary Hazard Analysis (PHA). In general, consent authorities would implement the framework based on information from the proponent of the proposed development and historical data from previous PHAs (or Final Hazard Analyses [FHAs], if available) undertaken as part of the development approval process for PHI.

Available PHAs and FHAs span a considerable period and represent a range of risk assessment methodologies. Hence, there will probably be a need for DoP to check the studies and perhaps carry out some normalisation of the results to ensure consistency in setting the CDs.

In some cases the Department's own land use safety studies may form the basis for establishing the CDs.

FRAMEWORK ISSUES

Framework issues that require consideration include:

Basis of consultation distance and number of zones

The UK HSE uses three (3) zones: inner (IZ), middle (MZ) and outer (OZ) within the consultation distance. The criteria that determine these zones appear to include the hazard ranges and consequences of the toxic and/or flammable substances present; the volume of those substances for which the site has consent and the method of storage. Specifically, the criteria appear to be consequence-based for thermal and explosion hazards and risk-based for toxic releases.

The consequence basis for thermal and explosion hazards may be justified by the relatively sharp decline of impacts at a specific distance. It is not known if the consequence distance is for a 'representative scenario' or if a 'worst-case credible scenario' is developed. For fire hazards, a thermal dose (TDU – thermal dose unit, $(kW/m^2)^{4/3}s$), representing the product of thermal flux and exposure duration, is used. For explosion hazards, explosion overpressure is used.

For toxic releases, the risk criteria are based on a 'dangerous dose' endpoint that would produce a particular level of toxicity in the general population. For the provision of land use planning (LUP) advice, the level of toxicity used by the HSE is termed the 'Specified Level of Toxicity' (SLOT). The LUP SLOT is defined as:

- Severe distress to almost every one in the area;
- Substantial fraction of exposed population requiring medical attention;
- Some people seriously injured, requiring prolonged treatment; and
- Highly susceptible people possibly being killed.

The 'dangerous dose' concept is applied through the use of a Dangerous Toxic Load (DTL) expression ($DTL = c^n.t$, where c = concentration [ppm], t = time [min] and n is typically 1, 2 or 3). The SLOT DTL is essentially an injurious load, which can cause death in a small proportion (~1%) of the exposed population. The HSE has determined the SLOT DTL for 164 toxic materials and provides guidance on how to determine these DTLs for other toxic materials.

As noted by Lees, for the exposed population as a whole, the HSE take 10^{-5} per year as the upper bound for the risk of exposure to the 'dangerous dose' or worse and 10^{-6} per year as the lower bound. This implies that these figures are also approximately the risk of death for vulnerable people. For the outer zone, the criterion is taken to be one third of the middle zone in order to take into consideration the high vulnerability of specific population groups (eg. elderly people, children, etc.). Table 1 sets out the HSE criteria (as reported by M.D. Christou, *Risk Assessment and Management in the Context of the Seveso II Directive*, 1998).

Table 5: HSE Consultation Zone Criteria

Criteria	Inner zone	Middle zone	Outer zone
Toxic risk	10^{-5} per year	10^{-6} per year	3×10^{-7} per year
Thermal consequences	Fireball radius	1000 TDU	500 TDU
Explosion consequences	60 kPa	14 kPa	7 kPa

It is proposed that the principles of UK HSE methodology be employed but that the criteria be reconfigured to better align with DoP's existing risk criteria.

It is proposed that the consultation distance and its zones be risk-based and defined by the distances to the individual risk fatality contours established by the fatality risk criteria published by the Department in HIPAP 4. Specifically, the zone boundaries are set by the criterion values and form the basis of defining the type of development that should be recommended against, consistent with the description of the type of development within each zone, as shown in Table 6.

Table 6: Risk Criteria for Intensification of Development

Type of Development	Individual Risk Criterion Value
Industrial sites	50×10^{-6} per year
Sporting complexes and active open space	10×10^{-6} per year
Commercial development, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres	5×10^{-6} per year
Residential developments and places of continuous occupancy, such as hotels and tourist resorts	1×10^{-6} per year
Hospitals, schools, child-care facilities, and old age housing development	0.5×10^{-6} per year

Essentially, greater separation distances are imposed as the sensitivity of the proposed development increases. The maximum extent of the CD is set by the 0.5×10^{-6} per year individual fatality risk contour.

The use of risks, rather than consequences, as a basis for defining the CDs is supported by the difficulty of aggregating fire, explosion and toxic impacts unless a consistent basis is used (in this case, risk of fatality). It also prevents distortion of the size of a CD by potentially high consequence but especially low frequency impacts.

DoP has also published injury risk criteria related to heat radiation, explosion overpressure and toxic exposure. However, the injury endpoint is subject to considerable variation as to the degree of injury it represents, lacking the clarity of the fatality endpoint. As experience develops with the consultation distance system the use of injury risk may be considered.

The 50 in a million per year site boundary criterion must be met by the potentially hazardous industry (PHI). No further development should be permitted within the 50 in a million per year boundary.

Boundary setting could be framed in terms of nominating acceptable land uses, consistent with the Queensland approach, however, since the criteria relate to risk avoidance, it is considered more appropriate to provide a basis to recommend against particular categories of development rather than deem certain types of development acceptable.

The DoP risk criteria are somewhat less conservative than those used by the HSE due to the use of the fatality endpoint rather than SLOT dangerous dose.

Development requiring consultation

The UK HSE is a statutory consultation body for a number of types of development. These types of development largely relate to residential, large scale commercial or industrial, or development that has the potential to increase the population density with the consultation zone. A similar approach would be adopted in the DoP framework.

Individual risk criteria may not provide a sufficient basis for advice as the there is a need to consider the scale of the proposed development and its population density. It is proposed to describe in more detail the population density applicable to each type of development, making use of existing DoP documents (e.g. *Residential Population Densities*) wherever possible. The sensitivity levels of the HSE and the land use characteristics development by the Queensland CHEM Unit might also be considered.

If the proposed development exceeds the population density thresholds for each type, then the MHU of DoP will review the acceptability of the risk exposure posed by the development. This review may draw on the 'Scaled Risk Integral' (SRI) technique developed by the HSE.

The SRI technique is derived from the standard societal risk 'FN Plot' concept, but uses the following information to determine a single SRI value:

- Average individual risk results;
- The land use category of each site (eg. Housing, retail, etc.);
- Details of the number of persons (n) at each site;
- The proportion of time each site is occupied by n persons; and
- The area of each site in hectares.

The number of persons ('n') at each site is adjusted by a factor 'c' to accommodate differing categories of development. For developments where the general public may be present (e.g. housing; hotel or holiday accommodation; retail facilities; community or leisure facilities; etc.) a value of 'c' of 1 is suggested by the HSE. Similarly, for developments where vulnerable populations may be present (e.g. hospitals; homes for the elderly; schools; etc.) a value of 4 is suggested, and for industrial, commercial or rural developments where working populations may be present (e.g. factories; warehouses; offices; farm buildings; etc.) a value of 0.25 is suggested.

A 'comparison value' is used for assessment purposes. The basis for the lower 'comparison value' adopted by the HSE is that an individual risk of exposure to a 'dangerous dose' is broadly acceptable at 1 per million per year for a development involving up to 75 people. Assuming an average of 2.5 people per dwelling, 75 people equates to 30 dwellings with a typical land area of 1.2 hectares and the SRI equals 0.5 x $(75+75^2)$ x 1 / 1.2 = 2,375. This limiting case (suitably rounded) gives a lower 'comparison value' of 2,500 (Carter D.A., June 1995).

Where a development is located in an urban area, surrounded by developments of an equivalent classification, then more intensive ('in-fill') development may be permitted (for example 30 dwellings on 0.75 hectares) and an upper 'comparison value' of 4,000 has been adopted by the HSE.

When the SRI is calculated on the basis of individual fatality risk rather than the risk of exposure to a 'dangerous dose', then the 'comparison value' is apparently reduced from 2,500 to 1,100.

If the SRI technique is used, the underlying theory and 'comparison values' will need to be reviewed, and possible adjusted, to ensure an appropriate alignment with DoP's existing individual and societal risk criteria.

Determination of Sensitivity levels

In the HSE approach, the development type, its details and size determine the sensitivity level of the population at the proposed development. Four sensitivity levels are used:

- Level 1 – normal working population
- Level 2 – general public
- Level 3 – vulnerable members of the public
- Level 4 – large scale examples of Level 3

A similar approach would be adopted in the DoP framework. The use of sensitivity levels takes into account differences in vulnerability of classes of exposed people. Rather than using sensitivity levels that introduce further decision points, a simpler approach will be adopted. Population variability is already taken into account in the current DoP risk criteria values and their corresponding land use descriptors. The population densities associated with the land use categories need to be determined.

Type of decision

In the HSE approach, the decision matrix below yields 2 categories of advice: Advise Against (AA) or Don't Advise Against (DAA). There may be scope to introduce a conditional category, however, as noted by the HSE, preparation of a framework guide provides the opportunity for the proponent to work through the procedure and modify the size, layout or location of the proposed development such that the proposed development would not fall into the AA category.

Table 7: Decision Matrix

Level of Sensitivity	Development in Inner zone	Development in Middle zone	Development in Outer zone
1	DAA	DAA	DAA
2	AA	DAA	DAA
3	AA	AA	DAA
4	AA	AA	AA

The HSE has also developed a number of zoning or modification rules that, if appropriate, are applied to the development assessment decision.

A similar approach may be adopted in the DoP framework, in which the MHU of DoP would provide the consent authority with an 'advise against' or 'don't advise against' response. However, a decision matrix is not necessary given the nature of the DoP individual risk criteria and only a couple of sensitivity levels may be necessary to accommodate variations of population density.

IMPLEMENTATION

In the first instance, the Department will be collating and mapping available Information on the risk associated with individual potentially hazardous industrial facilities (PHI). As noted earlier, a possible source of information is the Preliminary Hazard Analysis (PHA) which would typically accompany a development for PHI, or a subsequent Final Hazard Analysis (FHA), depending on the development approval. However, there may be a number of existing PHI facilities for which such studies are not available.

In these cases, it may be possible to establish tentative consultation distances based on information provided by facility operators and using risk approximation methods, such as those set out in the Department's *Multi-level Risk Assessment Guidelines*.

As part of its GIS system, the Department has a mechanism for mapping the extent of consultation distances around facilities, once the risk information is available.

Detailed implementation of the mechanisms suggested in this appendix will require consultation with affected stakeholders.

Appendix 3

Conditions of Consent for Potentially Hazardous Development

Note: The following standard conditions of consent are taken from *HIPAP 12: Hazards-Related Conditions of Consent.* They should be applied in accordance with those guidelines. In particular, Table 2 of HIPAP 12 should be consulted in deciding which of the following conditions should be imposed.

HIPAP 12 includes suggested conditions of consent for three categories of development:

1. Low Hazard
2. Medium Hazard
3. High Hazard

Section 2.3 of HIPAP 12 sets out principles for deciding into which category a particular project falls. Conditions of consent should be tailored to be “fit-for-purpose” in addressing both the category of development and its hazards and risks. The following conditions of consent are for a medium hazard development determined by Council.

Pre-construction

1. At least one month prior to the commencement of construction of the proposed development (except for construction of those preliminary works that are outside the scope of the hazard studies), or within such further period as Council may agree, the Applicant shall prepare and submit for the approval of Council the studies set out under subsections (a) to (d) (the pre-construction studies). Construction, other than of preliminary works, shall not commence until approval has been given by Council and, with respect to the Fire Safety Study, approval has also been given by Fire and Rescue NSW.

   (a) FIRE SAFETY STUDY

   A Fire Safety Study for the proposed development. This study shall cover the relevant aspects of the Department of Planning’s Hazardous Industry Planning Advisory Paper No. 2, ‘Fire Safety Study Guidelines’ and the New South Wales Government’s ‘Best Practice Guidelines for Contaminated Water Retention and Treatment Systems’. The study shall also be submitted for approval to Fire and Rescue NSW.

   (b) HAZARD AND OPERABILITY STUDY

   A Hazard and Operability Study for the proposed development, chaired by an independent qualified person approved by Council prior to the commencement of the study. The study shall be carried out in accordance with the Department of Planning’s Hazardous Industry Planning Advisory Paper No. 8, ‘HAZOP Guidelines’. The study report must be accompanied by a program for the implementation of all recommendations made in the report. If the Applicant intends to defer the implementation of a recommendation, justification must be included.

   (c) FINAL HAZARD ANALYSIS

   A Final Hazard Analysis of the proposed development prepared in accordance with the Department of Planning’s Hazardous Industry Planning Advisory Paper No. 6, ‘Hazard Analysis’.

(d) CONSTRUCTION SAFETY STUDY

A Construction Safety Study prepared in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper No. 7, 'Construction Safety'. For developments in which the construction period exceeds six (6) months, the commissioning portion of the Construction Safety Study may be submitted two months prior to the commencement of commissioning.

Pre-commissioning

2. The Applicant shall develop and implement the plans and systems set out under subsections (a) to (c). No later than two months prior to the commencement of commissioning of the proposed development, or within such further period as Council may agree, the Applicant shall submit for the approval of Council documentation describing those plans and systems. Commissioning shall not commence until approval has been given by Council.

(a) TRANSPORT OF HAZARDOUS MATERIALS

Arrangements covering the transport of hazardous materials including details of routes to be used for the movement of vehicles carrying hazardous materials to or from the proposed development. The routes shall be selected in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper No. 11, 'Route Selection'. Suitable routes identified in the study shall be used except where departures are necessary for local deliveries or emergencies.

(b) EMERGENCY PLAN

A comprehensive Emergency Plan and detailed emergency procedures for the proposed development. This plan shall include detailed procedures for the safety of all people outside of the development who may be at risk from the development. The plan shall be in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper No. 1, 'Emergency Planning'.

(c) SAFETY MANAGEMENT SYSTEM

A document setting out a comprehensive Safety Management System, covering all on-site operations and associated transport activities involving hazardous materials. The document shall clearly specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to the procedures. Records shall be kept on-site and shall be available for inspection by Council upon request. The Safety Management System shall be developed in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper No. 9, 'Safety Management'.

Pre-startup

3. PRE-STARTUP COMPLIANCE REPORT

One month prior to the commencement of operation of the development, the Applicant shall submit to Council, a report detailing compliance with conditions 1 and 2, including:

(a) dates of study/plan/system submission, approval, commencement of construction and commissioning;

(b) actions taken or proposed, to implement recommendations made in the studies/plans/systems; and

(c) responses to each requirement imposed by Council under condition 7.

Post-startup

4. POST-STARTUP COMPLIANCE REPORT

   Three months after the commencement of operation of the development, the Applicant shall submit to Council, a report verifying that:

   (a) transport routes specified under condition 2(a) are being followed;

   (b) the Emergency Plan required under condition 2(b) is effectively in place and that at least one emergency exercise has been conducted; and

   (c) the Safety Management System required under condition 2(c) has been fully implemented and that records required by the system are being kept.

Ongoing

5. INCIDENT REPORT

   Within 24 hours of any incident or potential incident with actual or potential significant off-site impacts on people or the biophysical environment, a report shall be supplied to the Department outlining the basic facts. A further detailed report shall be prepared and submitted following investigations of the causes and identification of necessary additional preventive measures. That report must be submitted to Council no later than 14 days after the incident or potential incident.

   The Applicant shall maintain a register of accidents, incidents and potential incidents. The register shall be made available for inspection at any time by the independent Hazard Auditor and Council.

6. HAZARD AUDIT

   Twelve months after the commencement of operations of the proposed development or within such further period as Council may agree, the Applicant shall carry out a comprehensive Hazard Audit of the proposed development and within one month of the audit submit a report to Council.

   The audit shall be carried out at the Applicant's expense by a duly qualified independent person or team approved by Council prior to commencement of the audit. Further audits shall be carried out every three years or as determined by Council and a report of each audit shall within a month of the audit be submitted to Council. Hazard Audits shall be carried out in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper No. 5, 'Hazard Audit Guidelines'.

   The audit shall include a review of the site Safety Management System and a review of all entries made in the incident register since the previous audit.

   The audit report must be accompanied by a program for the implementation of all recommendations made in the audit report. If the Applicant intends to defer the implementation of a recommendation, justification must be included.

7. FURTHER REQUIREMENTS

   The Applicant shall comply with all reasonable requirements of Council in respect of the implementation of any measures arising from the reports submitted in respect of conditions 1 to 6 inclusive, within such time as Council may agree.

Appendix 4

The Principles of Ecologically Sustainable Development (ESD)

The principles of ESD have been identified in the Intergovernmental Agreement on the Environment (signed by all governments in Australia) and in the Environmental Planning and Assessment Act and Regulations, the Local Government Act, the Protection of the Environment Administration and Operations Acts and an number of other key NSW Government legislation and policy initiatives. The principles are as follows:

(a) the **precautionary principle** - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

  (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

  (ii) an assessment of the risk-weighted consequences of various options,

(b) **inter-generational equity** -namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) **conservation of biological diversity and ecological integrity** -namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) **improved valuation, pricing and incentive mechanisms** -namely, that environmental factors should be included in the valuation of assets and services, such as:

  (i) **polluter pays**-that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

  (ii) the **users of goods and services** should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

  (iii) **environmental goals**, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Appendix 5

Appropriate Preparation and Assessment of Land Use Safety Studies

As indicated in section 4.1.2, the effective implementation of the hazards-related assessment process depends on the various studies being prepared and assessed by people with appropriate competencies. This is particularly true in the case of those facilities where accidents may have serious consequences. This appendix provides guidance on the qualifications and competencies that would be typically be expected of people engaged in the preparation and assessment of land use safety studies associated with such facilities.

The guidance can also be applied to studies associated with other potentially hazardous facilities. Requirements for formal qualifications and in-depth understanding of techniques may be less rigorous in cases where processes and their associated hazards are well defined and well understood, and accidents do not have serious consequences.

SAFETY STUDY PREPARATION

General Requirements

Those preparing the technical studies described in these guidelines would be expected to possess professional qualifications in a relevant scientific or engineering discipline or be able to demonstrate a level of education, training and practical experience commensurate with the requirements of the particular study.

Basic competencies that would be expected, irrespective of specialist skills required for specific tasks (such as calculations associated with quantitative risk analysis) include:

- knowledge and understanding of the hazards associated with the storage, handling and processing of hazardous materials, including dangerous goods;
- the basic concepts of hazard identification, risk assessment and risk control;
- the development and implementation of safety management systems;
- knowledge and understanding of relevant legislation, codes of practice and standards, including relevant HIPAPs; and
- report writing.

Requirements for Specific Studies

Additional core competencies for specific studies are summarised in Table 8.

Table 8: Competencies Matrix for Preparation of Specific Studies

Competencies by study	PHA/FHA	HAZOP	Fire Safety	Emergency Plan	Construction Safety	SMS	Hazard Audit	Comments
Material and process hazards	X	X	X			X		
Hazard identification, risk assessment and risk control	X		X	X	X			Expertise in QRA, including modelling techniques may be needed, depending on the nature of hazards and risks
HAZOP techniques		X						For computer-controlled processes, an understanding of CHAZOP may be needed
Safety Management Systems					X	X	X	
Fire system design			X					Including contaminated water retention issues

SAFETY STUDY ASSESSMENT

General Requirements

Ideally, individuals or teams involved in the assessment of safety studies should have and equivalent range of technical skills to those carrying out the studies. At the very least, they need to understand the key technical issues in order to be able to identify areas where they may need to seek external advice.

Irrespective of the type of safety study report being assessed, an assessor will need to have an understanding of:

Analytical techniques: different approaches to, and methods of, analysing information and how to select method appropriate to the assessment decisions which need to be made; how to judge the accuracy, relevance and sufficiency of information required to support decision making in the assessment of the study reports; how to identify information, which may be inadequate, contradictory or ambiguous, and how to deal with these in the context of the assessment process.

Information handling: how to select information relevant to the decisions to be made; the importance of record keeping to the analysis of the information, and how such records should be kept for the assessment of safety reports.

Land Use Safety Planning Framework: a thorough understanding of land use safety planning concepts and the purpose of, and relationship between, the various studies.

Current Regulatory Requirements: an understanding of relevant statutory requirements under major hazards legislation, planning legislation and associated planning instruments, such as SEPP 33.

Acceptability Criteria: an understanding of the basis on which studies are to be assessed and the relevant assessment criteria, as noted later in this appendix.

Specialist Requirements

People responsible for the assessment of safety studies need knowledge and understanding in two broad areas: skills that underpin the process of assessment, as noted above, and, secondly, specialist expertise related to the nature of the information contained in the study report. The detail of that specialist knowledge will vary from study to study but will broadly fall into the following categories:

- understanding and application of risk assessment
- understanding and assessment of safety management systems
- understanding and evaluating site operations, materials and processes
- understanding and evaluating the application of the principles of process safety in the storage, handling, process and transporting of hazardous substances.

Specialists responsible for assessing reports of quantitative risk analysis studies may need to be able to use mathematical models and use associated software when appropriate in evaluating the validity of the study's predictions.

Requirements for Specific Studies

Table 9 summarises areas of expertise that an assessor may need or be able to draw on during the assessment of specific studies. They broadly mirror the requirements in Table 8.

Table 9: Competencies Matrix for Assessment of Specific Studies

Competencies by study	PHA/FHA	HAZOP	Fire Safety	Emergency Plan	Construction Safety	SMS	Hazard Audit	Comments
Material and process hazards	X	X	X			X		
Hazard identification, risk assessment and risk control	X		X	X	X			Expertise in QRA, including modelling techniques may be needed, depending on the nature of hazards and risks
HAZOP techniques		X						
Safety Management Systems					X	X	X	
Fire system design			X					Studies may be referred to Fire and Rescue NSW for advice

SAFETY STUDY ASSESSMENT CRITERIA

The key requirement of any safety study is that it be ‘fit-for-purpose’. A simple definition is:

> 'sufficiently comprehensive to fully meet the requirements but without superfluous detail'.

The term is a recognition that facilities vary widely in their size, complexity and the types and magnitude of risk that they present. Hence, guidance material sets out a range of requirements that may not apply in every case. A 'fit-for-purpose' approach matches the depth of analysis and documentation associated with a particular study to the specific circumstances of the facility, without compromising fundamental principles and requirements.

The Department is presently preparing an assessment protocol for studies and reports required by the standard hazards-related conditions of consent.

Table 10 is a guide to the various DoP publications providing guidance of the assessment basis for various studies.

Table 10: Study Specific Assessment Criteria Sources

Study	Information Source(s)
PHA/FHA	HIPAP 6 – *Guidelines for Hazard Analysis* *Multi-level Risk Assessment Guidelines* See also Table 2 of this paper.
HAZOP	HIPAP 8 - *Hazard and Operability Studies*
Fire Safety Study	HIPAP 2 - *Fire Safety Study Guidelines*
Emergency Plan	HIPAP 1 – *Industry Emergency Planning Guidelines*
Construction Safety Study	HIPAP 7 - *Construction Safety Study Guidelines*
Safety Management System	HIPAP 9 – *Safety Management*
Hazard Audit	HIPAP 5 - *Hazard Audit Guidelines*

Additional Information

Relevant DoP Publications

Hazardous Industry Planning Advisory Papers (HIPAPs):

No. 1 - Emergency Planning
No. 2 - Fire Safety Study Guidelines
No. 3 - Risk Assessment
No. 4 - Risk Criteria for Land Use Safety Planning
No. 5 - Hazard Audit Guidelines
No. 6 - Hazard Analysis
No. 7 - Construction Safety
No. 8 - HAZOP Guidelines
No. 9 - Safety Management
No. 10 - Land Use Safety Planning
No. 11 - Route Selection
No. 12 - Hazards-Related Conditions of Consent

Other Publications:

Applying SEPP 33: Hazardous and Offensive Development Application Guidelines

Multi-level Risk Assessment

Locational Guideline: Liquefied Petroleum Gas Automotive Retail Outlets

Locational Guideline: Development in the Vicinity of Operating Coal Seam Methane Wells

Electronic copies of some of these publications are available at:
www.planning.nsw.gov.au