GUIDELINES

LICENCE ASSESSMENT GUIDELINES

GUIDELINES FOR USING A RISK MANAGEMENT APPROACH TO ASSESS COMPLIANCE WITH LICENCE CONDITIONS

Publication 1321.2* June 2011
Authorised and published by EPA Victoria, 200 Victoria Street, Carlton.

These guidelines should be used in preparing your annual performance statement. There is a summary of key changes from the previous version at the end. Comments may be submitted in writing to EPA via email to mailto:licensing.reform@epa.vic.gov.au or to the Project Coordinator — Licensing Reform, GPO Box 4395 Melbourne 3001, by 24 August 2011.

* This replaces publication 1321.1, released May 2010.

1 INTRODUCTION 3
2 PURPOSE 3
3 HOW YOU ASSESS YOUR OPERATIONS 3
3.1 THE RISK MANAGEMENT FRAMEWORK 3
4 RISK ASSESSMENT 6
4.1 ESTABLISH THE CONTEXT OF THE ASSESSMENT 6
4.2 IDENTIFY RISKS 8
4.3 RISK ANALYSIS 10
5 MONITORING 15
5.1 DEVELOP OR MODIFY A MONITORING PROGRAM 15
5.2 MONITOR 19
6 ANALYSIS AND REVIEW 21
6.1 DATA ANALYSIS AND INTERPRETATION 21
6.2 DRAW CONCLUSIONS 21
6.3 REPORT FINDINGS 22
DEFINITIONS 23
REFERENCES 24
APPENDIX A: CASE STUDIES 25
CASE STUDY 1 – THE SHEARER'S BACK HOTEL 25
1 BACKGROUND 25
2 AIMS 25
3 EPA LICENCE 25
4 RISK ASSESSMENT 26
CASE STUDY 2 – TIGER TANKS 32
1 BACKGROUND 32
2 AIMS 32
3 EPA LICENCE 32
4 RISK ASSESSMENT 33
CASE STUDY 3 – THE BOURKE SEWAGE TREATMENT PLANT 40
1 BACKGROUND 40
2 AIMS 40
3 RISK ASSESSMENT 40
4 MONITORING PROGRAM 51
5 RECOMMENDATIONS 57
ATTACHMENT A: PREMISES PLAN 59
CASE STUDY 4 – OLIEBOLLEN OIL RECYCLERS 60
1 BACKGROUND 60
2 AIMS 60
3 RISK ASSESSMENT 60
4 MONITORING PROGRAM 72
ATTACHMENT A: ENVIRONMENTAL MONITORING MATRIX 74
ATTACHMENT B: PREMISES PLAN 75
CHANGES MADE TO 1321.1 LICENCE ASSESSMENT GUIDELINES 76

1 INTRODUCTION

Every licence issued by EPA Victoria requires the licence-holder to have a monitoring program in place that enables the licence-holder and EPA to determine compliance with the licence. EPA expects businesses to have robust systems and processes in place to ensure that performance against the licence is adequately assessed and demonstrated.

Licence conditions are designed to address environmental hazards present at the various scheduled premises. Largely, they focus on environmental outcomes that need to be achieved. Following the risk identification and management process described in these guidelines will help businesses gain a better understanding of how their operations interact with the surrounding environment and how to determine licence compliance.

These guidelines are designed to assist holders of single-site, corporate and accredited licences to establish an appropriate monitoring program. Licence-holders may choose to engage a consultant to assist in this process. Businesses with established monitoring programs or environmental management systems may continue to use them. However, they should be reviewed and updated to ensure the licence condition requirements are being met. Businesses are no longer required to submit their monitoring programs to EPA for approval.

The risk management approach outlined in this document is based on the framework in the Australian Standard AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines*. While the guidance provided is generic in nature, it includes practical examples demonstrating likely outputs for the different stages of the assessment. Four case studies are included in the appendices to provide examples of risk-based approaches to preparing licence compliance monitoring programs.

This document **does not** cover specific monitoring requirements for particular industry sectors, specific sampling methodologies and techniques, occupational health and safety (OH&S) issues or suggestions on how businesses can deal with risks resulting from their licensed activities (risk treatment).

These guidelines present information and methods describing how to conduct a risk assessment and develop a monitoring plan that might take some time to grasp. In order to assist with this process, you may wish to look first at Case Study 1 (Shearer's Back Hotel) before reading the main body of these guidelines.

2 PURPOSE

The purpose of this document is to guide licence-holders through the process of developing a risk-based monitoring program that will enable them to determine and report compliance with their licence. For licence-holders to confidently claim and sign off their APS, attesting to compliance, they must hold documented monitoring results that support the signed declaration made in the APS.

This document provides EPA licence-holders with guidance for:

- conducting a risk assessment to inform monitoring needs
- developing a risk-based monitoring program
- assessing data from the monitoring program
- using the data to check compliance with licence conditions
- using the data to review site risks, inform management options and drive continuous improvement.

This guidance is designed to:

- guide development of a risk-based monitoring program that enables licence-holders and EPA to assess compliance with licence conditions
- give the chief executive officer (CEO) or equivalent manager greater confidence when signing their APS
- help licence-holders efficiently and effectively allocate resources for managing environmental risks at their site.

3 HOW YOU ASSESS YOUR OPERATIONS

This section provides an overview of the principles and framework for conducting an assessment of your operations.

3.1 The risk management framework

The risk management framework outlined in Figure 1 shows the main steps involved in completing an assessment of your operations within the context of your licence conditions. Existing assessment and monitoring programs maintained by licence-holders should be consistent with this process. Where such a program is not in place, you should develop one in accordance with these guidelines.

Regular review and revision of each of the steps of the risk management framework is required because business operations and the surrounding environment are rarely static. New hazards that may arise or be identified need to be managed according to their potential likelihood and consequence.

3.1.1 Detail of risk assessment and monitoring program

The level of complexity and detail of the risk assessment and monitoring program should reflect:

- the conditions in your licence
- the scale of your operations
- your industry type
- the environmental hazards associated with your activities
- the level of risk for each of those hazards.

The framework in Figure 1 is based on that described in Australian Standard AS/NZS ISO 31000:2009, *Risk management – Principles and guidelines*. It does not, however, include all parts of the described process, in particular the treatment of risks. This should be part of standard operational management but is not required for the purpose of demonstrating compliance with licence conditions. It also includes elements of the process described in Australian Standard ISO 14001:2004, *Environmental management systems – requirements with guidance for use*.

Assessment principles

When undertaking an assessment of your operations with respect to your licence conditions, applying these principles will help ensure that the assessment and monitoring programs are targeted, worthwhile and meet the needs of EPA, your business and stakeholders.

Risk-based

Any assessment of the environmental impact of a business's operations must be risk-based. This will help identify the high priority risks, guide resource investment and management, and assist with the development of a monitoring program that is proportional to the risk posed by environmental hazards at the site.

Fit for purpose

Assessment of operations must reflect environmental management goals and objectives. The monitoring program must be designed to collect and analyse sufficient relevant information to meet the goals and objectives.

Transparent

Documentation from an assessment program must be clear and understandable to stakeholders. It must include a record of the purpose, identified risks, monitoring plans, results, and explanations of decisions and actions taken in response to the results.

Scientifically rigorous

Sample collection, preservation, handling, data analysis, validation and reporting of results should be scientifically rigorous, quality assured and quality controlled, thus ensuring that monitoring results are reliable, credible and meet the defined objectives.

Best practice

Best-practice techniques, methods, processes or technology based on recognised and established standards and operating practices are preferred. EPA will support new and emerging technologies that can be shown to benefit environmental protection at the site.

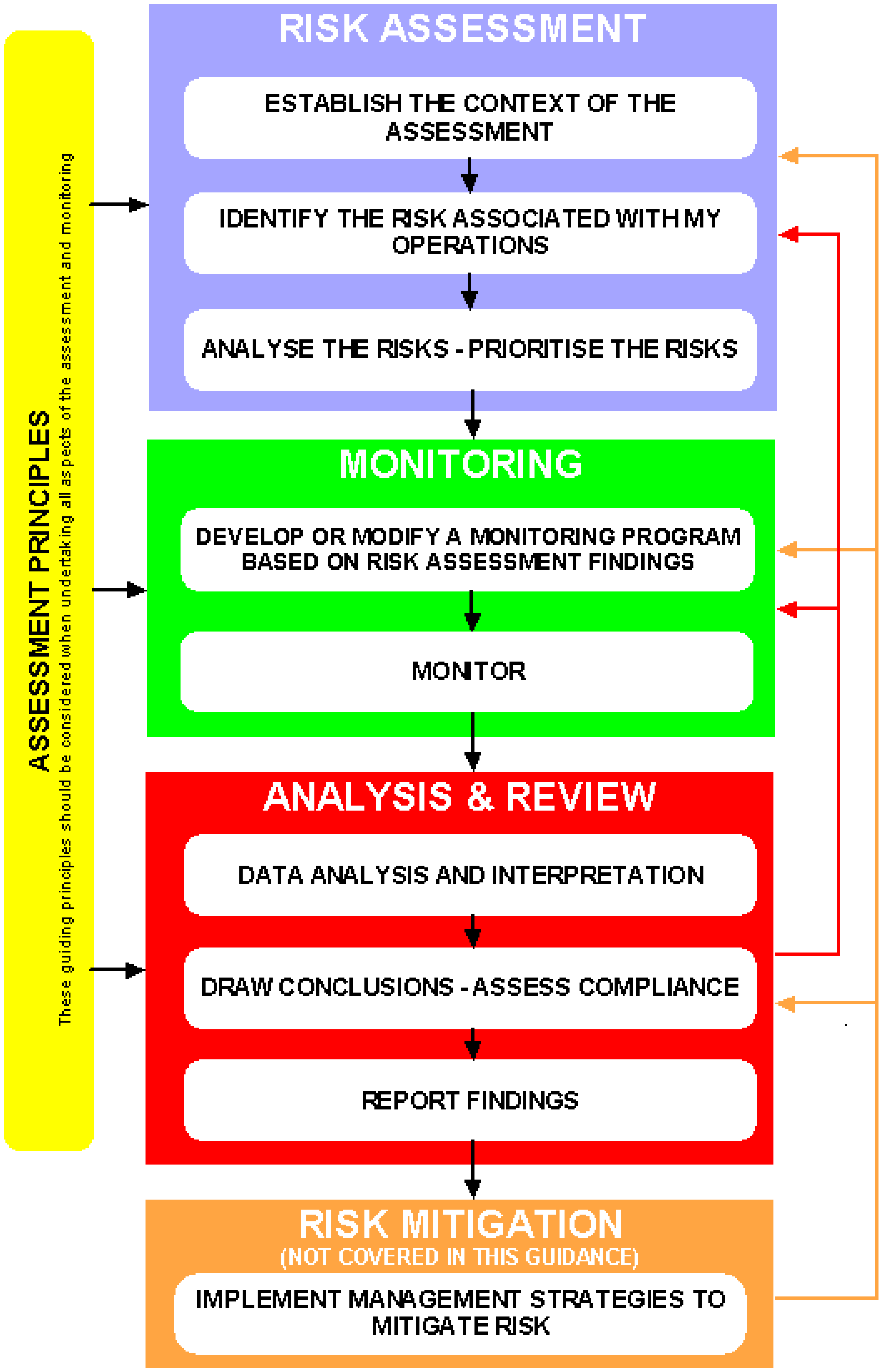


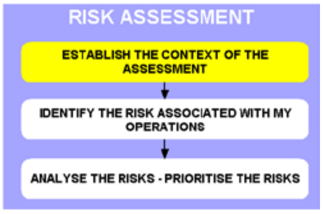
Figure 1: Framework for using a risk management approach to assess the risks of a site's activities

4 RISK ASSESSMENT

What are your licence obligations? What are the risks? Which are the most important? Where do they occur? Who needs to be involved to build your program? This section shows you how to set the context for your monitoring program by identifying and assessing your environmental risks and answers each of these questions.

At the outset, the risk assessment process may seem complex. The structured process described below is designed to help you to develop a defensible, risk-based monitoring program that can be used to demonstrate performance against your licence conditions and identify potential opportunities for continuous improvement.

4.1 Establish the context of the assessment



Establishing the context of the risk assessment enables you to identify the bounds of your risk assessment and the issues – such as company policies, stakeholder interests, regulatory requirements and cultural performance standards – that will drive the assessment. The outcomes of establishing the context will influence decisions on the acceptability or treatment of risks.

4.1.1 Identify and consult with stakeholders

Stakeholders can be both internal and external. Consulting with stakeholders early in the assessment process provides interested parties with an opportunity to express their thoughts about the site's performance and ongoing environmental risks. It also gives everyone clarity about the assessment process and how decisions are made.

For businesses that already have assessment and monitoring programs, it is important to review information obtained during previous stakeholder consultation and to review stakeholder involvement, including the need to consult additional stakeholders in the future.

Internal stakeholders

Key internal stakeholders should be consulted during the assessment, as this encourages accountability and ownership of risk (AS/NZS ISO 31000:2009). These can include in-house experts, section managers, general managers and, importantly, personnel involved in running the components of the business.

The following quote from the Australian Standards handbook HB 203:2006, *Environmental risk management – Principles and process*, emphasises the importance of involving all relevant internal stakeholders:

> Risk management involves everyone, and is never just the responsibility of the CEO, managers, or the organisation's risk consultant. It requires commitment and energy from top management through to the employee who may be the first to see an incident, a potential hazard, or an opportunity for improvement.

External stakeholders

External stakeholder consultation is an important element of the risk assessment process, particularly when there is a large amount of community concern or interest, or there are people with a vested interest in the business (see Text box 1 for some examples of external stakeholders).

External stakeholder consultation *may not apply for all licence-holders*, especially if there is no external interest in the site's activities, or the risks posed by operations are low. In other cases, external stakeholders may need to be kept up to date on the progress of an assessment and the key outcomes and outputs driving management strategies, or they might be actively involved in the planning phase of the risk assessment. Some licence-holders may have external stakeholders actively involved throughout the risk assessment process.

Overall, stakeholder input into the risk assessment process can add value, and the information gained can be used when making management decisions. It can also give the community confidence that businesses are meeting their licence obligations.

Text box 1: Examples of external stakeholders

- Industry representatives.
- Relevant state agencies.
- Local government.
- Scientific and technical experts.
- Adjacent landholders, including residential neighbours.
- Local community groups.

For further information on stakeholder consultation and its benefits, refer to AS/NZS ISO 31000:2009, *Risk management – Principles and guidelines*, or HB 203:2006, *Environmental risk management – Principles and process*.

4.1.2 Identify environmental management goals and objectives

For most licence-holders, the primary environmental management goal will be the licence conditions (such as A1 – offensive odours must not be discharged beyond the boundaries of the premises). However, you might take the opportunity to think about other environmental goals and include them in the assessment.

Environmental management goals are broadly stated objectives that give direction and focus to an assessment of operations. Broad goals can be broken down into more specific environmental management objectives (EPA 2009b). See Text box 2 for an example.

Clear goals and objectives must be set and understood by everyone involved at the start of the assessment. This ensures the data and information collected, as part of the risk assessment and monitoring program, will be aimed at achieving the identified goals.

Text box 2: Example of environmental management goals and objectives

Environmental management goals for a car manufacturer, focusing on the paint-spraying aspect of the business, might include these:

1. To dispose of waste generated from the site's activities in an appropriate manner.
2. To prevent discharge of nuisance airborne particles beyond the boundaries of the premises.
3. To prevent discharge of offensive odours beyond the boundaries of the premises.
4. To keep stormwater discharged from the premises free of contamination.

These goals could be broken down into more specific environmental **management objectives**, such as these:

- 1a) Dispose of all chemical waste (mostly solvent-based fluids), using a licensed waste transporter, to an appropriately licensed recycling facility.
- 1b) Recycle waste where appropriate.
- 2a) Prevent visible contamination of neighbour's property (e.g. paint aerosol deposits on surfaces).
- 2b) Prevent overspray being emitted into the surrounding environment by maintaining an effective air filter servicing the spray booth.
- 3a) Reduce the use of highly odorous products or replace them with less odorous materials.
- 4a) Treat wastewater using appropriate equipment.

4.1.3 Identify existing information and data

Existing information and data generally include past environmental monitoring results (see Text box 3 for an example of how such information can be used). In some situations, there may be information about the environment to which a business discharges (for example, water quality and biological data of a receiving water body). Integrating historical information and data into the assessment provides a stronger basis for identifying, defining and analysing risks, will improve the understanding of the impacts and may highlight knowledge gaps.

Text box 3: Example of the importance of existing information and data

A printing factory's monitoring data from the past five years indicate the plant has been operating at consistent production levels, and has emitted levels of volatile organic compounds (VOCs) well below the limits specified in the EPA licence. This business monitors its emissions quarterly. Based on the findings from the monitoring data (consistency in emissions, with a margin for safety), this company may decide to scale back monitoring efforts (only if operational processes and equipment used does not change), and/or measure a proxy indicator, such as the amount of solvent used that emits the VOCs. The freed up resources may be allocated to monitoring other risks, or investing in equipment upgrades. Although the risk in this case is low, some level of monitoring is still necessary.

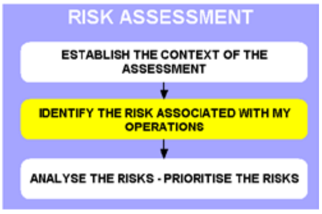
4.1.4 Determine the spatial boundary of the assessment

The spatial boundary of the assessment needs to be the area in which impacts may occur. When setting the spatial boundary for your risk assessment, you need to consider how far-reaching the impacts of your site's activities are. You may, for example, need to assess potential impacts of your operations at sensitive receptors beyond the boundary of your premises (Text box 4).

Text Box 4: Example determining the spatial boundary for an assessment

A business that generates a lot of noise as part of its regular operations is required by their licence to assess whether those operations are causing unacceptable noise beyond the boundary of the premises. Therefore, the business needs to assess the noise levels of its operations beyond the boundary of its premises with regard to their potential to be objectionable to neighbouring residents. This defines one part of the spatial boundary of the assessment.

4.2 Identify risks



Risk identification is the process of finding out what can happen, and where and when it might happen; that is:

- the sources of the risk – what activities (hazards) at your site pose a threat to the environment
- incidents or events that can lead to the hazard being realised and their consequence
- components of the environment that can be affected by those risks (the receptors)
- what can happen to those components of the environment due to your site's activities (the environmental impacts).

Collecting reliable information about your site's risks is vital for gaining a full understanding of the implications of your site's activities. Once collected and assessed, this information should be summarised in a risk identification table. This information is used to complete the risk register (see receptors).

4.2.1 Identifying the sources of risk

For you to be able to identify the risks that your operations pose, you must first identify each of your operational activities or situations that can interact with the environment – your 'environmental aspects'. You then consider the hazards associated with each of those environmental aspects, followed by events that can bring about the harm a hazard might present. Table 1 (adapted from HB 203:2006, *Environmental risk management – Principles and process)* illustrates this process. More examples of environmental aspects and hazards are provided in Text box 5, Table 1 and the case studies.

Table 1: Example risk identification table

Environmental aspect or hazard	Potential event or incident	Potential consequence	Receptor or surrounding environment	Potential environmental impact
Irrigation of a nearby golf course with wastewater containing nutrients.	Excessive application of nutrients to land due to over-irrigation with the wastewater.	Contamination of groundwater.	Groundwater.	Use of groundwater limited due to contamination.
Storage of bulk oil in a purpose-built hydrocarbon storage tank.	Fitting near base of tank fails.	Oil escapes to stormwater drain.	Stormwater drain runs to waterway.	Fish kill due to physical and chemical properties of the oil.
Storage of an odorous chemical in a vented tank fitted with an activated carbon canister to capture vapour.	Tank vents in hot weather and odour treatment canister fails.	Plume of odorous chemical discharged to air.	Residents downwind of tank.	People affected by offensive odour.

EPA VICTORIA

Text box 5: Example of environmental aspects and hazards

Examples of environmental aspects and associated hazards are:

Environmental aspect	Hazard
Chemical storage.	The toxicity or odorous nature of the chemicals stored.
Production of wastewater.	High salinity, nutrient or bacterial levels in the wastewater.
Production of industrial waste.	The toxicity of substances contained in the waste.

Conceptual model

Hazard identification can be assisted by developing a conceptual model to represent the operations and their interaction with the surrounding environment. A conceptual model can be a flow diagram, web diagram or a diagrammatic representation of the site layout (see case studies 3 and 4) that depicts the relationships between:

- site activities, hazards and the environment
- risk pathways
- impacts on environmental receptors.

Developing a conceptual model has several benefits, including:

- providing an easily understandable communication tool for conveying the risks, assumptions and uncertainties to all parties (EPA Victoria 2009b)
- encouraging businesses to think through and clarify their assumptions about cause-effect relationships (how hazards and environmental aspects affect receptors)
- identifying knowledge gaps and determining data needs
- assisting with the development of monitoring programs
- providing a holistic view of a site's operations.

Models will vary in complexity, depending on the premises and associated risks, and should be tailored to fit the level of analysis required for the risk assessment. Premises with operations that present a low risk may have a very simple model, whereas premises that present many high risks and complex interactions may require a series of models to represent all relationships.

It is also important that, where any assumptions have been made or knowledge is incomplete, these are identified, reviewed and documented as uncertainties. Data and information can be collected through monitoring to address these knowledge gaps and update the model (EPA Victoria 2009b).

4.2.2 Identifying the receptors

Describe the surrounding environment

Determining the impacts your operations have on the environment initially involves identifying all major elements of the surrounding environment. These may include biological components (such as animal and plant communities), social components (nearby residential areas, cultural land uses), and physical components (local airshed, land, groundwater).

List the receptors

The second step involves listing the receptors within each of the identified elements. Receptors are entities of the receiving environment that can be exposed to an impact from a site's activities (see Text box 6 for some examples). They can range in extent depending on the reach of your site's impacts, can include residents and can be a subset of the natural or physical environment, or the beneficial uses of the surrounding land. Identifying the receptors in the receiving environment is important for identifying the priority risks and the implications of their impacts. The impact to receptors needs to be measurable.

Text box 6: Examples of receptors

- Aquatic fauna subset (such as fish and aquatic bugs).
- Nearby residents.
- A food chain.
- A habitat.
- An entire ecosystem.

4.2.3 Identifying the potential environmental impacts

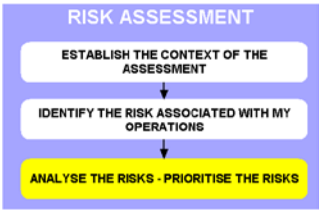
Once the hazards, environmental aspects, and receptors have been identified, the known or potential environmental impacts from your operations need to be assessed. Considering events or incidents that can lead to an environmental impact can assist with this process.

A useful tool for identifying environmental impacts is to draw up a table listing the environmental aspects against which the associated potential environmental impacts are listed (see Table 1 and Case Study 1). This helps to set out the interactions and can reveal where there might be a number of impacts associated with one aspect of the operations or a number of aspects that have a common environmental impact. Another way of identifying potential environmental impacts is to look at how an event involving each part of your operations can affect the receiving environment.

4.2.5 Existing controls

Operational or systems controls can be used to reduce the level of environmental risk posed by operations. The effectiveness of existing controls is an important consideration when evaluating the potential impact and the severity of that impact if it were to occur. Operational controls are usually reviewed after the risk evaluation step of the risk assessment process to determine if risk treatment requires modification to reduce environmental risks to an acceptable level.

4.3 Risk analysis



Risk analysis involves developing an understanding of risks at the site, allowing you to:

- determine the relative size of each risk
- prioritise the risks
- decide whether the risk is tolerable
- consider options for treatment of risks that are not tolerable.

Analysing the risks involves determining the likelihood of a risk occurring and the consequence if it occurs. Using this information, you can prioritise your site's risks and separate minor risks (including what may be tolerable) from the major ones. This information is used to develop a fit-for-purpose monitoring program, inform decisions concerning management strategies and is entered into the risk register.

Involvement of personnel from all areas of the operations in risk identification and analysis is valuable, as each person is best placed to identify the risks and impacts associated with their area of responsibility. It is also advisable to break staff into smaller groups, or have them individually analyse the site's risks. This will give everyone the chance to provide their opinion and highlight variation in opinions about the site's risks.

The risk analysis approach below is based on HB 203:2006, *Environmental risk management – Principles and process*.

4.3.1 Assessing likelihood

The likelihood of each risk occurring (in a qualitative risk assessment) is assessed using descriptions such as those shown in Table 2. Remember that you are free to modify these descriptions to meet your operational context, but you should ensure that they are distinct, can be understood by onsite personnel and can pass the test of being applied to real examples at your site.

There are usually five rating levels selected, but some risk assessors may choose to have six or seven rating levels to provide a greater level of resolution. Care should be taken when using more than five rating levels, as the process may rapidly become unmanageable unless you have experience in this type of analysis.

Table 2: Qualitative measures of likelihood

Level	Indicator	Frequency
A	Almost certain	Is expected to occur almost all of the time.
B	Likely	Is expected to occur most of the time.
C	Probable	Might occur.
D	Unlikely	Might occur but not expected.
E	Rare	Only expected to occur under exceptional circumstances.

4.3.2 Assessing consequence

The descriptions in Table 3 illustrate how you can assess the consequence or impact of each risk if an event were to occur. Again, you should use descriptions or measures that meet the specific needs and nature of your operations, and you may choose to have a different number of levels.

Table 3: Qualitative measures of consequence

Level	Indicator	Description
1	Severe	Death, substantial offsite impacts to broader environment, long-term environmental damage, extensive clean-up required, complete failure of environmental protection controls.
2	Significant	Hospitalisation required, offsite impacts to a segment of the environment, medium-term environmental damage, offsite clean-up required, breach of environmental legislation.
3	Moderate	Medical attention required, some offsite, temporary impacts, moderate onsite impacts.
4	Minor	First aid required, minimal onsite impacts immediately contained, no discernible offsite impacts, no external complaints received.
5	Negligible	No health impacts, negligible onsite impacts, no offsite impacts.

4.3.3 Assessing the level of risk

The level of risk is a combination of the likelihood of a risk occurring and the consequence of it occurring. Using a matrix such as those in tables 4a and 4b, the level of risk posed can be determined. Additional risk categories may be added, based on your business needs; however, there must be a clear difference between each category. As always, you need to clearly define what the levels of risk mean to you (see definitions for this example below Table 4).

If you develop your own risk analysis matrix, check its suitability by running a few scenarios through it to see if the identified risk ratings are appropriate to your operations (conduct a sensitivity check). The distribution of levels of risk can vary within the matrix, depending on your risk assessment needs. However, weighting the matrix too heavily towards one end or other of the risk scale will bias your results. Such a weighting may be appropriate in some circumstances (for example, with parachute jumping, where you would have a bias towards higher risk ratings, as your tolerance of failures would be very low). Two examples are provided below.

Table 4a is adapted from HB203:2006, *Environmental risk management – Principles and process*, and might be used for a site with a greater sensitivity to environmental hazards or where more hazardous materials are handled, whereas 4b might be used for a site with a greater tolerance of environmental hazards.

Table 4a: Qualitative risk analysis matrix – Level of risk, Example A

	Likelihood				
Consequence	**A Almost certain**	**B Likely**	**C Probable**	**D Unlikely**	**E Rare**
1 Severe	V	V	V	V	H
2 Significant	V	V	V	H	H
3 Moderate	V	H	H	M	M
4 Minor	H	H	M	L	L
5 Negligible	H	M	L	L	L

Table 4b: Qualitative risk analysis matrix – Level of risk, Example B

Consequence	Likelihood				
	A Almost certain	B Likely	C Probable	D Unlikely	E Rare
1 Severe	V	V	V	H	H
2 Significant	V	H	H	H	M
3 Moderate	V	H	M	M	M
4 Minor	H	M	M	M	L
5 Negligible	H	M	L	L	L

V = Very high risk; immediate action required.
H = High risk; management required from senior staff; check monthly.
M = Moderate risk; specify required management; check every three months.
L = Low risk; manage with standard operating procedure; check annually.

4.3.4 Risk register

The risk register documents the hazards and environmental aspects of your site's activities, their potential impact and an analysis of the level of risk posed. It should be completed for all identified risks. Your site's hazards, environmental aspects and their impacts may have been documented in a risk identification table, as part of the risk identification process. To complete the risk register provided in this document (see Table 5) for each of the identified risks, businesses should identify:

- the date of the analysis
- the location of the hazard
- the category the hazard falls into (e.g. water, air)
- the existing controls to mitigate the risk
- the likelihood of the risk occurring (from Table 2)
- the consequence if the risk should occur (i.e. the impact on receptors from Table 3)
- the level of risk posed (from Table 4)
- any further comments (this could include risk mitigation strategies).

Table 5 is an example risk register adapted from HB 203:2006*.* You should follow this format, though additional columns can be included where they add value to the risk analysis.

Risk registers should be updated when there is a significant change in operations or risk profile. Regular site inspections and monitoring data provide an excellent opportunity to validate and expand on the information in the risk register.

4.3.5 Evaluating the risks to inform risk management and monitoring needs

The identified risks are prioritised using the information in the risk register. This must take into consideration what is acceptable to you, the community, EPA and other stakeholders. The risks can be broadly categorised as 'acceptable', 'unacceptable but tolerable' and 'unacceptable and intolerable' (HB 203:2006). Another example set of categories for risks is 'acceptable without review', 'acceptable with review', 'undesirable' and 'unacceptable'.

Prioritising risks will target management actions to prevent and manage those with greater risks, such as:

- checking existing control measures for effectiveness
- updating existing controls to make them more effective
- incorporating and implementing new control measures (this could include upgrading equipment or using alternative materials) to prevent or lower the level of risk.

This process will also drive monitoring effort, as more effort should be invested in monitoring higher priority risks than the lower, more tolerable risks. Monitoring data will also help to review the effectiveness of the various control measures and help verify or discount the perceived risk. In some cases it may be viable to hire an EPA-appointed auditor to perform an environmental audit of risk to the environment from your industrial process. (This is not required by EPA unless specified, but may be conducted as part of voluntary due diligence.) It is important to note that activities presenting a low risk to the environment still need to be monitored, typically at a lower frequency than for the higher risk activities.

Overall, you can tailor this process to meet your needs and to suit your operations but, as noted above, you should conduct a sensitivity check of the descriptions and the structure of the risk matrix to ensure it covers all potential events and produces a useful and justifiable risk analysis matrix.

Table 5: Example risk register

Date	Location	Environment element	Aspects (activities/ emissions for each phase of project)	Potential impact	Pathways for risk (factors influencing risk occurring)	Existing control	Likelihood	Consequence	Level of risk	Comments
[Include the date of assessment]	[Indicate where the hazard is located. This might be a readily recognised description of the location or GPS coordinates.]	[Indicate what element the risk relates to. For example; air, water, and land.]	[List the environmental aspects and hazards of the site.]	[Describe the potential consequence if an incident were to occur.]	[What are the things that increase the likelihood of the risk occurring?]	[What are the controls that are in place to try and prevent or mitigate the risk?]	[Insert the 'likelihood level' from Table 2.]	[Insert the 'consequence level' from Table 3.]	[Insert the 'level of risk' from Table 4. Including the colour code for the level of risk helps to visualise the results.]	[Include any additional comments that are relevant to interpretation of the level of risk. See level of risk descriptors in 4.3.3.]
01 Sep 2009	Discharge point 1, at the rear of the property behind building 15.	Water	Wastewater with high nutrient levels being discharged to receiving waters.	Algal blooms leading to fish deaths and ecosystem degradation. Also preventing recreational use of the waterway by swimmers and boaters etc.	Low flow of receiving waters, sunlight and elevated water temperature. Issues with treatment of the wastewater, such as equipment failure.	Secondary treatment of wastewater. Maintenance of treatment processes and equipment.	B	3	High	Looking to upgrade the level of wastewater treatment, so will re-address the level of risk when upgrade is done.
01 Sep 2009	Tank farm	Air	Storage of odorous chemicals.	Offensive odours reducing amenity of downwind areas.	Tank venting via carbon canister – failure of canister.	Carbon canister used to adsorb chemicals.	E (due to frequent servicing)	2	Medium	Canister requires regular servicing to maintain this level of risk

5 MONITORING

Now that you're clear on your obligations and what risks your operations pose to the environment, you can determine how you will monitor them. In this section guidance is provided on what to monitor, how often, where to undertake that monitoring and how to go about it.

The aim of your monitoring program is to determine and demonstrate compliance with your licence conditions. Which aspects of your operations or discharges need to be monitored will have been identified by the risk assessment.

Existing environmental management systems at some premises will include structured monitoring programs. In this case you should check (using this guidance) whether the program is sufficient to demonstrate compliance with the licence conditions.

The amount and type of monitoring will depend on the risk posed (in other words, higher risks would warrant greater monitoring effort), the variability of operations (for example, the less predictable operational processes are, the more monitoring may be required), and the surrounding environment (the more sensitive the receptors are, the greater the monitoring needed).

Types of monitoring

Monitoring that might be conducted to assess compliance with licence conditions may be continuous, semi-continuous (regular), baseline or incident-based. Some or all of these may make up a monitoring program.

Continuous monitoring is non-stop monitoring of an indicator or operational process – usually a more critical indicator, such as particles or oxides of sulfur in a discharge to air. Semi-continuous, or regular, monitoring is hourly, daily, weekly or monthly monitoring conducted on an ongoing basis.

Baseline monitoring is used to describe background environmental conditions using either historical or current data. Baseline data provide a reference point against which other monitoring results can be compared. Monitoring reference sites (areas that are not impacted on by site activities) provides baseline data.

Incident or impact monitoring occurs in response to incidents, when trigger levels (see section 5.1.5) are exceeded, and/or to estimate the impact of operations on the receiving environment. The purpose of this monitoring is to:

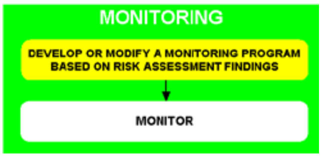
- identify the source of the issue (i.e. where the operations or processes deviated from normal practice)
- characterise the nature and extent of the risk
- evaluate the risk to the receptors (i.e. what the actual/potential impact on the receptors is)
- evaluate the contingency measures put in place to prevent or minimise the risk
- provide information that can be used in your APS in the event of a non-compliance
- provide information that can be used in reviewing the design and implementation of corrective measures, and in operational processes and checks (EPA Ireland 2003).

Elements of a successful monitoring program

For a monitoring program to be successful, it should be based on the assessment principles (see section 3.1), with consideration given to all stages of monitoring, including designing the program, undertaking monitoring and analysing and reviewing the monitoring data.

It is important that the monitoring plan, the results and their interpretation are documented. More detail is provided in the following sections.

5.1 Develop or modify a monitoring program



5.1.1 Monitoring plans

A monitoring plan details the actions, responsibilities and timeframes of the monitoring program; the what, when, who, how, and why of the monitoring activities. It helps ensure a systematic and consistent approach to monitoring and testing that delivers reliable, fit-for-purpose data. It can also be useful for staff if you develop a monitoring matrix (see Case study 4: Oliebollen Oil Recyclers).

You may consider having your monitoring plan verified by an environmental auditor, to assess the adequacy of your monitoring programs. Such verification is currently a requirement for landfills only, but other businesses may consider this option.

5.1.2 Monitoring objectives

Monitoring objectives detail the need for monitoring and are the first step in constructing a monitoring program. They may include:

- understanding the baseline condition of the environment
- monitoring the environmental impacts of the operations
- determining and demonstrating compliance with licence conditions
- assessing the effectiveness of management actions or process controls.

Before committing further time and costs to a monitoring program, you should take time to review the outcomes of the risk assessment and check that the monitoring objectives:

- address your licence conditions
- are based on the outcomes of the risk analysis so produce fit-for-purpose data
- address the risks that exceed a preset level (for example, all medium, high and very high risk levels)
- address any knowledge gaps.

Text box 9: Example of monitoring objectives

Potential monitoring objectives for a landfill site:

1. Determine the presence of harmful substances in leachate in relation to the risk presented to identified receptors.
2. Determine the level of groundwater contamination.
3. Indicate whether current control measures are adequate to prevent, reduce or clean up groundwater pollution.

5.1.3 Describing site activities and the surrounding environment

Having a clear description and understanding of the surrounding/receiving environment can help you decide what, where, when, and how often monitoring needs to be done, helping the development of a robust monitoring program.

This information is compiled during risk identification (see section 4.2).

5.1.4 Select appropriate indicators

Choosing appropriate indicators to be monitored requires careful consideration, to ensure the data obtained address the monitoring objectives (see Text box 10). Things to consider when selecting indicators are:

- licence conditions (including discharge tables)
- an indicator's responsiveness to management actions and systematic controls (e.g. monitoring phosphorus can indicate the effectiveness of an upgrade to the wastewater treatment process at a site, where the upgrade is designed to decrease levels of phosphorus in the discharge)
- the potential impact at receptors (e.g. reduced invertebrate health in a creek to which there is a discharge)
- the constituents of the discharge, including the presence of highly toxic substances in the discharge (e.g. class 3 chemicals, heavy metals)
- factors in the receiving environment that have the potential to confuse the data (e.g. are there other sources of pollutants that affect the indicator or increase the levels of pollutants in the receiving environment?)
- cost-effective indicators for monitoring the priority risks (e.g. there may be multiple indicators that can be monitored to measure risk. As long as all of the options measure risk adequately the less expensive indicators can be used).

Text Box 10: Selecting appropriate indicators

A kraft pulp mill may have the risk of being smelly to neighbouring residents, and potentially causing some health issues for residents that are particularly sensitive to some elements of the air discharge.

In this case the **appropriate indicators** to monitor in the **air emission** might be one or more of:

- hydrogen sulfide
- methyl mercaptan
- dimethyl sulfide
- dimethyl disulfide
- total reduced sulfur compounds.

This pulp mill also has a water discharge into a nearby river. This discharge could potentially impact on the aquatic life and any recreational uses of the waterbody.

The **appropriate indicators** to monitor in the **water discharge** might include:

- biological oxygen demand (BOD)
- total suspended solids
- dioxin
- adsorbable organic halides (AOX).

5.1.5 Set trigger levels

Trigger levels are set to initiate an action or contingency plan to prevent further pollution when exceeded. An action or contingency plan may require further monitoring, or action to determine the source of the increase in pollutants and to remedy the situation. Trigger levels also help to indicate if compliance with licence conditions has been obtained.

Each trigger level needs to be set at a value between that obtained for normal operating conditions and a value above which there is potential for unacceptable environmental harm to occur. These values may be set in the licence discharge limit tables or they may be set by the site operator. In many instances, it might be at a level that would indicate a change in operational conditions or the failure of pollution abatement equipment.

Setting trigger levels and having contingency plans in place is crucial to the good environmental performance of a site.

When developing trigger levels, you should consider:

- levels set in the licence or in government policies (e.g. objectives set for different indicators in the various State environment protection policies – SEPPs)
- any other technical guidance
- setting independent trigger levels at monitoring locations that indicate the performance of operations (including where contaminants/pollutants are made and/or where they are controlled) to verify that pollution has not occurred
- setting trigger levels only for substances that relate to the identified risks
- the appropriate levels of contaminants for the receptors or beneficial uses that are being impacted on
- setting trigger levels that are precautionary to **avoid** catastrophic consequences (there is no point in setting trigger levels that indicate a severe impact after it has occurred)
- setting trigger levels that allow you to assess the performance of the operations (e.g. a wastewater treater trying to reduce levels of nutrients in its discharge would set trigger levels for nutrients in the discharge that would indicate improvement or otherwise).

5.1.6 Monitoring locations

Monitoring locations should be selected to provide measurements of selected indicators that can be easily reproduced and are defensible. An adequate number of monitoring locations must be selected so the extent of the impact can be defined and robust conclusions drawn.

When selecting locations, consider the following:

- point of discharge
- location of receptors that might be impacted on by site activities
- expected pollutant pathways and mixing zones

- plant layout and operational processes (i.e. where in your site's activities do risks lie? For example, production areas where chemicals are produced)
- indicator behaviour (e.g. once emitted or produced, how do indicators behave in the receiving environment?)
- contaminants of concern (e.g. where are contaminants of concern produced and where are they emitted?)
- the receiving environment (e.g. geological, hydrogeological and hydrological regimes; depth profiles etc)
- background conditions as a benchmark to measure you premises' impact (i.e. baseline monitoring of a control site that is ideally identical in nature to that of the premises impact site, provides data against which the impact of the premises can be assessed, e.g. in a mixing zone)
- contaminants from external sources (locate monitoring where there is potential input of external contaminants)
- the environmental management and monitoring objectives
- accessibility and occupational health and safety issues (i.e. safe to enter and accessible at all times).

Monitoring locations should be mapped, with the premises' boundaries shown and the surrounding environment clearly described.

5.1.7 Frequency and timing of sampling

The frequency and timing of sampling should enable compliance with licence conditions to be determined and help detect any changes in operations that may lead to unacceptable negative impacts before they occur. The following need to be considered when determining the frequency and timing of sampling:

- timing of discharge (e.g. intermittent, continuous)
- operational variability (e.g. daily and weekly variability of operations, peak times of operations, etc)
- compliance history. Past data may show that emissions of a particular substance are well below licence limits; therefore the frequency of monitoring could be scaled back. The number of complaints can also indicate how a particular aspect of a business is functioning (i.e. offensive odour sources) and may lead to scaling the monitoring up or down accordingly
- risk-related (i.e. the higher the risk the more frequent the monitoring effort should be, e.g. by identifying the priority risks, you can target monitoring effort to address these risks and spend less time monitoring aspects that pose a low risk)
- the nature and type of the indicator being measured (e.g. mobility, dispersion rates, how long it takes for the indicator to show change)
- characteristics of the receiving environment (e.g. stream flow in the summer months is generally lower, so there is less dilution and potentially higher discharge impacts, requiring more frequent monitoring)
- monitoring frequency requirements in the various SEPPs (e.g. to compare a business's water quality data with the *SEPP (Waters of Victoria)* water quality objectives, 11 monthly data points within one year are required)
- events-based (e.g. rain, hot weather, deviation from regular operating practise, etc)
- statistical validity (i.e. you need to decide what type of data analysis is required prior to collecting data, to ensure that a sufficient quantity and range of data are collected to produce valid analytical results)
- community expectations or corporate standards and commitments.

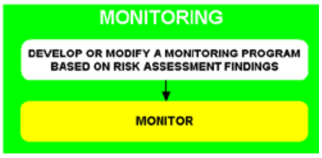
Additional monitoring or a change to the frequency might be considered when:

- an unusual monitoring result has been obtained, or trigger level exceeded
- a review of monitoring data indicates inadequate monitoring frequency
- monitoring results show a trend towards unacceptable environmental impact and/or licence non-compliance
- a result indicates non-compliance with licence conditions
- there is a change in site operations/equipment (i.e. monitoring should be increased if there is any major departure from baseline or design conditions, e.g. the type of waste received may change, equipment may be upgraded, production may have increased, etc)
- a new receptor is identified
- surrounding land use changes
- a direction is made by EPA.

5.1.8 Quality assurance and control measures

Quality assurance (QA) and quality control (QC) measures are crucial to all elements of a monitoring program. QA is a set of operating principles and includes the policies, procedures, actions and review mechanisms that give confidence in sampling methodology, data integrity and accuracy. QC is the aspect of QA that ensures all activities undertaken throughout monitoring and the resulting data, are inherently accurate and precise (EPA Ireland, 2003). QC can include a rigorous and thorough program of accuracy checks on data collection and calculations, identification of errors and thorough record-keeping of QC activities. QA and QC measures must be in place when undertaking a monitoring program.

5.2 Monitor



You must conduct monitoring in accordance with your monitoring program. If additional monitoring occurs or there is a deviation from the documented monitoring program, this change must be recorded and considered during the review of the monitoring program.

5.2.1 Monitoring equipment

Monitoring equipment used at your premises must be suitable for the proposed monitoring and sufficiently well maintained to provide representative samples or accurate results. The environmental monitoring program should specify:

- the types of sampling equipment to be used at each monitoring location
- maintenance requirements for the equipment
- calibration requirements
- references to operating manuals or procedures
- safety procedures to be observed during use of the equipment
- the employee responsible for care of the equipment.

5.2.2 Sample collection

Sampling must be conducted in accordance with the appropriate EPA guidelines (see below) by a qualified technician or competent, trained internal personnel. Where it can be demonstrated that new and emerging sampling methods provide a better understanding of your environmental impacts, this will be supported by EPA.

The following guidelines provide information on sampling methods for various media:

- *Groundwater sampling guidelines.* EPA publication 669
- *A guide to the sampling and analysis or air emissions and air quality*. EPA publication 440
- *Rapid bioassessment methodology for rivers and streams*. EPA publication 604
- *Sampling and analysis of waters, wastewaters, soils and wastes*. EPA publication IWRG701
- *Soil sampling*. EPA publication IWRG702
- *Solid industrial waste sampling*. EPA publication IWRG703.

Sampling must be quality assured and quality controlled. QA/QC can include regular auditing (by industry auditors) of samplers and their procedures (including calibration of sampling equipment, sampling techniques, recording of data, sample storage and sample transportation).

During sampling and analysis, adhering to QA and QC minimises sources of potential error and ensures that:

- the entire process, including field and laboratory operations, is adequately documented
- any deviations in the sampling method that may impact on the results are documented and considered in the assessment of the data (e.g. existing stack monitoring ports that do not comply with the latest Australian Standards)
- all field and laboratory staff involved in monitoring are adequately trained
- the integrity of samples is maintained during sampling, transportation and storage
- appropriate analytical techniques are employed (e.g. using NATA-accredited laboratories to analyse samples).

Information on sample quality assurance and control for soil and groundwater sampling is provided in National Environment Protection (Assessment of Site Contamination) Measure 1999 *B(2) Guideline on data collection, sample design and reporting*, National Environment Protection Council, 1999.

Sampling protocol must be followed and records kept to demonstrate this, including: completion of standard field sheets, electronic field records (from using a hand held personal digital assistant) and any other sampling records. Records can include:

Field sheets

- Date & time of sampling.
- Name of the sampler.

- Weather and other environmental conditions.
- Precise location of monitoring points (this can include GPS readings).
- Indicators sampled and the methods used.
- Description of samples.
- Details of preservatives used.
- Any measurements of indicators taken in the field.

Other records

- Details of laboratory and field calibration of equipment.
- Personnel training records.
- Completion of any standard forms (e.g. sample inventories, surveys etc).
- Procedures for conducting surveys, inspections and observations.
- Databases containing monitoring data and information.
- Documentation of any deviation from the standard protocol and why it was necessary.
- Difficulties encountered during sampling.
- OH&S checks.

This is not an exhaustive list and you should tailor your record keeping to meet your monitoring needs.

5.2.3 Sample analysis

All samples taken during monitoring must be analysed by a laboratory competent in, or accredited for, the selected analyses. In most cases this means using National Association of Testing Authorities (NATA) approved and accredited laboratories. If sample analysis is performed in-house, it must be done by suitably qualified staff. Internal staff members are required to undertake QA/QC measures that would occur in accredited laboratories. These measures might include: maintenance and calibration of equipment; adhering to standard operating procedures; being audited by accredited auditors; maintaining current accreditation and attending performance assessment programs to monitor the performance of the methods used, and so forth. Note that the samples must have been taken, preserved and transported under suitable conditions, using chain of custody forms, for the laboratory results to be meaningful.

5.2.4 Data management

Quality assurance and quality control measures should be applied to test the integrity of the data during collection, transcription, analysis, and storage.

According to ISO: 14001, 2004, 'the organisation shall establish, implement and maintain a procedure(s) for the identification, storage, protection, retrieval, retention and disposal of records. Records shall be and remain legible, identifiable and traceable'. This means implementing procedures that include data entry, data validation, data protection, and the prevention of data loss or inaccuracies at any stage. Data manipulation and storage systems should be used to facilitate the QA/QC measures. These could be tailor-built databases that store this information in a centralised location, making it easy to manipulate and control. Typically, these databases have administrator access only to ensure protection of the data.

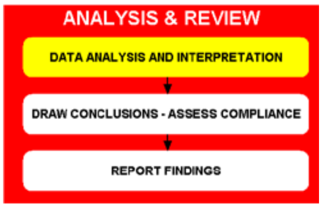
In accordance with the condition in EPA licences, records must be maintained for **seven years**. EPA may require all documentation that proves compliance/non-compliance with licence conditions.

6 ANALYSIS AND REVIEW

Now you have collected data on your risks, you will need to interpret the data so you can demonstrate compliance with your licence conditions. You will also be able to use the findings to refine your monitoring program and help you better understand and manage your site. This section provides a brief outline of the steps you need to take to analyse and use your data.

Once monitoring has been completed, you must analyse the results. The conclusions should then be used to re-evaluate the risk posed by operations, the process control measures, and the monitoring effort.

6.1 Data analysis and interpretation

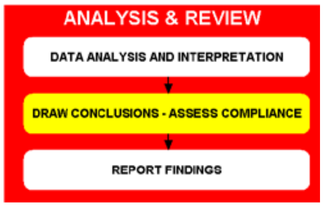


Design of monitoring programs and data analysis must be statistically sound. Monitoring data can be assessed in relation to a limit value (like the limits in licence discharge tables) or a measure of significant deviation (a departure from background conditions). Analysing results may involve making a simple calculation of a median value for an indicator, or using more sophisticated statistical tests and modelling to determine whether an impact is significant.

The periodic sampling that is generally undertaken to demonstrate performance against licence conditions has a degree of uncertainty, because it is generally not possible to sample the environment under all conditions. It is important that the monitoring program design and data analysis methods can distinguish between natural variability and an actual response of the indicator under evaluation (US EPA, 2004).

For some licence-holders, analysing monitoring data may require statistical analysis. A variety of statistical tests may be used, depending on the questions that the monitoring is trying to answer. For example, if monitoring of a parameter is simply to show that a specified maximum has been exceeded, then statistical analysis is not required. On the other hand some businesses may need to compare against baseline, or background data to estimate the level of impact their operations are having on the environment. This type of comparison may require statistical analysis.

6.2 Draw conclusions



The results and information generated from monitoring should be used to assess compliance with licence conditions, and to re-evaluate the risks posed by operations, system/process controls, and monitoring effort.

6.2.1 Licence compliance assessment

At the end of each monitoring year and prior to completion of the APS, you must assess compliance of operations with your licence conditions using the year's monitoring results. The assessment process must be sufficiently robust to be acceptable to the representative of your company signing the APS and for the conclusions to be audited by an external authority such as EPA.

Monitoring results should be assessed for compliance with licence conditions at the time of receipt of the results for each round of monitoring. This enables prompt action to be taken to remedy any problems indicated in the results.

To ensure a thorough comparison of monitoring data against each of the licence conditions, compliance should be assessed using the following steps.

1. Collate the monitoring data and other evidence obtained during the preceding year.
2. Identify the monitoring data for parameters and other evidence relevant to each licence condition and discharge limit.
3. Compare the results obtained for each parameter against the respective licence compliance limit (if applicable).
4. Identify results that do not meet licence obligations (this includes exceedance of licence limits).
5. Examine the results for a trend that may indicate an improvement in performance or a creep towards non-compliance. This information will be used when reviewing the monitoring program.
6. If licence non-compliance is identified, you must determine the cause, severity, geographical extent, duration, potential environmental impacts and actions taken to remedy the situation and prevent recurrence for each issue. This information must be included in the APS.

6.2.2 Review risks posed by operations

In some cases monitoring may indicate that priority risks are less of an issue than originally thought. On the other hand, data may indicate perceived lower risks actually pose more of a threat. In both cases the risks will need to be reevaluated. The results may also highlight risks that were not originally identified in the assessment. These new risks need to be addressed and analysed.

All revised risk related information is used to update the risk register and the conceptual model. It is also used to evaluate the effectiveness of process controls and the level of monitoring effort required.

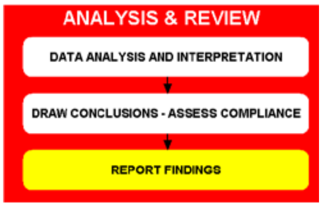
6.2.3 Process controls

Monitoring results provide insight into how well systematic controls are working. In some cases, equipment may need to be replaced or repaired to improve performance against licence conditions and decrease the level of risk, or eliminate risks entirely.

6.2.4 Monitoring effort

Monitoring should always have a clear purpose and add value to how premises operate and are managed. Conclusions drawn from monitoring data should be used to re-assess the resources invested into monitoring. The conclusions will inform where monitoring effort can be decreased (i.e. if premises are consistently meeting licence conditions for a few years, and are well under licensed limits, the level of risk is reduced) and where it needs to be more concentrated. Therefore you need to be capable of adapting to changing circumstances.

6.3 Report findings



It is important that the monitoring plan, the monitoring results and their interpretation are documented to demonstrate performance against licence conditions. Summarising this information in an easily digestible form will provide confidence to the CEO or equivalent manager when signing an APS. EPA *does not require* sites to send in annual monitoring reports.

Generally, monitoring reports should include:

- a high level overview of the monitoring program
- a summary of the data analyses performed
- data interpretation, including consideration of assumptions and uncertainties
- conclusions, including re-evaluation of the risks posed, operational controls and other management strategies, and monitoring effort
- recommended changes.

DEFINITIONS

- **Annual performance statement** is the annual reporting requirement of licences. It provides a summary of compliance against licence conditions. If licence conditions are not met, the report includes details of non-compliance and any remedial actions taken or proposed.
- **Beneficial use** is an actual or potential use of the environment which is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges (SEPP Waters of Victoria).
- **Consequence** is the outcome or impact of an event affecting objectives (AS/NZS ISO 31000:2009). It may be expressed qualitatively or quantitatively, being a loss, injury, an expressed concern, disadvantage or gain (HB 203:2006). A single event may have several consequences.
- **Continuous improvement** is an ongoing process to seek small improvements to processes and products, with the objective of increasing efficiency, quality and reducing impacts on the environment.
- **Environmental aspects** are those elements of a company's operations, products or services that can interact with the environment, including, for example, a discharge, a waste, and the consumption or reuse of a material. They could also involve noise, odour, light or vibration (HB 203:2006).
- **Environmental impacts** are any change in the environment, whether adverse or beneficial, as a result of an aspect (wholly or partly resulting from a client's activities, products or services) (ISO 14001: 2004). An impact often results from an event that releases the potential of the source of risk.
- **Hazard** is a source of potential harm, or a situation with the potential to cause loss or adverse impacts. (HB 203:2006).
- **Incidents** are any occurrences that can have an adverse impact (or impacts) on the environment. An incident releases the intrinsic potential of the hazard (HB 203:2006).
- **Likelihood** is the chance of something happening (AS/NZS ISO 31000:2009). It is used as a general description of probability or frequency of something occurring.
- **Receptors** are aspects of the receiving environment that are receptive to the risks generated from a site's activities
- **Risk** is the effect of uncertainty on objectives (AS/NZS ISO 31000:2009). It is measured in terms of a combination of the consequences of an event and their likelihood (HB 203:2006).
- **Risk assessment** is the overall process of identifying risks, analysing risks, and evaluating risks.
- **Risk register** is a record of a business's environmental aspects and their impacts, including potential management strategies, and ratings of consequence, likelihood and overall risk.
- **Stakeholders** are people and organisations that can affect, be affected by, or perceive themselves to be affected by a decision or activity (AS/NZS ISO 31000:2009).
- **State environment protection policies (SEPPs)** are subordinate legislation made under the provisions of the Environment Protection Act 1970 to provide more detailed requirements and guidance for the application of the Act to Victoria. SEPPs administered by EPA cover the areas of air, land, groundwater, noise and water.

REFERENCES

- AS/NZS ISO 31000:2009, *Risk management – Principles and guidelines*, Standards Australia & Standards New Zealand, Sydney & Wellington.
- AS/NZS ISO 14001:2004, *Environmental management systems — requirements with guidance for use,* third edition, Standards Australia & Standards New Zealand, Sydney & Wellington.
- EPA Victoria 1970, *Environment Protection Act 1970,* No. 8056 of 1970.
- EPA Victoria 2000, *Groundwater sampling guidelines,* EPA publication 669.
- EPA Victoria 2002, *A guide to the sampling and analysis or air emissions and air quality*, EPA publication 440.
- EPA Victoria 2003a, *Rapid bioassessment methodology for rivers and streams*, EPA publication 604.
- EPA Victoria 2003b, *State Environment Protection Policy (Waters of Victoria)*, Government Gazette No. S107, 2003.
- EPA Victoria 2009a, *Sampling and analysis of waters, wastewaters, soils and wastes*, EPA publication IWRG701.
- EPA Victoria, 2009b, *Guidelines for risk assessment of wastewater discharges to waterways*, EPA publication 1287.
- EPA Victoria 2009c, *Soil sampling*, EPA publication IWRG702.
- EPA Victoria 2009d, *Solid industrial waste sampling*, EPA publication IWRG703.
- HB 203:2006, *Environmental risk management — Principles and process*, third edition, Standards Australia & Standards New Zealand, Sydney & Wellington.
- EPA Ireland 2003, Landfill manuals, landfill monitoring, second edition, Environmental Protection Agency, Co. Wexford, Ireland.
- US EPA 2004, *Guidance for monitoring at hazardous waste sites: Framework for monitoring plan development and implementation,* OSWER Directive No. 9355.4-28, Office of Superfund Remediation and Technology Innovation, Washington, DC.
- National Environment Protection Council, 1999, National Environment Protection (Assessment of Site Contamination) Measure 1999 *B(2) Guideline on data collection, sample design and reporting*.

APPENDIX A: CASE STUDIES

The following four case studies are fictional and have been produced to demonstrate how the guidance provided in the main body of this document can be used to determine compliance with licence conditions. For this purpose, the case studies include explanatory information to provide context and understanding. The case studies are:

1. The Shearer's Back Hotel (small operation)
2. Tiger Tanks (small to medium-sized operation)
3. The Bourke Street sewage treatment plant (large operation)
4. Oliebollen Oil Recyclers (medium operation)

CASE STUDY 1 – THE SHEARER'S BACK HOTEL

This case study has been provided as an example of a small business that holds a waste discharge licence for a single discharge point. It describes how the licence-holder might work out what can happen, how it can affect the environment and what to monitor to check compliance with licence conditions.

1 Background

The Shearer's Back Hotel is located in a rural setting that backs onto Woolshed Creek, an unspoilt stream running from the high country to Wheelabarraback River. It is owned by the publican who, as well as managing a well presented bar, runs a good kitchen that attracts clientele from outside the area.

It treats its own wastewater in a small sewage treatment plant that discharges from the rear of the property into Woolshed Creek. The site is licensed by EPA as a G05 (sewage treatment) site.

2 Aims

The publican wants to be sure she is doing enough monitoring to check that the plant is complying with the licence conditions and that she can, as the most senior representative of the business, sign the annual performance statement with confidence. To set up a suitable monitoring program she needs to:

- identify the environmental risks of her licensed operations
- prepare a monitoring program based on those risks and the licence conditions
- do the monitoring
- review the results of the monitoring
- review the monitoring plan.

3 EPA licence

The Shearer's Back Hotel licence includes the conditions listed in Tables A2.1 and A2.2, as well as conditions G1, G2, G3, G4 and G5 (not included in this case study).

Table A2.1: Selected licence conditions for The Shearer's Back Hotel

Condition reference	Management area	Condition text
A1	Odour	Offensive odours must not be discharged beyond the boundaries of the premises
DW1	Stormwater	Stormwater discharged from the premises must not be contaminated with waste
DW2	Discharge to water	Discharge of waste to surface waters must be in accordance with the 'Discharge to Water' table

Table A2.2: 'Discharge to Water' Table from The Shearer's Back Hotel EPA licence

Indicator	Unit	Limit type	to Woolshed Creek
Biochemical oxygen demand (five- day)	mg/L	Maximum	20
Suspended solids	mg/L	Maximum	20
Escherichia coli	orgs/100 mL	Maximum	1000
pH	range		6-9
Total residual chlorine	mg/L	Maximum	1
Maximum flow rate	ML/day	Maximum	0.03

4 Risk assessment

4.1 Context of the assessment

The publican sets the boundaries of the risk assessment by looking at when the pub's sewage treatment plant (STP) may have an impact on the environment and cause a breach of the EPA licence.

The STP consists of a primary sewage tank, pump well, trickling filter, humus tank, chlorine contact tank and a discharge to Woolshed Creek, where the EPA discharge sampling point is located. Kitchen wastewater runs to the STP via a grease trap.

The main risks to the environment faced by The Shearer's Back Hotel are:

- impacts of treated wastewater discharge to Woolshed Creek
- overflows from equipment breakdown
- odours from the STP causing complaint
- contamination of stormwater by wastewater.

4.2 Scope

The publican decides to assess the environmental risks associated with the STP, as this is the primary source of environmental impacts and is the reason for holding the EPA licence.

4.3 Identifying the risks

The publican lists the site activities that might have an impact on the environment and identifies:

- drainage of wastewater to the STP
- operation of the STP and its discharge to Woolshed Creek.

She then draws up a hazard table to see what sort of environmental impacts each of these activities might have.

Table A2.3: Hazard table to identify environmental impacts of STP operation

Site activities and associated hazards	Environmental impact		
	Pollution of creek water	**Stormwater contamination**	**Odour emission**
1. Drainage of wastewater to STP			
A. Tipping of bleach down drain poisons the STP biological system.	X		X
B. Tipping of fat down kitchen drain blocks grease trap and causes overflow of wastewater.	X	X	X
C. Wastewater flow exceeds licence limit.	X		
2. Operation of STP			
D. Buildup of sludge in the primary sewage tank reduces its capacity and causes solids to be pumped to the trickling filter.	X		X
E. Trickling filter pump breaks down, causing wastewater to overflow and not enter the trickling filter.	X	X	X
F. Trickling filter distribution arms break down, causing inadequate treatment of the wastewater.	X		X
G. Buildup of sludge in humus tank reduces capacity and stops humus solids washed off the trickling filter being removed from the wastewater.	X		
H. Chlorine contact tank dosing unit fails.	X		
I. Discharge of inadequately treated wastewater to Woolshed Creek.	X		

4.4 Analysing the risks

The publican uses a simple risk table to see which of these potential events is sufficiently severe to require treatment. She sets definitions for likelihood and consequence and the associated risk level keys (Table A2.4). The publican decides to take action to better control any activities with a risk level of 'red'.

Table A2.4: Table of definitions for risk analysis

Label	Level	Definition
Likelihood	Likely	Will probably occur in most circumstances.
	Possible	Could occur.
	Unlikely	Could occur but not expected.
Consequence	Major	Release of inadequately treated wastewater or contaminated stormwater to Woolshed Creek, licence non-compliance.
	Moderate	Onsite overflow of wastewater, odour complaint received (or is detectable in the bar or dining room).
	Minor	Soakage of wastewater into ground without a surface flow. Localised odour release (not detectable in the bar or dining room) without an odour complaint. Treated wastewater discharge within licence limits.
Risk level key	Red	Immediate action or ongoing close scrutiny required.
	Amber	Requires ongoing active management.
	Green	Manage by routine procedures.

Table A2.5: Risk table

	Consequences		
Likelihood	**Major**	**Moderate**	**Minor**
Likely	Red	Red	Amber
Possible	Red	Amber	Green
Unlikely	Amber	Green	Green

Using information in the hazard table (Table A2.3), the publican uses the definitions for likelihood, consequence and risk level given in Table A2.4 and the risk table (Table A2.5) to draw up a risk register (Table A2.6).

Table A2.6: The Shearer's Back Hotel risk register

Activity/ potential event	Outcome	Potential environmental impact	Existing controls	Post-control risk analysis		
				Likelihood	Consequence	Level of risk
Drainage of wastewater to STP						
A. Tipping of bleach down drain	Poisoning of STP biological system	Damage to creek Odour emission	Training of domestic and catering staff regarding the need to avoid tipping toxic materials into the drains.	Unlikely	Moderate	Green
B. Tipping of fat down kitchen drain	Blockage of grease trap causing overflow of kitchen wastewater onto ground behind main building	Damage to creek Stormwater contamination Odour emission	Training of catering staff to tip waste oils and fats into drums for removal by waste collection contractor. Signs put up over sinks as a reminder.	Unlikely	Moderate	Green
C. High wastewater flow exceeds capacity of STP	Exceedance of licence condition DW2	Damage to creek	The STP design capacity and licence is sufficient to accommodate normal flows. The volume of wastewater treated is checked using the discharge water meter.	Unlikely	Major	Amber
Operation of STP						
D. Sludge build-up in primary sewage tank	Excess solids pumped to the trickling filter	Damage to creek	Primary sewage tank is pumped out by waste contractor every year.	Possible	Moderate	Amber
E. Trickling filter pump breaks down	Wastewater backs up in the trickling filter sump and primary sewage tank then overflow	Damage to creek Stormwater contamination Odour emission	Trickling filter pump is checked daily.	Possible	Moderate	Amber
F. Trickling filter distribution arm breaks down	Wastewater is only applied to a small section of the trickling filter bed, causing the remainder of the trickling filter to dry out and the water to be under-treated	Damage to creek Odour emission	Trickling filter operation is checked weekly.	Possible	Moderate	Amber
G. Sludge build-up in the humus tank	Humus solids from the trickling filter flow to the discharge causing increase in suspended solids load	Damage to creek	Humus tank is pumped out by waste contractor every two years.	Possible	Moderate	Amber
H. Chlorine contact tank dosing unit fails or runs out of hypochlorite	Wastewater is not disinfected leading to high levels of *E. coli* in discharge to creek	Damage to creek	Chlorine supply and dosing pump checked weekly (see Table A2.7).	Possible	Major	Red
I. Discharge to creek	Potential for inadequately treated wastewater to pollute the creek	Damage to creek	Ongoing monitoring of STP and quarterly monitoring of treated wastewater sampled at the discharge point.	Likely	Minor	Amber

4.5 Evaluating and treating the risks

The publican looks at the results of the risk analysis to see if any of the onsite activities present an unacceptable ('red') risk. The analysis shows that failure of the chlorination system would lead to high levels of *E. coli* being discharged to the creek, contrary to licence condition DW2, so it requires better management.

The publican checks the condition of the chlorine contract tank and realises that she needs to upgrade the chlorine dosing equipment to provide better reliability and to install an audible alarm with strobe light for chlorine dosing pump failure. She also increases the frequency of checking the pump from weekly to daily. This would take the level of risk from 'red' to 'amber'.

4.6 Monitoring

After looking at the results of the risk analysis, the publican has developed the following monitoring plan. Note that the licence management guidelines (EPA publication 1322) provide guidance on monitoring and reporting for each condition.

The publican records the results of each inspection on a checklist and stores them in a safe place with her other EPA correspondence. This provides written confirmation of the inspections, which is used to support the annual performance statement.

Table A2.7: The Shearer's Back Hotel monitoring plan

Monitoring location	Potential event	Risk rating	Monitoring or risk control action	Monitoring times	Responsibility
Kitchen	Tipping of bleach down drain	Green	Domestic and catering staff are made aware of the need to avoid tipping toxic materials (e.g. bleach) into the drains.	A reminder to existing employees and new employees advised	Catering manager
Kitchen	Tipping of fat down kitchen drain	Green	Catering staff are advised to tip waste oils and fats into the designated drums. Signs are put up over sinks as a reminder.	A reminder to existing employees and new employees advised	Catering manager
Grease trap	Blockage by solidified fat	Green	The area around the grease trap is free of spilled wastewater. The grease trap is serviced by a licensed waste contractor. The pink copy of the waste transport certificate is mailed to EPA and the green copy of the certificate is kept as a record that the grease interceptor trap waste has been sent for reuse or recycling.	Weekly inspection and pump out when required	Publican
Grease trap and trickling filter	Overflow causing bad odours	Amber	The yard is checked for odours from the STP. This includes walking around the plant to check for any odours downwind of the plant.	Weekly	Publican
Water meter at licensed discharge point	High wastewater flow	Amber	The rate of wastewater flow to the creek is monitored using the cumulative reading on a flow meter.	Weekly normally; daily if flow exceeds five times the licensed daily flow; or monthly if flow does not change much from week to week and is well below the licence limit. (Changes and reasons for change are to be documented.)	Publican
Primary sewage tank	Build-up of sludge	Amber	Primary sewage tank is pumped out by waste contractor every year. Check with the contractor to ensure that this frequency is sufficient.	Annual inspection and pump out when required	Publican
Trickling filter	Break down of pump or distribution arm	Amber	The trickling filter is checked to be in good working order.	Weekly	Publican
Overall area of the STP	Overflow of wastewater onto the ground	Amber	The area around the STP is inspected. This includes looking for areas of soaked ground or unduly green and fast-growing grass that might indicate in-ground leakage of wastewater.	Weekly	Publican
Humus tank	Build-up of sludge	Amber	The humus tank is pumped out by waste contractor every year. The publican checks with the contractor to ensure that this frequency is sufficient.	Annual inspection and pump out when required	Publican
Chlorine contact tank	Failure of chlorine dosing	Amber (with additional controls in place)	Chlorine supply and dosing pump checked daily (increased from the initial weekly frequency to reduce the potential risk level). Chlorine pump alarm is tested.	Daily inspection, weekly alarm test	Publican

Monitoring location	Potential event	Risk rating	Monitoring or risk control action	Monitoring times	Responsibility
Wastewater discharge point at Woolshed Creek	Ongoing discharge to waterway	Amber	The discharged wastewater is checked for the water quality indicators specified in the licence.	Quarterly. The frequency will be reduced to six-monthly if the BOD, SS and *E. coli* values are well below (say one-quarter) the licence limits for one year.	Water sampling by analytical laboratory organised by the publican

After preparing the monitoring plan, the publican cross-checks the plan against the licence conditions to make sure they are all covered. She draws up a simple table (Table A2.8) to complete the cross-check and confirms that the monitoring covers each of the licence conditions.

Table A2.8: The Shearers Back Hotel monitoring plan cross-check

Licence condition	Management area	Monitoring or control action (see Table A2.7)
A1	Odour	1, 2, 4, 7, 9
DW1	Stormwater	2, 3, 7, 8
DW2	Discharge to water	1, 2, 5, 6, 7, 9, 10, 11

4.7 Review of monitoring results

The publican checks compliance of each set of water quality results with the licence conditions. Every year she reviews all of the monitoring results and looks at whether there are ongoing issues with things such as ongoing maintenance issues with the STP or chronic odours from the plant.

Most importantly, she checks compliance of the monitoring results with each of the licence conditions, including G1 to G5, before completing and signing the Annual Performance Statement.

The publican is aware that if the discharge does not comply with the licence conditions, EPA may require the condition of Woolshed Creek to be examined by a suitably experienced consultant.

4.8 Review of monitoring plan

After review of the year's monitoring results, the publican will go through the monitoring plan to:

- check that the plan reflects any changes to operations or licence conditions
- increase monitoring in areas where there are data gaps or in areas where problems have been found
- reduce monitoring (after careful review) in areas where testing results are consistently negative and are not critical to demonstrate licence compliance.

CASE STUDY 2 – TIGER TANKS

This case study has been provided as an example of a medium-sized business that holds an EPA licence to operate a tank servicing business. It describes how the licence-holder might work out what can happen, how it can affect the environment and what to monitor to check compliance with licence conditions.

1 Background

Tiger Tanks cleans, repairs and integrity tests bulk liquid transport tanks, some of which have been used to carry prescribed industrial waste (PIW). When present, the residual PIW is recovered and stored prior to despatch for disposal. Wastewater from tank cleaning and washdown is discharged to sewer. The licence, issued for G05 (bulk transport container washing) premises, addresses potential pollution of air (odour), land and water by the operations.

2 Aims

The general manager (the licence-holder) wants to be sure he is doing enough monitoring to check compliance with the licence conditions and for the CEO to sign the annual performance statement with confidence. To set up a suitable monitoring program he needs to:

- identify the environmental risks of his licensed operations
- prepare a monitoring program based on those risks and the licence conditions
- do the monitoring
- review the results of the monitoring
- review the monitoring plan.

3 EPA licence

The Tiger Tanks licence includes the conditions listed in Table A1.1, as well as conditions G1, G2, G3, G4, G5, G6 and G6.1 (for simplicity, not included in this case study).

Table A1.1: Selected licence conditions for Tiger Tanks

Condition reference	Management area	Condition text
A1	Odour	Offensive odours must not be discharged beyond the boundaries of the premises.
WA1.4	Waste acceptance	You must not accept: a) hexachlorobenzene b) polychlorinated biphenyls (PCBs) c) organochlorine pesticides d) germicides e) acrylonitrile f) benzene g) 1,3-butadiene h) 1,2-dichloroethane (ethylene dichloride) i) ethylene dioxide j) diphenylmethane diisocyanate (MDI) k) propylene oxide l) toluene-2,4-diisocyanate or toluene-2,6-diisocyanate (TDI) m) trichloroethane or n) other chlorinated hydrocarbons.
DW1	Stormwater	Stormwater discharged from the premises must not be contaminated with waste.
DL1	Contamination of land or groundwater	You must not contaminate land or groundwater.

4 Risk assessment

4.1 Context of the assessment

The general manager sets the boundaries of the risk assessment by looking at where the operations might cause an environmental problem.

Tiger Tanks is located within an industrial area in the outskirts of a regional city. Its neighbours are a car and truck tyre fitting workshop, a panel beaters and a fuel depot. The neighbouring businesses are key external stakeholders.

The main risks to the environment faced by Tiger Tanks are:

- acceptance of prescribed industrial wastes (PIW)
- discharges of prescribed industrial wastes to the environment
- complaints from its neighbours regarding odours
- non-compliance with environmental laws and the EPA licence.

4.2 Scope

The general manager decides to look at the areas of the operations that are covered by the EPA licence, as compliance with the licence would address all of the main environmental risk management drivers identified above.

4.3 Identifying the risks

The general manager lists the site activities that might have an impact on the environment and identifies:

- acceptance of tanks that contain PIW
- storage and handling of PIW
- removal and disposal of waste from the tanks
- washing of the tanks
- disposal of tank washwater.

He then draws up a table to see what sort of environmental impacts each of these activities might have.

Table A1.2: Potential environmental impacts

Activity or process	Potential event	Element of environment affected or issue	Potential environmental impact (without any environment protection controls)
A Acceptance of tank containing waste residues	Acceptance of waste contaminated with the compounds listed in the licence (the prohibited compounds)	Licence condition non-compliance	Contamination of the waste stream and waste handling and storage equipment by the prohibited compounds.
B Unloading of tank containing waste residues	Leakage of wastes from faulty tank, couplings or hoses	Land Water	Contamination of soil and groundwater. Contamination of stormwater.
C Decanting of waste residues from tank	Leakage of wastes from faulty couplings or hoses, leakage of waste from storage tanks, release of odorous volatiles	Land Water Air	Contamination of soil and groundwater. Contamination of stormwater. Offensive odours.
D Storage of waste residues from tank	Leakage of wastes from storage tanks	Land Water	Contamination of soil and groundwater. Contamination of stormwater.
E Disposal of waste residues from tank	Leakage of wastes from faulty couplings or hoses or transport vehicle	Land Water	Contamination of soil and groundwater. Contamination of stormwater.
F Washing of tanks	Spillage of washings onto ground outside of wash station	Land Water	Contamination of soil and groundwater. Contamination of stormwater.
G Collection and disposal of washwater	Blockage of wastewater drain to sewer, leading to entry of wastewater into stormwater drains	Water	Contamination of stormwater.

4.4 Analysing the risks

The general manager elects to use a simple risk table to see which of these potential events is sufficiently severe to require treatment. He sets definitions for likelihood and consequence and the associated risk level keys (Table A1.3). The general manager decides to take action to better control any activities with a risk level of 'red'.

Table A1.3: Table of definitions for risk analysis

Label	Level	Definition
Likelihood	Likely	Will probably occur in most circumstances.
	Possible	Could occur.
	Unlikely	Could occur but not expected.
Consequence	Major	Offsite release of waste or contaminated stormwater, environmental damage (contamination of soil or groundwater) onsite from PIW, licence non-compliance.
	Moderate	Onsite release not contained, odour complaint received.
	Minor	Onsite release contained on impermeable surface, localised odour release without an odour complaint.
Risk level key	Red	Immediate action or ongoing close scrutiny required.
	Amber	Requires ongoing active management.
	Green	Manage by routine procedures.

Table A1.4: Risk table

	Consequences		
Likelihood	**Major**	**Moderate**	**Minor**
Likely	Red	Red	Amber
Possible	Red	Amber	Green
Unlikely	Amber	Green	Green

The general manager checks this list with licence condition requirements to identify any other activities that may need to be considered. He notes that he also needs to check waste coming onto the site for the presence of compounds listed in his licence and includes the check in the risk register.

Using information in the hazard table, the general manager uses the definitions for likelihood, consequence and risk level given in Table A1.4 and in the risk table (Table A1.5) to fill out a risk register.

Table A1.5: Tiger Tanks risk register

Activity	Potential event	Potential environmental impact	Existing controls	Post-control risk analysis		
				Likelihood	Consequence	Level of risk
A Acceptance of tank containing waste residues	Acceptance of waste contaminated with the prohibited compounds	Contamination of other wastes and waste handling equipment with the prohibited compounds	The source of the tank is checked before the tank is accepted. Tanks thought to have contained the prohibited compounds are not accepted (see Table A1.6).	Possible	Major	Red
B Unloading of tank containing waste residues	Leakage of wastes from faulty tank, couplings or hoses	Contamination of soil or groundwater	Surface of receiving yard is concreted and bunded. Each tank is inspected on arrival.	Unlikely	Major	Amber
		Contamination of stormwater	Receiving yard is located within a rollover bund that drains to a wastewater collection pit. . The area is inspected daily.	Possible	Moderate	Amber
C Decanting of waste residues from tank	Leakage of wastes from faulty couplings or hoses	Contamination of soil or groundwater	Surface of receiving bay concreted and bunded, couplings and hoses inspected at each use.	Unlikely	Major	Amber
		Contamination of stormwater	Receiving yard is located within a rollover bund that drains to a wastewater collection pit. The area is inspected after each transfer.	Possible	Moderate	Amber
	Exposure of waste to air during decanting from smaller tanks	Release of offensive odours	Closed vessels are used to contain liquid wastes. Site is located in an industrial area.	Unlikely	Moderate	Green
D Storage of waste residues from tank	Leakage of wastes from storage tanks	Contamination of soil or groundwater. Contamination of stormwater	Storage tanks and loading bay are located in a bunded area with a concreted surface. Tank compound is inspected daily.	Unlikely	Major	Amber
E Disposal of waste residues from tank	Leakage of wastes from faulty couplings or hoses or transport vehicle	Contamination of soil or groundwater. Contamination of stormwater	Run-off from the bunded tank compound and loading bay drains to the wastewater collection system via a control valve.	Possible	Moderate	Amber
F Washing of tanks	Spillage of washings onto ground outside of wash station	Contamination of soil or groundwater	Surface of wash station is concreted and bunded. Condition of the concrete and drains is checked weekly.	Unlikely	Major	Amber
		Contamination of stormwater	Run-off from wash station is contained in rollover bund and drains to wastewater collection pit.	Possible	Minor	Green
G Collection and disposal of washwater	Blockage of wastewater drain to sewer, leading to entry of wastewater into stormwater drains	Contamination of stormwater	The drain is monitored at the conclusion of each wash. Any buildup of wastewater would be contained in the bunded wash bay. The wash bay is located within a larger, concreted compound.	Possible	Minor	Green

4.5 Evaluating and treating the risks

The general manager looks at the results of the risk analysis to see if any of the onsite activities present an unacceptable ('red') risk to the environment. The highest risk at the site is the potential for acceptance of the prohibited compounds in a contaminated tank, contrary to licence condition WA1.4.

The general manager therefore looks at the controls in place for acceptance of tanks containing residual wastes for potential contamination by the prohibited compounds. He decides to better manage the source of waste by having the contract manager send a copy of the licence to each client and inform them in the covering letter of the wastes that can be accepted and those that cannot be accepted. He also reminds the clients that a waste transport certificate for each tank sent to Tiger Tanks for servicing must accurately describe the type of waste in the tank.

The general manager also requires each new client to complete a checklist that sets out quality control requirements for waste identification, and to provide a list of the types of industries serviced by the client and the nature of the wastes collected. He states in the letter that Tiger Tanks can not accept wastes contaminated with the prohibited compounds. For each new client, the general manager will have the waste taken from the first two tanks that are received for servicing sampled and tested for the prohibited compounds by a NATA-accredited laboratory.

A sample of waste will also be taken from any tank and analysed by a NATA-accredited laboratory if the waste appears to be inconsistent with the description in the waste transport certificate or is markedly different from previous loads from that client.

4.6 Monitoring

After looking at the results of the risk analysis, the general manager has developed the following monitoring plan. Note that the licence management guidelines (EPA publication 1322) provide guidance on monitoring and reporting for each condition.

Table A1.6: Tiger Tanks monitoring plan and risk control actions

Monitoring location	Potential event	Risk rating	Monitoring or risk control action	Monitoring times	Responsibility
Tank unloading area – waste acceptance.	Acceptance of waste contaminated with the prohibited compounds	Amber (with additional controls)	Completion and return of quality control checklist and written acknowledgement of Tiger Tank licence conditions by each new client.	Prior to acceptance of waste from each new client.	Contract manager.
		Amber	A copy of the Tiger Tanks licence and waste acceptance criteria is sent to every client with the covering letter, stating that Tiger Tanks can not accept the prohibited compounds.	Once for every client.	Contract manager.
		Amber	Sample under laboratory instruction and analysis by a NATA-accredited laboratory, of waste in first two tanks received for cleaning from new client.	Once for each new client	Yard supervisor to arrange sampling by suitably qualified person.
		Amber	Visual checking of waste in tanks received for cleaning.	Every tank.	Yard supervisor.
		Amber	Sample of waste that appears to be inconsistent with the description in the waste transport certificate. Samples are to be taken under laboratory instruction and analysed by a NATA-accredited laboratory. Waste that is being tested is placed in a separate 'quarantine' tank until the results of the testing are known.	Every suspect tank plus a sample taken from a randomly selected tank.	Yard supervisor to arrange sampling by suitably qualified person.
Tank unloading area – waste unloading.	Leakage of wastes from faulty tank, couplings or hoses	Amber	Hoses and couplings are checked for serviceability before use and for lack of leaks during use.	Before and during unloading waste from every tank.	Yard operator.
		Amber	The surface of the tank unloading area is inspected for leaks of waste from tanks being emptied.	After unloading waste from every tank.	Yard operator.
Tank unloading area – waste decanting.	Leakage of wastes from faulty couplings or hoses	Amber	Hoses and couplings are checked for serviceability before use and of lack of leaks during use.	Before and during decanting waste from every tank.	Yard operator.
		Amber	The surface of the tank decanting area is inspected for waste that has leaked from tanks being emptied.	After decanting waste from every tank.	Yard operator.
		Green	The surface of the tank unloading area is inspected for cracks or other defects that could allow spills to reach the underlying ground.	Monthly.	Yard supervisor.
	Odour emissions	Green	Receiving vessels and decanting methods are chosen to minimise aeration of liquid wastes.	During decanting waste from every tank.	Yard operator.

Monitoring location	Potential event	Risk rating	Monitoring or risk control action	Monitoring times	Responsibility
		Green	The perimeter of the premises is checked for the presence of odours that might be regarded as offensive to members of the public. The monitoring is done during waste unloading activities, by a person who is not directly involved with waste handling and, therefore, has not become acclimatised to the odour.	Monthly	Yard supervisor or suitably experienced person with a good sense of smell
Waste storage area	Leakage of wastes from storage tanks	Amber	Tank compound is inspected for spills and leaks and to check that the bund drainage valve is closed.	Every day	Yard supervisor
		Amber	Tank compound bunding is inspected for integrity (lack of cracks or other defects that could allow waste to pass through the bund floor) and serviceability (valve is sufficient to stop flow from the bunded area).	Monthly	Yard supervisor
		Amber	The tank compound drain from the bunded area to the wastewater pit is serviceable.	Prior to each time the valve is opened	Yard operator
Tank washing area	Spillage of washings onto ground outside of tank wash bay	Amber	The area around the tank washing bay is free of spilled washwater.	After each tank has been washed	Yard operator
		Green	Washwater from the tank wash bay is draining to the collection pit.	During each tank washing	Yard operator
Washwater disposal point to sewer	Blockage of wastewater drain to sewer	Green	The drain is free of materials that might block the drain and it flows freely.	At the end of each wash	Yard operator
Stormwater drain discharge point from site	Contamination of stormwater	Amber	Stormwater is checked for oily sheen, sediment, litter or colour.	At the end of each day	Yard operator

After preparing the monitoring plan, the general manager cross-checks the plan against the licence conditions to make sure they are all covered. He draws up a simple table (Table A1.7) to complete the cross-check and confirms that the monitoring covers each of the licence conditions.

Table A1.7: Tiger Tanks monitoring plan cross-check

Licence condition	Management area	Monitoring or control action (see Table A1.6)
A1	Odour	11, 12
WA1.4	Waste acceptance	1, 2, 3, 4, 5
DW1	Stormwater	6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19
DL1	Contamination of land or groundwater	6, 7, 8, 9, 10, 13, 14, 16

The general manager has included the monitoring responsibilities in the job descriptions of the respective employees and has provided checklists that include the required monitoring for each of the areas. The completed checklists are returned to the yard supervisor, who stores them in a safe, accessible place.

The general manager has directed that any issues with waste type must be reported to him immediately and that he be advised as soon as any waste spill has been isolated. He, in turn, advises EPA immediately of any licence non-compliance.

4.7 Review of monitoring results

Throughout the year, the general manager checks compliance of each set of laboratory results with the licence conditions, and looks at whether there are ongoing issues with leaks from tanks from a particular client, or whether there are chronic maintenance issues.

Every year, the general manager reviews the monitoring results.

Most importantly, he checks compliance of the monitoring results with each of the licence conditions, including G1 to G6, as part of preparing the annual performance statement.

4.8 Review of monitoring plan

After review of the year's monitoring results, the general manager will go through the monitoring plan to:

- check that the plan reflects any changes to operations or licence conditions
- increase monitoring in areas where there are data gaps or in areas where problems have been found
- reduce monitoring (after careful review) in areas where testing results are consistently negative and are not critical to demonstrate licence compliance.

CASE STUDY 3 – THE BOURKE SEWAGE TREATMENT PLANT

This case study was designed to address the only plant's impact on the receiving surface water environment. Therefore, the only licence conditions addressed in this case study are those concerning the impact of the wastewater discharge on surface waters. Ordinarily, plant operators would address every licence condition.

1 Background

The township of Bourke has a population of 10,000 and is located in the foothills of the Great Dividing Range, alongside the Westbury River. The town is a regional service centre primarily for agriculture, but also caters for the large number of tourists who visit the region. The main industries in the area are an abattoir and a large commercial bakery, both of which discharge wastes to the sewerage system.

The sewage treatment plant (STP) is located on the banks of the Westbury River, downstream of the township (see Attachment A – Premises plan). It has the ability to remove phosphorus but not nitrogen. Wastewater is discharged directly to the Westbury River. The STP has an EPA licence to discharge treated effluent to the river.

While the average annual flow of the river is relatively large, flows can be very low in late summer or after prolonged dry periods. As with most regions in Victoria, the more recent climate has been much drier, and flows have substantially decreased compared to the previous 10 years.

2 Aims

The aims of this assessment are to demonstrate compliance against licence conditions for the Bourke STP. This will involve:

- assessing the potential risks resulting from operations that relate to licence conditions
- developing and implementing a risk-based monitoring program to assess potential risk and any environmental impacts
- using the monitoring data to demonstrate compliance with licence conditions, and evaluate and review operations and required monitoring
- reporting the findings of the assessment to the plant's CEO.

3 Risk assessment

3.1 Licence conditions

The Bourke STP licence has the following licence conditions as listed in Table A3.1. Table A3.2 represents the discharge limits for the wastewater discharge.

Table A3.1: Licence conditions for the Bourke STP

Condition reference	Management area	Condition text
DW2	Discharge to water	Discharge of waste to surface waters must be in accordance with the discharge to water table.
DW3	Mixing zone	The mixing zone extends for 1 km downstream of the licensed waste discharge point.

The Licence management guidelines *(EPA publication 1322) provide guidance on what to consider when monitoring and reporting compliance with each condition. Relevant suggestions for conditions DW2 and DW3 are provided below.*

Condition DW2:

- Monitor discharges to water to show licence compliance.
- Treat wastewater to the set discharge limits. Remember that the quality of the water discharge(s) can be affected by variations in the wastewater prior to treatment.
- Manage wastewater discharges in accordance with the waste hierarchy (see SEPP WoV) with priority given to avoidance and reduction of the discharge and pollutants. Recycle and reuse treated wastewater as far as possible.

Condition DW3:

- Monitor and assess the extent of the mixing zone.
- Ensure the mixing zone does not result in harm to humans, unacceptable impacts on plants and animals, a loss of aesthetic enjoyment, or an objectionable odour.

- Develop an understanding of how the discharge interacts with the environment and how the receiving waters will be impacted. This includes considering physical (currents, depth profiles), chemical (background concentrations) and biological attributes that influence the mixing of the discharge.
- Ensure there are no impacts to beneficial uses outside the mixing zone.

Table A3.2: Bourke STP wastewater discharge limits to the Westbury River

Indicator	Licence limit	
Suspended solids (mg/L)	Median	20
	90th percentile	80
Total phosphorus (mg/L)	Median	2
	90th percentile	10
Total nitrogen (mg/L)	Median	8
	90th percentile	10
Ammonia (mg/L)	Median	5
	90t percentile	20
Biochemical oxygen demand (five-day) (mg/L)	Median	10
	90th percentile	20
Escherichia coli (orgs/100 mL)	Median	200
	90th percentile	1000

3.2 Context of the assessment

3.2.1 Consultation

Due to the extensive community interest surrounding the impacts of the Bourke STP on the Westbury River, both internal and external stakeholders were consulted during the risk assessment. The external stakeholders consulted included:

- a Bourke Shire representative
- the Northern Victorian Catchment Management Authority (NVCMA)
- major industrial users of the sewerage system
- the Department of Sustainability and Environment
- scientific and technical experts
- adjacent landholders, including residential neighbours
- local community groups.

3.2.2 Environmental management goals and objectives

Environmental management goals and objectives for the Bourke STP are:

1. Wastewater generated must be disposed of in a manner that causes minimal environmental harm.
   - Discharge of waste to surface waters must be in accordance with Table A3.2.
   - The STP will be operated to minimise and, over time, reduce the impact on the receiving waters.
2. To determine the extent and impact of the mixing zone.
   - Determine the extent of the mixing zone by monitoring water quality upstream and downstream of the discharge.
   - Determine the impact of the mixing zone by monitoring invertebrates upstream and downstream of the mixing zone.

3.2.3 Existing information and data

Plant operations and the characteristics of the effluent and receiving environment have been assessed by the Bourke water authority for a number of years.

Operational processes

The Bourke STP operators have been collecting monitoring data on plant operations since the plant began operating. This data include information on how the plant functions, how effective system controls are, the products and by-products of treating the wastewater, and plant emissions to the environment. This information helps guide the completion of the risk register and define the site's priority risks.

Effluent quality

The Bourke STP discharges between 1.5 and 2 ML per day. There are no industrial inputs to the sewerage system other than the abattoir and the bakery and, therefore, toxicants such as heavy metals should not be present in the effluent and are not regularly monitored.

Currently, effluent water quality data indicate that the discharge meets the licence limits (see Table A3.3). However, water quality data collected in the Westbury River indicate an impact from the discharge (see section below). As management goals are to reduce the impact of the discharge on the Westbury River and to define the extent and impact of the mixing zone, the impact will need to be investigated further.

Receiving environment

The Bourke water authority collect water quality data from two sites in the Westbury River. One site is located 100 m upstream of the discharge point and the other is 100 m downstream of the point of discharge. An assessment of these data indicates that the STP discharge increases concentrations of all monitored indicators downstream of the discharge compared with upstream of the discharge (see Table A3.3). Total phosphorus and total nitrogen at the downstream site exceed the SEPP (WoV) objectives (Table A3.4), suggesting the potential for an unacceptable impact on the ecosystem.

The Victorian Water Quality Monitoring Network takes one monthly sample at a location 5 km upstream of Bourke in cleared grazing country. Invertebrate sampling was also conducted at this site in 2006. The water quality and invertebrate results for 2006 are presented in Table A3.4. The site discharges met SEPP (WoV) environmental quality objectives in 2006, although total phosphorus concentration and the SIGNAL score only just met the objectives. In conclusion, the Westbury River upstream of Bourke appeared to be in relatively good ecological condition.

Table A3.3: Discharge limits and water quality monitoring results for the Bourke STP discharge and sites in the Westbury River in 2006

Indicator		Licence limit	Discharge	Westbury River 100 m upstream of discharge point	Westbury River 100 m downstream of discharge point
Electrical conductivity (µS/cm)	Median	None	800	210	250
	90th percentile	None	1000	220	410
Suspended solids (mg/L)	Median	20	10	6	7
	90th percentile	80	20	7	10
Total phosphorus (mg/L)	Median	2	1	0.024	0.045
	90th percentile	10	4	0.041	0.098
Total nitrogen (mg/L)	Median	8	8	0.390	0.590
	90th percentile	10	10	0.520	1.150
Ammonia (mg/L)	Median	5	2	<0.01	0.11
	90th percentile	20	3	0.03	0.37
Biochemical oxygen demand (mg/L)	Median	10	5	<5	5
	90th percentile	20	10	7	10

1 The SIGNAL score is the Stream Invertebrate Grade Number Average Level score. This score gives an indication of water quality of the waters from which the sample was taken

Table A3.4: Water quality and biological data for the Westbury River 5 km upstream of Bourke in 2006 compared with SEPP (WoV).

Indicator	SEPP (WoV) objectives (Cleared Hills Segment)	5 km upstream of Bourke
Electrical conductivity (µS/cm) 75th percentile[1]	500	180
Suspended solids[2] (mg/L) 75th percentile[1]	N/A	7
Turbidity (NTU) 75th percentile[1]	10	7
Total phosphorus (mg/L) 75th percentile[1]	0.025	0.025
Total nitrogen (mg/L) 75th percentile[1]	0.600	0.360
SIGNAL score: riffle (rapid and turbulent stream habitat)	5.5	5.5
SIGNAL score: edge (slow flowing stream habitat)	5.5	5.6
Number of families: riffle	23	25
Number of families: edge	26	28

1: Calculation of 75th percentiles requires 12 data points (monthly data).
2: There is no SEPP (WoV) objective for suspended solids.
3: Invertebrate indices require two samples, one in spring and one in autumn.

3.2.4 Spatial boundary of the assessment

Stakeholders decided that the assessment should include the STP and the extent of the mixing zone in the Westbury River. As the extent of the mixing zone was unknown, technical experts advised plant operators to sample at intervals both upstream and up to 2.5 km downstream of the discharge. If results show that the mixing zone extends beyond this distance, further sampling will be required and the spatial boundary of the assessment increased.

3.3 Identify risks

3.3.1 Site's hazards and environmental aspects

Stakeholders and technical experts identified the potential hazards/environmental aspects generated from operating the STP (see Table A3.5). These have the potential to cause adverse impacts to the environment and increase the extent of the mixing zone.

Table A3.5: Hazards and environmental aspects for the Bourke STP

Environmental aspects	Hazards
Storing toxic chemicals	Alum for flocculation.
Discharge of wastewater to the Westbury River	Nutrient levels. Oxygen demanding substances. Salinity levels. Pathogen levels (*E. coli*). Flows in the receiving waters.
Discharge of untreated effluent (in the event of plant malfunctions)	Untreated effluent entering the Westbury River, surrounding land and groundwater.

3.3.2 Receptors/values

Using Table 1 in SEPP (WoV) 'Beneficial uses to be protected', the potential receptors/values in the surrounding environment that may be impacted by the Bourke STP were identified by the plant operators and stakeholders.

Aquatic ecosystems (including fish and aquatic macroinvertebrates). The Westbury River is considered a high priority reach by the NVCMA due to good riparian vegetation, aquatic communities and in-stream habitat. It also supports major populations of listed native fish species including silver perch, Macquarie perch (endangered) and river blackfish.

Primary recreation. Few people swim in the Westbury River during the summer months.

Secondary recreation (including fishers and canoeists/kayakers). The Westbury River is a major recreational fishery (particularly for native fish species).

Agriculture and irrigation. Local residents rely on the Westbury River as a good clean water supply for stock.

3.3.3 Environmental impacts

Potential environmental impacts on the surrounding environment were identified, by considering each hazard/environmental aspect against the different receptors/elements of the surrounding environment (see Table A3.6).

Table A3.6: Potential impacts of the Bourke STP on the surrounding environment

Hazards/environmental aspects	Potential consequences	Receptor/surrounding environment	Potential environmental impacts
Nutrients present in **wastewater discharge**	High levels of nitrogen and phosphorus downstream of the discharge	Aquatic ecosystems and fishers (secondary contact)	Excessive plant growth in the river Low oxygen levels in the river Fish deaths and reduced amenity
Salinity present in **wastewater discharge**	High electrical conductivity levels downstream of the discharge	Aquatic ecosystems and fishers (secondary contact)	Death to aquatic life as high salinity levels are toxic to aquatic life
Oxygen demanding substances present in **wastewater discharge**	High levels of BOD and/or COD downstream of the discharge	Aquatic ecosystems and fishers (secondary contact)	Low oxygen levels in the river Excessive plant growth in the river Death of aquatic life and reduced amenity
Pathogens present in **wastewater discharge**	Excessive levels of *E. coli* are present in the river	People swimming and boating (primary and secondary contact recreation)	Poor water quality and potential health impacts for those that come into contact with it
Nutrients and oxygen demanding substances present in the discharge of **untreated effluent** to the Westbury River	Very high levels of BOD/COD and nutrients and very low oxygen levels, downstream of the discharge, in the river	Aquatic ecosystems and fishers (secondary contact)	Low oxygen levels in the river Excessive plant growth in the river Death of aquatic life and loss of amenity
Pathogens present in the discharge of **untreated effluent** to the Westbury River	Very high levels of pathogens (*E. coli*) in the discharge to the river	People swimming and boating (primary and secondary contact recreation)	Poor water quality and potential health impacts for those that come into contact with it
Alum spill from ruptured storage tank (plant malfunction)	Aluminium levels increase in the river near the STP	Aquatic ecosystems and fishers (secondary contact)	Aluminium toxicity to aquatic life

3.3.4 Existing controls

Existing operational or systematic controls help to reduce the level of risk posed by current operations. Considering the effectiveness of existing controls is important when evaluating potential impacts. Table A3.7 shows the existing controls at Bourke STP to mitigate environmental impacts.

Table A3.7: Potential hazards and existing controls

Hazards/environmental aspects	Existing controls
Nutrients present in wastewater discharge	Phosphorus removal to 1 mg/L, below EPA licence limits. No nitrogen removal.
Salinity present in wastewater discharge	No controls.
Oxygen demanding substances present in wastewater discharge	Treatment achieves levels below EPA licence limit.
Pathogens present in wastewater discharge	Chlorination to reduce *E. coli* levels to less than EPA licence limits.
High levels of nutrients and oxygen demanding substances from the discharge of untreated effluent to the Westbury River	24-hour monitoring and built in redundancy, including 2 ML containment pond.
Alum spill from ruptured storage tank	Storage tank is bunded. Bund will contain entire contents of storage tank.

3.3.5 Factors influencing risks occurring

As daily effluent monitoring indicates that the wastewater discharge meets the licence limits, the factors most likely to influence the chance of an impact occurring are **plant malfunctions** (including ineffectiveness of systematic controls) and **river flows**.

Plant malfunction

Plant malfunction is unlikely as processes are computer controlled, have built in backups and are monitored 24 hours a day. Inflow volumes may vary but an equalisation tank will buffer the system. The maximum the system has run at during a substantial wet weather event was only 80 per cent of capacity.

River flows

River flows are critical to minimising impacts from the wastewater discharge, including the size of the mixing zone. Given Victoria's current climate, river flows have reduced in most parts of the State over recent years. Flow levels tend to reach critical levels during summer months. This trend is experienced in the Westbury River.

3.3.6 Conceptual model

Figure A1.1 represents the potential major impacts caused by STP operations and the discharge to the Westbury River.

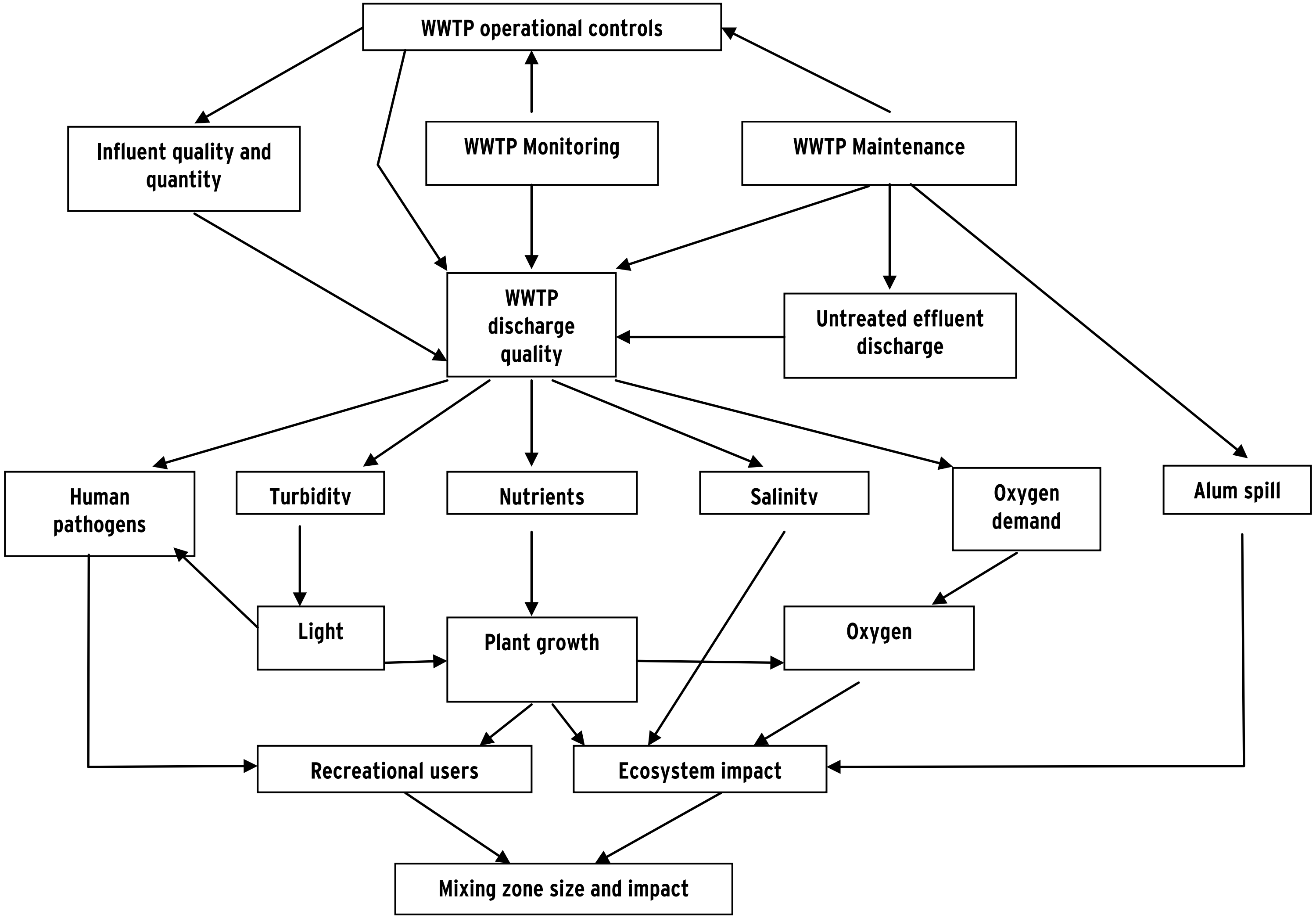


Figure A1.1: Conceptual model of impacts of the Bourke STP effluent discharge on beneficial uses in the Westbury River.

3.4 Risk analysis

3.4.1 Assessing likelihood

The descriptors in table A3.8 were used to determine the likelihood of each risk occurring as a result of site operations. This is a qualitative assessment of likelihood.

Table A3.8: Qualitative measures of likelihood

Rating	Indicator	Description
A	Almost certain	Is expected to occur almost all of the time
B	Likely	Is expected to occur most of the time
C	Probable	Might occur
D	Not likely	Might occur but not expected to
E	Rare	Only expected to occur under atypical conditions

3.4.2 Assessing consequence

The descriptors in table A3.9 were used to determine the consequence/impact if a risk were to occur as a result of site operations. This is a qualitative assessment of consequence.

Table A3.9: Qualitative measures of consequence/impact

Level	Descriptor	Detail description
1	Severe	• Human deaths • Operations cause catastrophic off-site impacts - loss of significant fauna or flora • Immense financial loss
2	Significant	• Extensive human injuries or illness • Operations cause substantial off-site impacts - substantial alteration to ecosystem structure of function • Major financial loss
3	Medium	• Some health impacts to humans • Operations cause some external impacts - significant alteration to ecosystem structure of function • Large financial loss
4	Minor	• First aid treatment • Operations cause minimal off-site impacts - minimal measurable alteration to ecosystem structure of function • Small financial loss
5	Negligible	• Operations cause no injuries • Negligible off-site impacts - no measurable alteration to ecosystem structure of function • Negligible financial loss

3.4.3 Assessing level of risk

Using the results from assessing the likelihood and consequence of each risk, the level of risk was determined using the descriptors in table A3.10. This is a qualitative assessment of level of risk.

Table A3.10: Qualitative risk analysis matrix – level of risk

Consequence	Likelihood				
	A Almost certain	B Likely	C Probable	D Not likely	E Rare
1 Severe	V	V	V	H	H
2 Significant	V	H	H	H	M
3 Medium	V	H	M	M	M
4 Minor	H	M	M	M	L
5 Negligible	H	M	L	L	L

V = Very high risk; immediate action required.
H = High risk; management required from senior staff.
M = Medium risk; specify required management.
L = Low risk; manage with standard operating procedure.

3.4.5 Risk register

The risk register documents the hazards and environmental aspects resulting from the STP activities, their potential impact, and the resulting likelihood, consequence and level of risk rating for each risk (see Table A3.11).

Priority risks were identified from the risk register by ranking risks based on the level of risk posed to the environment (the likelihood of a risk occurring and the consequence if it does). That is, the higher the level of risk, the higher the priority of dealing with the risk. Management actions are based on the highest risk(s). The risk register was completed using information and data collected from the stakeholder workshops, the risk analysis, and consultation with relevant experts.

The highest risk was determined to be the impact of nutrients on the ecological health of the Westbury River. The priority for monitoring therefore is the need to better understand the magnitude and extent of the impact of the discharge on the Westbury River. This will help determine compliance with the site's mixing zone licence condition. The outcome of the assessment indicates that the lower priority risks do not require ongoing monitoring. However, a log of incidents needs to be kept and any major incidents immediately investigated.

Table A3.11: Bourke STP risk register

Date	Location	Environment category	Aspects (activities/ emissions for each phase of project)	Description of potential impacts	Pathways for risk (factors influencing risk occurring)	Existing controls	Likelihood	Consequence severity rating	Level of risk	Comments
03/11/06	Outside western boundary of premises at discharge point to Westbury River	Water	**Wastewater discharge** with high nutrient levels.	Excessive plant growths lead to ecosystem degradation, including fish deaths and changes to macroinvertebrate communities. Also affects recreational uses.	Low flow, clear waters, sunlight and temperature. Also wastewater treatment process upsets such as equipment failure.	Secondary treatment of influent with phosphorus removal. Maintenance of treatment processes and equipment, and continuous monitoring of process.	Almost certain	Significant	V	Data indicates impact on river. Lack of data suggests need to further assess impacts and extent of mixing zone, then assess need for plant upgrades.
03/11/06	Outside western boundary of premises at discharge point to Westbury River	Water	**Untreated effluent discharge** with high nutrient levels and BOD/COD.	Excessive plant growths and low oxygen levels lead to ecosystem degradation, including fish deaths and changes to macroinvertebrate communities. Also affects recreational.	Low flow, clear waters, sunlight and temperature. Also wastewater treatment such as equipment failure.	In the event of process upsets, influent is diverted to holding pond. Maintenance of treatment processes and equipment, and continuous monitoring of process.	Rare	Significant	M	Maintenance of treatment processes and equipment, and continuous monitoring of process will avoid failure, but pond is backup if issue arises.
03/11/06	Outside western boundary of premises at discharge point to Westbury River	Water	**Wastewater discharge** with high pathogen levels	Affect swimmers and potentially and boaters and fishers	Low flow, low light. Also wastewater treatment such as equipment failure.	Secondary treatment of influent with chlorine disinfection. Maintenance of treatment processes and equipment, and continuous monitoring of process.	Rare	Medium	M	Data indicate low *E. coli* levels. There is little swimming in the river. Potential for high levels only with plant failure that is unlikely.

Date	Location	Environment category	Aspects (activities/ emissions for each phase of project)	Description of potential impacts	Pathways for risk (factors influencing risk occurring)	Existing controls	Likelihood	Consequence severity rating	Level of risk	Comments
03/11/06	Outside western boundary of premises at discharge point to Westbury River	Water	**Untreated effluent discharge** with high pathogen levels.	Affect swimmers and potentially and boaters and fishers	Low flow, low light Also wastewater treatment such as equipment failure.	In the event of process upsets, influent is diverted to holding pond. Maintenance of treatment processes and equipment, and continuous monitoring of process	Rare	Significant	M	Data indicate low *E. coli* levels. There is little swimming in the river. Potential for high levels only with plant failure that is unlikely.
03/11/06	Outside western boundary of premises at discharge point to Westbury River	Water	**Wastewater discharge** with high salinity levels	High salinity levels are toxic and lead to ecosystem degradation, including fish deaths and changes to macroinvertebrate communities.	Low flow, temperature. Also wastewater treatment such as equipment failure.	Secondary treatment of influent. Maintenance of treatment processes and equipment, and continuous monitoring of process.	Rare	Minor	L	Data indicate salinity levels will not exceed toxic levels even if river flow is very low.
03/11/06	Outside western boundary of premises at or near discharge point to Westbury River	Water	Spill of alum in the STP enters the river resulting in high levels of aluminium in the river	Aluminium (from alum) is toxic to aquatic life and will cause fish deaths and major changes to macroinvertebrate communities	pH, low flow and temperature. Maintenance of storage tank or delivery system.	Storage tank is bunded. Maintenance of system. Continuous monitoring of alum flows.	Rare	Negligible	L	In the event of a leak contents will be kept within the bund. Maintenance of equipment, and continuous monitoring of process will avoid failure but pond is back up if issue arises.

4 Monitoring program

Monitoring focuses on measuring the licence discharge limits and understanding the magnitude and extent of the impact of the discharge. Based on the findings of the risk assessment, the following monitoring program has been developed.

The highest (priority) risk posed by the site's operations is the impact of nutrients on the ecological health of the Westbury River. The level of these indicators may result in non-compliance with the mixing zone licence condition. While other risks have been assessed to be of lower priority, an ongoing log of incidents is kept and, in the event of a major incident, appropriate monitoring will be undertaken.

4.1 Monitoring objectives

The objectives of this monitoring program are to:

1. determine compliance with licence limits in the discharge
2. determine compliance with the mixing size as specified in the licence
3. assess the level of impact on the Westbury River
4. recommend operational changes necessary to protect the health of the Westbury River downstream of the STP discharge and reduce the mixing zone.

4.2 Surrounding environment

Refer to section 1 above.

4.3 Indicators

4.3.1 Discharge

The indicators monitored in the wastewater discharge (at the end of pipe) are suspended solids, total phosphorus, total nitrogen, ammonia, BOD, and *E. coli*. These indicators are included in the Bourke STP licence (see Table A3.2.)

4.3.2 Receiving environment

Indicators for assessing the extent of the mixing zone were identified on the basis of potential risks. The nutrients for plant growth, phosphorus and nitrogen were the most likely cause of potential risk. With increased plant growth, overnight oxygen concentrations may be depressed. In addition, salinity in the discharge is high as is ammonia so these were also targeted. The ecological health of the river was identified as a major value; therefore the invertebrate community was chosen as an indicator. Overall the following indicators were measured to assess the extent and impact of the mixing zone:

- total phosphorus
- total nitrogen
- dissolved oxygen
- total ammonia
- electrical conductivity
- invertebrates taken from both the riffle and pool in-stream habitats.

4.4 Trigger levels

For the discharge to the Westbury River the EPA licence limits (Table A3.2) are considered to be appropriate. If one or more of the triggers are exceeded, the operational status of the plant must be immediately assessed. In addition, when a trigger is exceeded, further monitoring needs to be undertaken to assess the current status of the issue.

4.5 Monitoring locations

Sites were sampled upstream of the discharge and downstream of the discharge at increasing distance. See Figure A3.2 for sampling sites. An upstream site was chosen to establish background conditions in the river (minus the impact from the discharge). A site was selected 100 m downstream of the discharge to indicate the initial impact in the river from the discharge. Sites were then chosen at increasing distance downstream to work out the extent and the impact of the mixing zone. In addition to these sites, the discharge was monitored at the end of pipe immediately before entering the river.

4.6 Frequency and timing

4.6.1 Discharge monitoring

The indicators in the wastewater discharge are monitored by plant operators on a monthly basis. The reason for this frequency is so medians and 90th percentiles can be calculated with a high degree of confidence. Also, past monitoring data indicates that discharge parameters comply with the limits set in the licence; therefore monthly monitoring is adequate. In the event that site operations deviate from what is expected, monitoring of the discharge may need to be increased. Monthly monitoring of the discharge matches the monitoring frequency of water quality sampling in the Westbury River.

4.6.2 Water quality monitoring in the Westbury River

Water quality sampling in the Westbury River was undertaken monthly for two years, from January 2007 to December 2008 to determine the extent and the impact of the mixing zone. Sampling was undertaken monthly so that 75th percentiles and medians could be calculated with a high degree of confidence. Data is reported on annually to satisfy licence requirements.

4.6.3 Invertebrate sampling

Invertebrates were sampled twice a year, once in autumn and once in spring. This is recommended for using the AUSRIVAS models and calculating other invertebrate indices. AUSRIVAS, the Australian Rivers Assessment System, is a suite of mathematical models that predict the aquatic invertebrates that should be present in specific stream habitats under reference conditions.

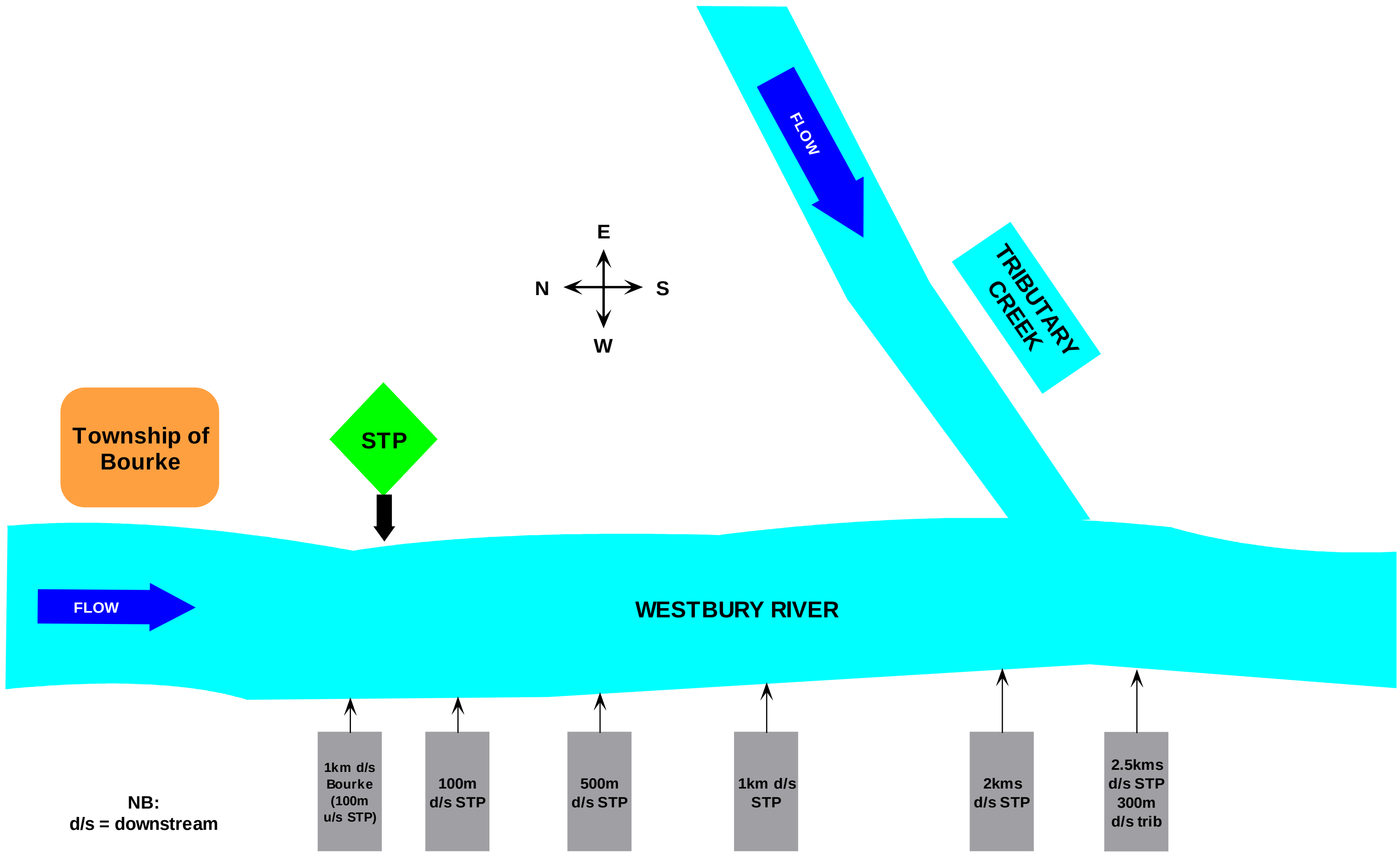


Figure A3.2: Location of sampling sites on the Westbury River in 2007–08

4.7 Quality assurance and quality control measures

4.7.1 Sample collection and analysis

The QA/QC program for sample collection and analysis ensures:

- biological and water quality sampling is undertaken by qualified and accredited personnel
- water quality sample analysis is undertaken by NATA accredited laboratories (QA/QC results forwarded with results)
- biological sample analysis is undertaken by qualified and accredited personnel
- operational aspects of the STP are monitored and documented
- a dedicated project officer manages the ongoing issues, including investigation of trigger value exceedances.

All data collection followed the methods and procedures in the following publications:

- EPA Victoria (2009). *Sampling and analysis of waters, wastewaters, soils and wastes*. Publication IWRG701.
- EPA Victoria (2003a). *Rapid bioassessment methodology for rivers and streams*. Publication 604.1.

4.7.2 Data management

All data are stored in an in-house database, with backup hard copies held in a filing system. Data entered on databases are checked by another staff member to pick up any data entry errors.

4.8 Analysis of monitoring results

The impact of the STP discharge and extent of the mixing zone were assessed based on the worst-case scenario, that is, the minimum dilution capacity of the receiving waters during the summer months of around 10:1. Therefore, the data reported on here are from the summer period of November 2007 to April 2008. The data points used in the graphs are median values from this time period. Data from the other times in the year show the discharge to have less of an impact on the Westbury River (e.g. during cooler months).

Downstream of the Bourke STP

Downstream of the STP discharge concentrations of nutrients increased substantially (Figures A3.4 and A3.5). Concentrations were at levels that are known to result in substantial filamentous algal growths in upland rivers. Daytime oxygen levels increased to greater than 100 per cent saturation (Figure A3.3), indicating increased plant productivity and oxygen generation during the day. Pre-dawn spot measurements revealed oxygen levels down to 50 per cent saturation within 0.5 km of the discharge, which would have had substantial effects on upland stream fauna.

The substantial decrease in all invertebrate scores downstream of the STP discharge indicates an impact on the invertebrate community (Figures A3.7, A3.8 and A3.9). Changes in the invertebrate community may not only be due to low oxygen levels, but changes in habitat and food sources due to excessive algal and macrophyte growth (Newall & Bourke 2002).

While total ammonia levels increase dramatically (Figure A3.6), the concentration is still below levels that are toxic and pose a risk to aquatic biota (ANZECC & ARMCANZ 2000). The pH (around 7.0) and water temperature (around 20 °C) measurements suggest that levels of free ammonia (NH_3), the toxic form, would have been low and most would be in the ionised form, NH_4^+. The temperature and turbulence quickly converts the NH_4^+ to other forms of nitrogen and it declined back to background very quickly.

Phosphorus decreased progressively downstream and at 2 km downstream was approximately half the level at the discharge and at levels similar to upstream of the discharge (Figure A3.4). Daytime oxygen levels (Figure A3.3) and all invertebrate scores (Figures A3.7, A3.8 and A3.9) were back to levels upstream of the STP by 2 km downstream of the discharge. Nitrogen, however, remained high until the diluting influence of the tributary occurred (Figure A3.5). All indicators, except nitrogen, were back to levels upstream of the discharge, downstream of the tributary.

Interestingly, SIGNAL scores increased at 2 km to above the score for the site upstream of the discharge (Figure A3.7). This is most likely due to stimulation of the community by a moderate growth of plant material.

A mixing zone is the area where background levels or SEPP (WoV) objectives are not met. This analysis suggests that the extent of the mixing zone is 2 km, that is, the invertebrate community and most of the water quality indicators returned to conditions similar to upstream of the STP by 2 km. While nitrogen levels did not return to upstream levels at this point, the impact of the nitrogen was minimal as it is phosphorus that was driving the excess plant growth and the changes to the invertebrate communities.

Within the mixing zone low levels of oxygen were measured during the night and although these measurements were limited, extensive measurements during daylight hours show very high levels, suggesting a substantial ongoing period of oxygen stress to aquatic biota during the night.

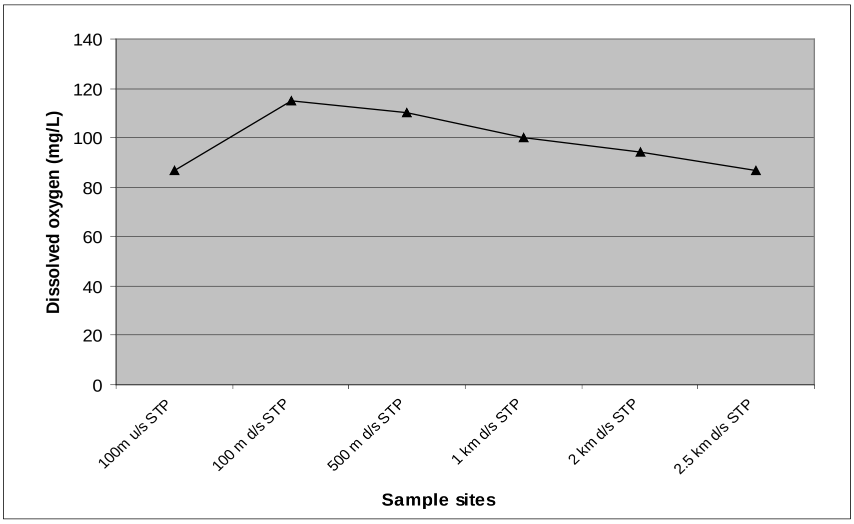


Figure A3.3: Dissolved oxygen levels (% saturation) in the Westbury River summer 2007-08

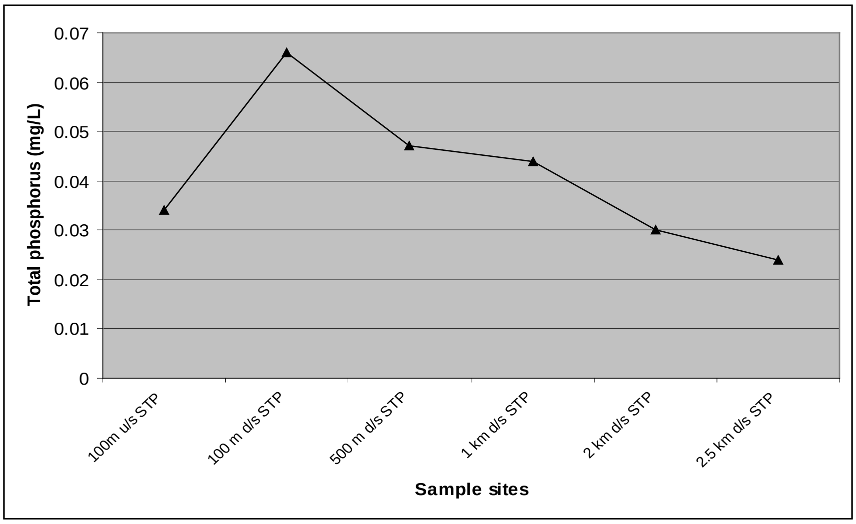


Figure A3.4: Total phosphorus concentrations (mg/L) in the Westbury River summer 2007-08

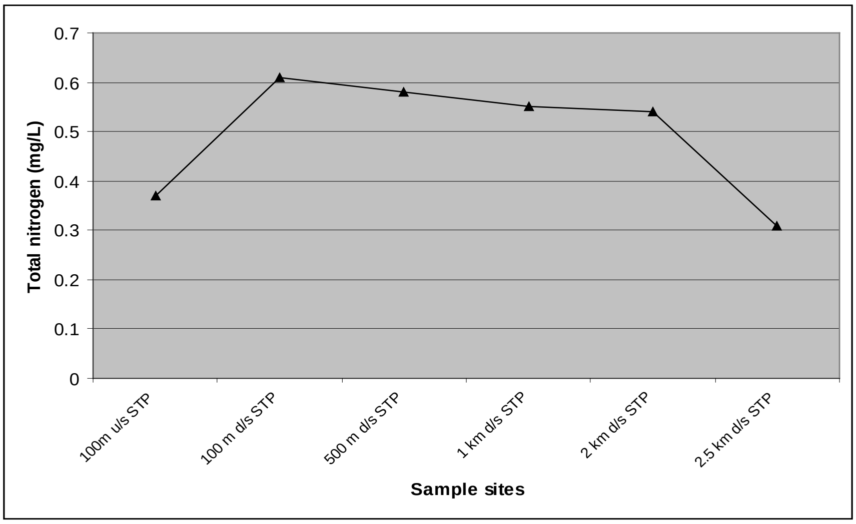


Figure A3.5: Total nitrogen concentrations (mg/L) in the Westbury River summer 2007-08

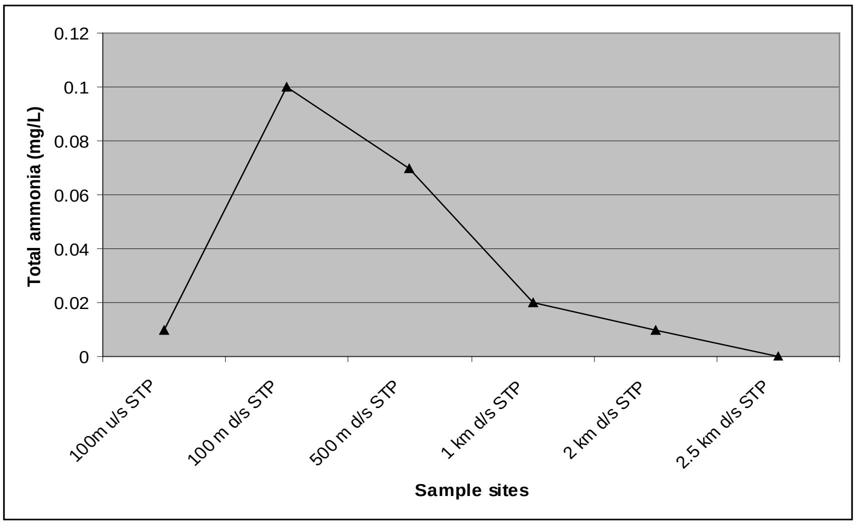


Figure A3.6: Total ammonia concentrations (mg/L) in the Westbury River summer 2007-08

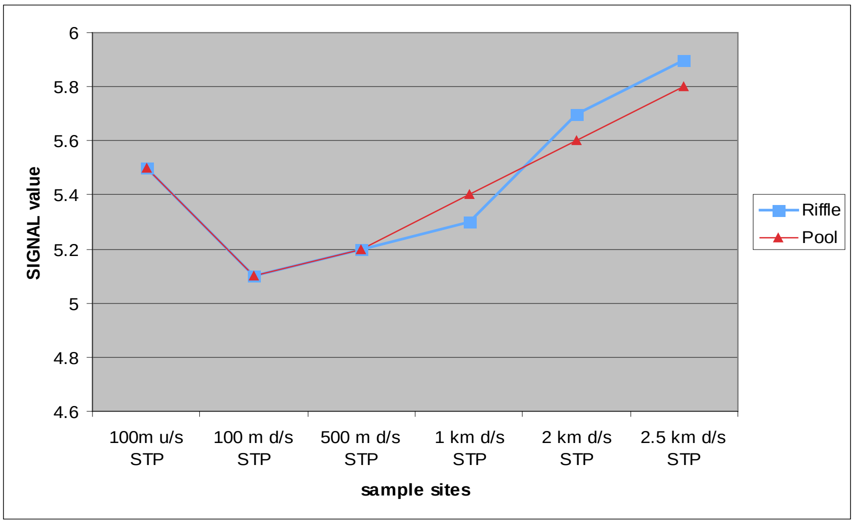


Figure A3.7: SIGNAL scores for riffles in the Westbury River summer 2007-08

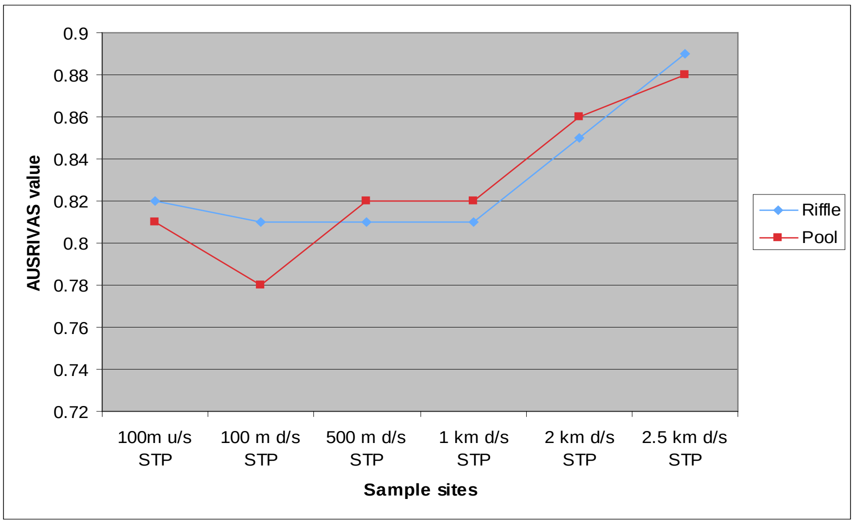


Figure A3.8: AUSRIVAS scores for riffles in the Westbury River summer 2007-08

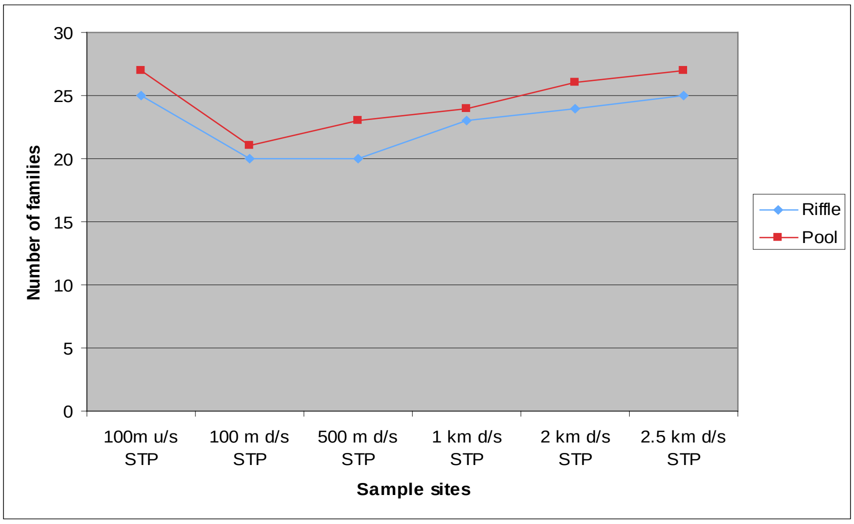


Figure A3.9: Number of families in riffles in the Westbury River summer 2007-08

The Bourke STP discharge substantially alters the water quality and invertebrate communities in the Westbury River during the high risk summer low flow months. In summer, the mixing zone was determined to extend for 2 km downstream of the discharge. During the high flow winter months the extent of the mixing zone is substantially less and meets the licence requirement of a 1 km mixing zone. Total phosphorus is likely to be the limiting nutrient for plant growth in the Westbury River. Reducing total phosphorus concentrations in the discharge is likely to reduce the extent of the mixing zone.

While total nitrogen levels were elevated to at least 2.5 km downstream of the STP discharge, there were no measurable impacts on aquatic life.

5 Recommendations

1. Compliance with licence conditions:

The Bourke STP discharge complies with the limits set in the discharge table of the licence. Although the Bourke STP meets the mixing zone licence condition requirements during the cooler, wetter winter months, this is not the case during summer. During summer, operations do not comply with the mixing zone requirements as the extent of the mixing zone was determined to be 2 km instead of 1 km. Breaching this licence condition and the requirements of the SEPP (WoV) has consequences for the environment and may lead to enforcement action by EPA. It is therefore imperative that the plant operators of the Bourke STP reduce these impacts so they comply with their mixing zone licence condition and the SEPP (WoV).

2. Potential management actions:

The extent of the mixing zone should be reduced through either: reducing the concentration of nutrients in the discharge; reducing the volume of discharge; or eliminating the discharge during the low flow summer months. In accordance with the waste hierarchy, avoidance should be the first consideration, followed by re-use and then recycling. Reuse during the summer months should be investigated.

3. Ongoing monitoring program:

Monitoring is important for verifying the outcomes of management action and the extent and impact of the mixing zone. The implications of climate change should also be a major issue assessed as part of the ongoing monitoring program.

Monitoring effort should focus on the high risk summer low flow period – monthly sampling from November to April inclusive.

Sites can be limited to key sites at:

- 100 m upstream of the discharge
- the discharge
- 100 m downstream of the discharge
- 500 m downstream of the discharge

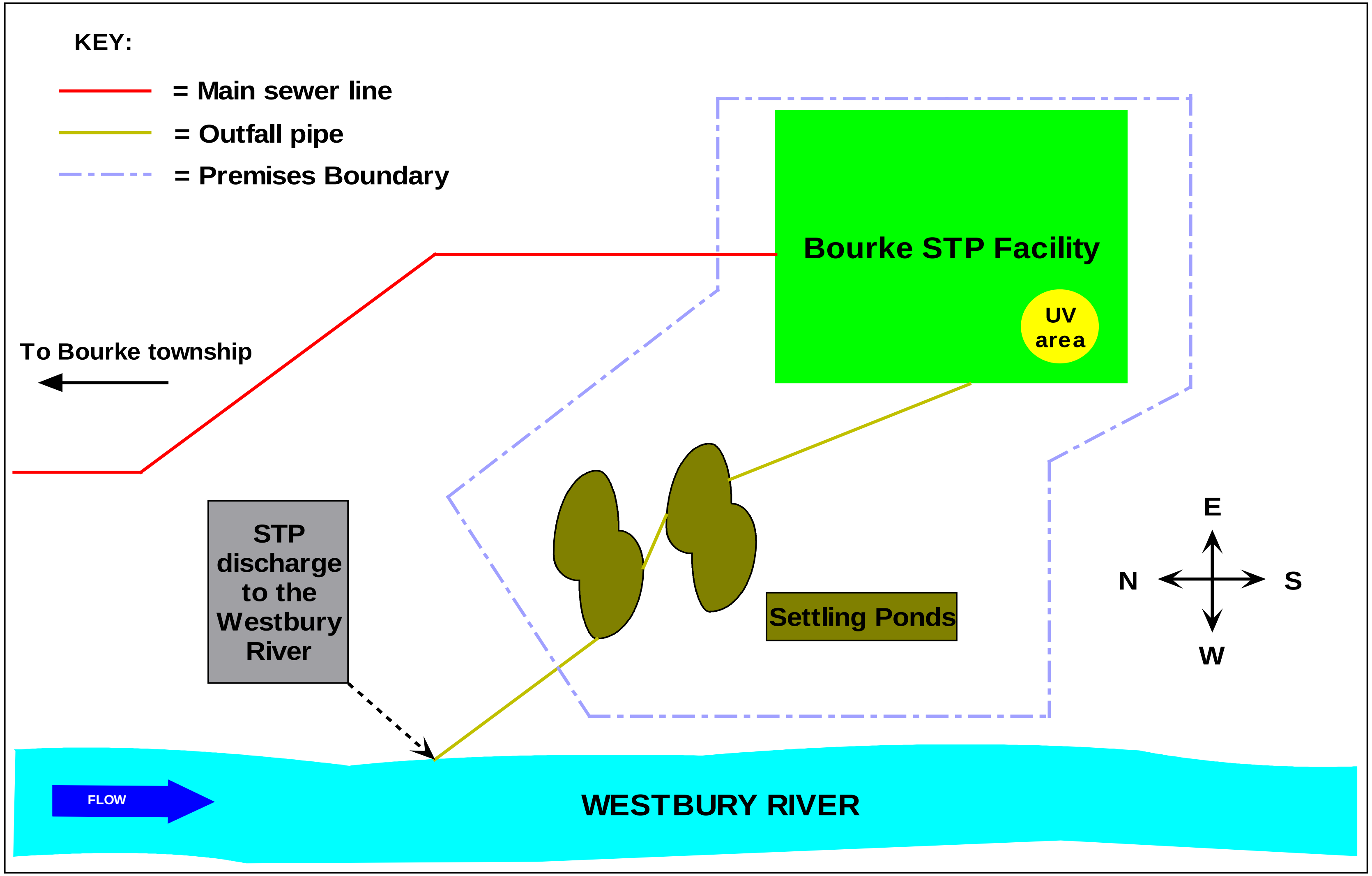
- 1 km downstream of the discharge
- 2 km downstream of the discharge.

Indicators should include:

- total phosphorus
- total ammonia
- total nitrogen
- pH
- EC
- pathogens – *E. coli*
- invertebrates.

Data should be reviewed and reported annually and used to evaluate the monitoring program and the effectiveness of any implemented management actions.

ATTACHMENT A: PREMISES PLAN



CASE STUDY 4 – OLIEBOLLEN OIL RECYCLERS

This case study only addresses the plant's impact on the receiving air environment. Consequently, this case study only deals with air-related licence conditions and not any other requirements that might be in the licence. In all cases, licence-holders must address each of the licence conditions, which in an industry of this type would include soil and groundwater controls. In order to provide a more comprehensive example, this case study represents air emissions from a medium to large premises at which there is a range of potential emission sources including both fugitive and point source discharges.

Depending on the range of potential emission points from your operations, your risk-based monitoring plan may be more or less complex than the one presented in this case study. By following the guidelines, you should be able to prepare a risk-based monitoring plan that reflects your operations, clearly identifies your monitoring needs and meets your EPA licence requirements.

1 Background

Oliebollen Oil operates a waste mineral oil recycling facility in an industrial precinct on the fringe of Melbourne. The site is surrounded by other industrial premises that include a heavy vehicle repair workshop, a galvanising works, a waste storage facility and a plastics extrusion plant. A residential area is located 500 metres away from the premises.

Waste oil from various sources, including marine, heavy industrial and motor mechanics workshops, is delivered to the facility using road tankers. The oil is pumped into a receiving tank from which it is transferred to different process tanks, depending on the proposed treatment.

The raw waste oil is pre-treated in a heated de-watering tank from which the discharge streams are dehydrated oil, wastewater and vapour. The dehydrated oil is treated using a propane de-asphalting process that generates de-asphalted oil and an asphalt extract. Depending on market requirements, the de-asphalted oil may be distilled to produce oil of required viscosity. Waste streams from this process include furnace combustion gases, a vapour stream that is flared and vacuum tower bottoms (oil contaminants removed during distillation).

2 Aims

The aims of this assessment are to demonstrate compliance against licence conditions for Oliebollen Oil. This will involve:

- assessing the potential risks resulting from operations
- developing and implementing a risk-based monitoring program to assess potential risk and any environmental impacts
- using the results of the monitoring program to demonstrate compliance with licence conditions and to review operations and required monitoring
- reporting the findings of the monitoring program to the plant's chief executive officer.

3 Risk assessment

3.1 Licence conditions

The Oliebollen Oil licence has the air-related licence conditions listed in Table A4.1. Air discharge limits specified in the licence are given in Table A4.2.

Table A4.1: Air-related licence conditions for Oliebollen Oil

Condition reference	Management area	Condition text
DA1	Point source and bubble limit	Discharge of waste to air must be in accordance with the 'Discharge to air' table.
DA2	Smoke – visible emissions	Visible emissions to air other than steam must not be discharged from the premises.
A1	Odour	Offensive odours must not be discharged beyond the boundaries of the plant.

The Licence management guidelines *(EPA publication 1322) provide guidance on what to consider when monitoring and reporting compliance with each condition. Suggestions for conditions DA1, DA2 and A1 are provided below.*

Condition DA1:

- 'Best practice' is applied to the management of emissions to air, with discharges of air quality indicators listed as Class 3 indicators in SEPP AQM to be reduced to the maximum extent achievable.

- Meet all the limits in the discharge table.
- Monitor discharges to air to show compliance with your licence.
- Check for any variations in temperature, pH and feedstock, as this can affect air discharges.
- Look to continuously reduce your emissions.
- Determine particle size of air emissions, as smaller particles are more hazardous to humans and efforts should be made to reduce their discharge.

Condition DA2:

- Ensure there are no visible emissions to air.
- Ensure any discharged steam is not contaminated.
- Notify EPA as soon as possible if a flare is used as the result of an emergency.
- Keep records of complaints received and the investigation of those complaints. Note all visible emission complaints in the APS, as they are an indicator of licence non-compliance.

Condition A1:

- Identify sources of odour which may include discharges to air from flues and vents, delivery and pick up of odorous materials, unenclosed buildings housing odorous activities.
- Enclose any sources of odour as far as possible.
- Keep any odour control equipment fully functional.
- Inform neighbours when aware of any odorous discharge during maintenance activities or because of an upset in operations so that they understand what is happening. Consider the contingency and mitigation measures for such circumstances
- Investigate complaints received and keep records of the complaints and any findings of the investigation. Note all odour complaints in the APS, as they are an indicator of licence non-compliance
- Conduct regular odour surveys along your premises boundary to identify any odour emissions and manage the sources of those odour discharges and monitor their performance.

Table A4.2: Oliebollen Oil licence discharge to air limits

Indicator	Licence limit – maximum rate (g/min)
Oxides of sulfur (as SO_2)	35
Oxides of nitrogen (as NOx)	5
Carbon monoxide	10
Total volatile organic compounds	8
Particles	6
Polycyclic aromatic hydrocarbons (total)	0.5

3.2 Context of the assessment

3.2.1 Consultation

As uncontrolled discharges are likely to cause odour complaints and ongoing emissions can affect the local air environment, both internal and external stakeholders were consulted during the risk assessment. The external stakeholders consulted include:

- a city council representative
- scientific and technical experts in oil distillation and odour control
- adjacent landholders or occupiers, including residential neighbours
- local community groups.

3.2.2 Management goals and objectives

Management goals for Oliebollen Oil are:

1. emissions to air are controlled to cause minimal environmental harm
2. residual emissions are monitored to assess compliance with licence conditions and to identify excessive emissions or trends in emissions that may indicate process control or equipment failure.

These goals are represented by the following specific management objectives:

1. Discharge of waste to air to be in accordance with Table A4.2.
2. Process and pollution control equipment at the premises to be operated to minimise and, over time, reduce the impact on the atmosphere.
3. If necessary, raw material (waste oil) accepted at the premises is checked and analysed to verify that it is within the acceptable quality standards. This reduces the likelihood of process upsets that may lead to the discharge of waste to air (including odour) and cause an exceedance of licence limits.
4. Isolate and return to the consigner any raw material that does not meet required quality limits.

3.2.3. Existing information and data

Plant operational parameters and waste discharges to air have been monitored by Oliebollen Oil for a number of years. The available information includes a register of complaints made to Oliebollen Oil by members of the public and regulatory authorities.

An ambient sulfur dioxide (SO_2) monitor has been installed at the prevailing downwind (eastern) end of the premises to provide continuous monitoring of atmospheric SO_2. Review of the monitoring results from the past two years has determined that the ambient concentrations of sulfur dioxide have consistently remained well below (and is expected to remain well below) the State environment protection policy toxicity-based design criterion of 0.17 ppm (and, therefore, also meets the NEPM pollutant standard level of 0.2 ppm). Oliebollen Oil has decided to discontinue use of the sulfur dioxide monitoring station. The monitoring will be restarted if there is a significant increase in throughput or a significant change in operations.

Raw materials

Oliebollen Oil has an established range of customers from which it regularly obtains used oil. The source and history of the oil obtained from these sources is well characterised. On occasions, however, maintenance works at some of the customers’ sites generate waste oils that have unusual contaminants that could cause excessive odour emissions. When a new customer delivers a consignment of waste oil, the provenance and condition of the oil are checked prior to acceptance of the load. Where there is a potential for the oil to be contaminated with PCBs (i.e. it comes from a high-risk source such as a producer dealing with electrical equipment), the oil is quarantined and a sample is taken for analysis. A second sample is also taken and retained for six months as part of the company’s assessment protocols and to demonstrate compliance verification efforts to EPA if required. Once the analytical results indicate that the oil is acceptable, it is then introduced to the process stream. If it contains PCBs, then, depending on the concentration of PCBs, the consignment is held in quarantine and the consignor and EPA are informed.

A targeted risk assessment is conducted for each shipment of oil received to determine its source, quality and potential for contamination by PCBs, odorous compounds, or other such material that might cause licence non-compliance.

Operational processes

Oil processing equipment maintained by Oliebollen Oil is controlled by a PLC (programmable logic controller) system. This system retains operational data that can be used to trigger an alarm if a process parameter is exceeded, or interrogated to identify process upsets once excessive emissions have been detected.

Experienced operators at the plant are also able to determine from equipment performance and waste oil characteristics if there is a potential for process upsets to occur.

3.2.4 Spatial boundary of the assessment

The boundaries of the assessment extend to include the immediate neighbours and the reporters of any verified complaints directly relating to plant operations.

3.3 Identify risks

3.3.1 Site’s hazards and environmental aspects

Discussion with stakeholders and technical experts identified the potential hazards/environmental aspects generated from operating the oil recycling plant. These are listed in Table A4.3.

Table A4.3: Hazards and environmental aspects (air emissions) for Oliebollen Oil

Environmental aspect	Hazard
Receipt of waste oil	• Waste oil contaminants, such as PCBs or with sulfur compounds, cause problems as premises not capable of handling these wastes. • Vapour, contaminant and odorous materials within waste oil. • Vapour and odours in headspace of receiving tank. • Raw waste oil held in receiving tank.
Dewatering of waste oil	• Vapour generated in heated oil dewatering tank. • Heated oil held in dewatering tank. • Stored dehydrated oil.
Propane de-asphalting	• Propane held in storage, reticulation, heating and condensing system. • Heated hydrocarbon vapour held in de-asphalting vessels. • Stored asphalt extract. • Stored de-asphalted oil.
Oil distillation	• Stored oil fractions. • Distilled oil vapour stream. • Stored vacuum tower bottoms. • Cooling water used for condenser.
Waste gas flaring	• Fuel used to fire the gas flare. • Flare exhaust gas.
Oil shipment	• Oil held in road tanker loading gantry.

3.3.2 Receptors

Potential receptors identified during the meeting of plant operators and stakeholders are:

- air shed
- employees working at adjacent properties
- pedestrians using the footpath in front of the premises
- drivers and passengers in road traffic
- people who may live, work or participate in recreational activities downwind of the premises
- receivers of treated oil, by-products and wastewater.

Note: site employees are not addressed here, as they are covered by occupational health and safety requirements.

3.3.3 Environmental impacts

Potential environmental impacts on the surrounding environment were identified by considering each environmental hazard in the context of the various receptors. The results are shown in Table A4.4.

Table A4.4: Potential impacts of the Oliebollen Oil on the surrounding environment

Environmental aspect	Potential consequence	Receptor	Potential environmental impact
Receipt of waste oil			
Vapour, contaminants (such as PCBs) and odorous materials within waste oil.	Vapour and odour released from oil during handling. Ignition of volatile gases. Contamination of waste oil stream with PCBs.	Downwind employees, residents, pedestrians and road users. End-users of recycled oil product.	Inhalation of vapours leading to illness. Exposure to odours leading to offence. Discharge of noxious smoke. Release of PCBs to the environment.
Vapour and odours in headspace of receiving tank.	Discharge of vapour and odours to air from displacement of tank headspace. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours leading to offence. Discharge of noxious smoke.
Raw waste oil held in receiving tank.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours leading to offence. Discharge of noxious smoke.

Environmental aspect	Potential consequence	Receptor	Potential environmental impact
Dewatering of waste oil			
Vapour generated in heated oil dewatering tank.	Release of oil vapour and odour. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Heated oil held in dewatering tank.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Stored dehydrated oil.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Propane de-asphalting			
Propane held in storage, reticulation, heating and condensing system.	Release of propane. Ignition of propane.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Heated hydrocarbon vapour held in de-asphalting vessels.	Loss of containment of vapours. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Stored asphalt extract.	Loss of containment of extract.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Stored de-asphalted oil.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Oil distillation			
Stored oil fractions.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Distilled oil vapour stream.	Loss of containment of vapours. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.
Stored vacuum tower bottoms.	Loss of containment of bottoms.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence.
Cooling water used for condenser.	Contamination of water by oil and release of odour.	Downwind employees, residents, pedestrians and road users.	Exposure to odours causing offence. (Note: issues associated with management of the cooling water are not addressed here. They are covered by Victorian Department of Health guidelines.)
Waste gas flaring			
Fuel used to fire the gas flare.	Release of gas fuel. Ignition of gas fuel.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Discharge of noxious smoke.
Flare exhaust gas.	Discharge of products of combustion.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence.
Oil shipment			
Oil held in road tanker loading gantry.	Loss of containment of oil. Ignition of volatile gases.	Downwind employees, residents, pedestrians and road users.	Inhalation of vapours leading to illness. Exposure to odours causing offence. Discharge of noxious smoke.

3.3.4 Existing controls

A range of operational and system controls are in place at Oliebollen Oil to reduce the level of risk posed by the current operations. These controls are listed in Table A4.5.

Table A4.5: Operational control systems in place for air emissions from Oliebollen Oil

Environmental aspect	Existing environmental control
Receipt of waste oil	
Vapour, contaminant and odorous materials within waste oil.	Vapour recovery system fitted. Intrinsically safe equipment fitted. Oil assessed for potential contamination and not accepted if found to be unsuitable.
Vapour and odours in headspace of receiving tank.	Vapour recovery system fitted. Intrinsically safe equipment fitted.
Raw waste oil held in receiving tank.	Tank and fittings subject to regular inspection. Tank located within bunded compound.
Dewatering of waste oil	
Vapour generated in heated oil dewatering tank.	Vapour capture system fitted. Intrinsically safe equipment fitted.
Heated oil held in dewatering tank.	Tank and fittings subject to regular inspection. Tank located within bunded compound.
Stored dehydrated oil.	Tank and fittings subject to regular inspection. Tank located within bunded compound.
Propane de-asphalting	
Propane held in storage, reticulation, heating and condensing system.	Vessels and fittings subject to regular inspection. Intrinsically safe equipment fitted.
Heated hydrocarbon vapour held in de-asphalting vessels.	Vessels and fittings subject to regular inspection. Intrinsically safe equipment fitted.
Stored asphalt extract.	Tank and fittings subject to regular inspection. Tank located within bunded compound. Intrinsically safe equipment fitted.
Stored de-asphalted oil.	Tank and fittings subject to regular inspection. Tank located within bunded compound. Intrinsically safe equipment fitted.
Oil distillation	
Stored oil fractions.	Tank and fittings subject to regular inspection. Tank located within bunded compound. Intrinsically safe equipment fitted.
Distilled oil vapour stream.	Vapour recovery system fitted. Intrinsically safe equipment fitted.
Stored vacuum tower bottoms.	Tank and fittings subject to regular inspection. Tank located within bunded compound. Intrinsically safe equipment fitted.
Cooling water used for condenser.	Water regularly inspected for oil contamination.
Waste gas flaring	
Fuel used to fire the gas flare.	Fittings inspected and regularly maintained. Intrinsically safe equipment fitted.
Flare exhaust gas.	Equipment fitted to continually monitor exhaust gas temperature and carbon monoxide concentration.
Oil shipment	
Oil held in road tanker loading gantry.	Gantry regularly inspected and located within bunded area. Intrinsically safe equipment fitted.

3.3.5 Factors influencing occurrence of risks

Factors that might influence the likelihood of risks occurring are described below. These are listed to highlight the factors that need to be considered when conducting the operations and are incorporated into the risk assessment process below.

Raw material variability

The critical variable in the oil recycling industry is the quality of oil received at the facility. Oil quality may vary significantly according to its source. Oliebollen Oil must exercise care when accepting waste oil, particularly from new customers or new sources, where the provenance of the oil is not certain. Particular care needs to be taken with waste oil from locations that has come from, or may have been contaminated by oil from, electrical equipment, as it may be contaminated by PCBs. Oil from these sources must be held in a quarantine tank and sampled and analysed before it can be transferred into the process stream.

Critical process steps

The process steps that require greatest operator attention are the propane de-asphalting and distillation. These are critical due to their high potential for generation of environmental emissions from the heating of oil and liberation of volatile compounds from the oil.

Critical environmental control equipment

The critical item of pollution control equipment is the thermal oxidiser, which is used to destroy the waste volatile compounds and odour generated during operation of the plant.

Less critical, but important pollution control equipment is the trade waste oil/water separator and the cooling tower. Each of these items requires regular maintenance and inspection, as failure of either can cause significant environmental problems.

3.3.6 Conceptual model

Figure A2.1 represents the potential major impacts caused by Oliebollen Oil operations.

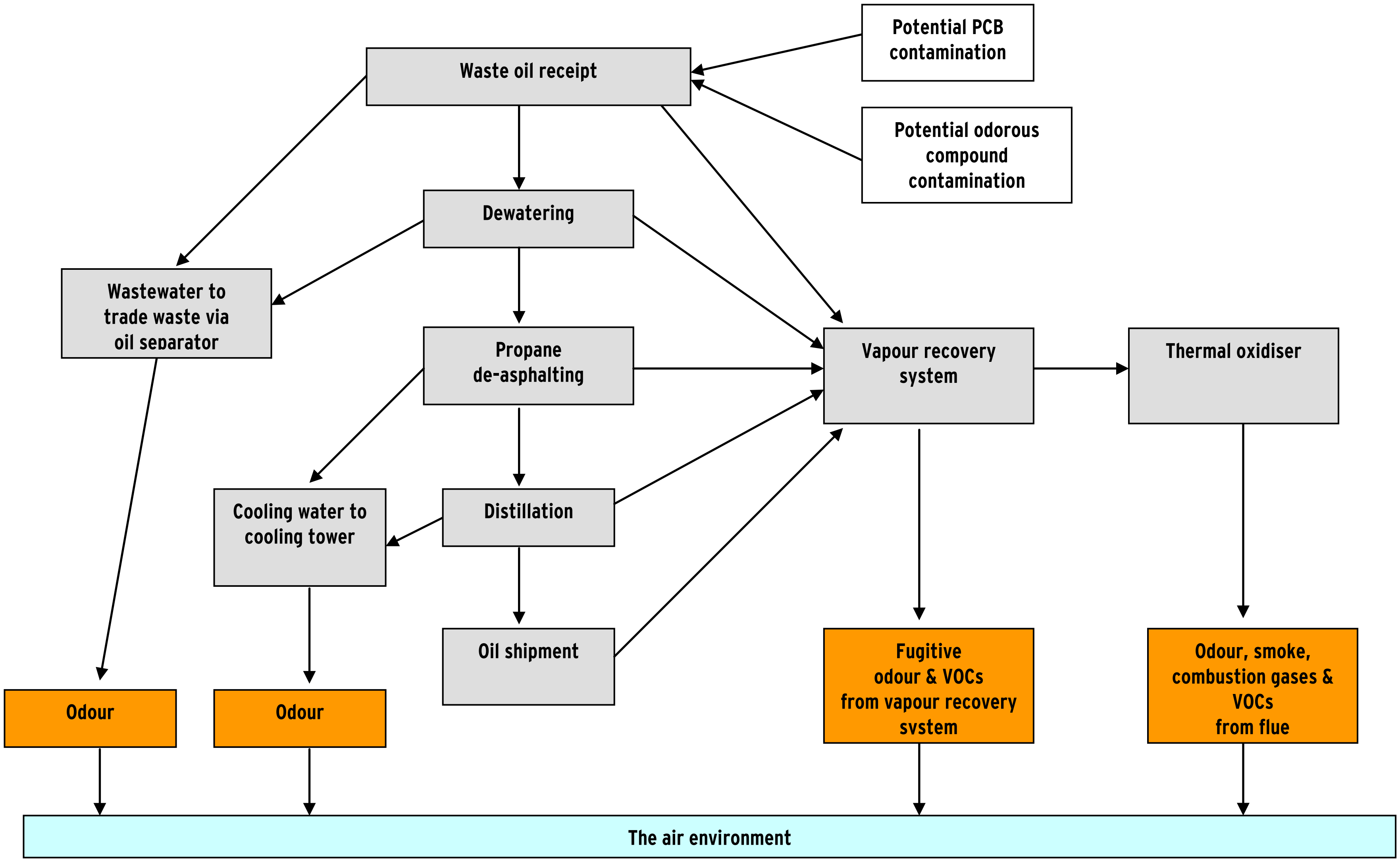


Figure A2.1: Conceptual model of potential environmental impacts to air of Oliebollen Oil operations

3.4 Risk analysis

3.4.1 Assessment of likelihood

The descriptors in the following table (Table A4.6) were used to determine the likelihood of each risk, occurring as a result of site operations. This is a qualitative assessment of likelihood.

Table A4.6: Qualitative measures of likelihood

	Indicator	Description
5	Almost certain	Is expected to occur almost all of the time
4	Likely	Is expected to occur most of the time
3	Probable	Might occur
2	Not likely	Might occur but not expected to
1	Rare	Only expected to occur under atypical conditions

3.4.2 Assessment of consequence

The descriptors in the following table (Table A4.7) were used to determine the consequence/impact if a risk was to occur as a result of site operations. This is a qualitative assessment of consequence.

Table A4.7: Qualitative measures of consequence/impact

Level	Descriptor	Detail description
5	Severe	Human deaths Operations cause catastrophic off-site impacts Immense financial loss
4	Significant	Extensive human injuries or illness Operations cause substantial off-site impacts Major financial loss
3	Medium	Some health impacts to humans Operations cause some external impacts Large financial loss
2	Minor	First aid treatment Operations cause minimal off-site impacts Small financial loss
1	Negligible	Operations cause no injuries Negligible off-site impacts Negligible financial loss

3.4.3 Assessment of level of risk

Using the results from assessing the likelihood and consequence of each risk the level of risk was determined using the descriptors in the following table (Table A4.8). This is a qualitative assessment of level of risk.

Table A4.8: Qualitative risk analysis matrix - Level of risk

Consequence	Likelihood				
	A Almost certain	B Likely	C Probable	D Not likely	E Rare
1 Severe	V	V	V	H	H
2 Significant	V	H	H	H	M
3 Medium	V	H	M	M	M
4 Minor	H	M	M	M	L
5 Negligible	H	M	L	L	L

V = Very high risk; immediate action required
H = High risk; management required from senior staff
M = Medium risk; specify required management
L = Low risk; manage with standard operating procedure

3.4.5 Risk register

The risk register (see Table A4.9) documents the hazards and environmental aspects resulting from the oil recycling activities, their potential impact, and the resulting likelihood, consequence and level of risk rating for each risk.

Priority risks were identified from the risk register by ranking risks based on the level of risk posed to the environment (the likelihood of a risk occurring and the consequence if it does). That is, the higher the level of risk, the higher the priority of dealing with and monitoring the risk. Management actions are based on the highest risk(s). The risk register was completed using information and data collected from the stakeholder workshops, the risk analysis, and consultation with relevant experts.

The highest risk was determined to arise from failure of the vapour recovery infrastructure, which would cause the release of volatile hydrocarbons and potentially odorous compounds to the atmosphere. A secondary risk associated with this was fire. The next highest risk was discharge of combustion products from the thermal oxidiser in excess of the licence condition limits.

Table A4.9: Oliebollen Oil risk register

Date	Item and location	Category	Aspects (activities for each phase of project)	Description of potential impacts	Pathways for risk (factors influencing occurrence of event)	Existing controls	Likelihood of occurrence	Consequence severity rating	Level of risk	Comments
03/11/09	1. Eastern boundary of premises at discharge point to sewer	Air	Wastewater treatment causing odour emissions.	Strong odours due to formation of anaerobic conditions in sewer.	Low flow, dirty wastewater and warm temperature.	Agitation of water by inflow, regular discharge of wastewater to sewer.	Probable	Minor	M	Problem is most likely to occur during plant shuts during summer, when there is not a flow of wastewater and ambient conditions promote bacterial activity in the wastewater pit.
03/11/09	2. Eastern boundary of premises.	Air	Cooling tower operation producing odours.	Odours from cooling water that has absorbed and is dispersing odorous compounds or has been contaminated by oily water.	Cooling tower not properly maintained or cooling water chemical treatment fails.	Cooling tower maintenance contract in place. Cooling tower water treatment equipment inspected daily.	Rare	Minor	L	Water condition must be assessed for oily contamination and odour between contracted maintenance inspections.
03/11/09	3. Within oil recycling plant compound	Air	Vapour recovery system carries volatile emissions from the oil that may include odorous compounds and VOCs.	Highly concentrated oil vapours and odorous compounds that might cause illness and offence if released from a failed section of the plant. This has a secondary issue of potential fire.	Failure of the vapour recovery infrastructure.	Regular inspection of the vapour recovery infrastructure.	Probable	Significant	H	This is an important part of the plant infrastructure that requires regular visual inspection and testing during regular programmed maintenance.

Date	Item and location	Category	Aspects (activities for each phase of project)	Description of potential impacts	Pathways for risk (factors influencing occurrence of event)	Existing controls	Likelihood of occurrence	Consequence severity rating	Level of risk	Comments
03/11/09	4. Thermal oxidiser unit in eastern section of premises.	Air	Thermal oxidiser discharge releasing odour, VOCs and smoke.	Would only occur during gross failure of the unit.	Failure of the thermal oxidiser.	Continual monitoring of the thermal oxidiser operating parameters. Alarm would be raised by PLC.	Probable	Severe	V	This is a critical part of the plant infrastructure that requires regular monitoring and programmed maintenance to maintain licence compliance.
03/11/09	5. Thermal oxidiser unit in eastern section of premises.	Air	Thermal oxidiser discharge releasing combustion gases in excess of licence condition limits.	Occurs during normal operation of thermal oxidiser.	Discharges are influenced by burner design, emission control equipment, temperature of operation and residence time.	Continual monitoring of the thermal oxidiser operating parameters. Six-monthly testing of flue gases by contractor.	Probable	Severe	V	This is a critical part of the plant infrastructure that requires regular monitoring and programmed maintenance to maintain licence compliance.

4 Monitoring program

Monitoring will focus on measuring the licence discharge limits and understanding the magnitude and extent of the impact of the discharge from the thermal oxidiser and from fugitive sources – in particular, the vapour recovery system. The monitoring program provided below has been based on the findings of the risk assessment. The highest (priority) risk posed by the site's operations is the failure of the vapour recovery system. The second highest risk is associated with operation of the thermal oxidiser under conditions that lead to the discharge of combustion products that exceed the licence condition requirements. While other risks have been assessed to be of lower priority, an ongoing log of incidents is kept and, in the event of a major incident occurring, appropriate monitoring will be conducted.

A matrix for environmental monitoring has been prepared to assist with identifying the monitoring needs. This matrix is provided in Attachment A.

4.1 Monitoring objectives

The objectives of this monitoring program are to:

1. assess the condition of the vapour recovery system
2. continually assess the operating efficiency of the thermal oxidiser
3. assess the general odour impacts on surrounding land
4. identify operational or monitoring program changes necessary to improve protection of the air environment.

4.2 Indicators

4.2.1 Fugitive discharges

Fugitive discharge is monitored by visual inspection of the vapour collection system ducting and fittings. Detailed integrity testing is conducted during the annual plant close. Operators are required to maintain a watch for pipework leaks when working within the plant area. An operator is required to walk the perimeter of the plant to check for the presence of unusual odour levels.

In order to reduce the potential for emission of offensive odours, Oliebollen Oil has implemented a waste oil receipt assessment procedure. The procedure requires the operator in charge of receiving waste oil to complete a checklist that assesses the source of the oil, the type of industry it is derived from, previous issues with oil from that source and the general appearance of the oil in a sample taken from every load. If the oil is noted as being highly odorous, it is not accepted. If there is a possibility that it has been contaminated with PCBs, it is quarantined until tested and its contents identified.

4.2.2 Discharge from thermal oxidiser

The indicators monitored in the discharge from the thermal oxidiser, in accordance with licence requirements (see Table A4.2), are oxides of sulfur, oxides of nitrogen and total polycyclic aromatic hydrocarbons.

In addition, carbon monoxide emissions and the operating temperature of the thermal oxidiser are continually monitored as part of the process control for the unit. This checks that the unit is being operated to maintain required destruction conditions and hence the licensed discharge limits should be met.

4.2.3 Receiving environment

The key indicator of fugitive emissions from the plant is an elevated odour level. Oliebollen Oil has provided its nearest neighbours with a contact number so that any traces of odour in the vicinity of the plant can be brought to the attention of the operators and appropriate action taken.

4.2.4 Cooling tower

The water quality in the cooling tower is checked for odorous producing substances. Written reports on water quality, condition of the cooling tower structure are provided by the contractor.

4.3 Trigger levels

Trigger levels for the discharges from the thermal oxidiser are derived from those set in the licence. In addition, specified operating parameters (temperature and carbon monoxide concentration) of the discharge from the thermal oxidiser are also used as proxy indicators of proper operation of the unit.

The trigger level for detection of fugitive emissions from the plant is nominally the detection of an offensive odour level at or beyond the boundary of the premises. This is in accordance with the State environment protection policy (Air Quality Management) (SEPP (AQM)), which sets odour as an unclassified indicator of the beneficial uses of local amenity and aesthetic enjoyment. Some Class 2 indicators identified in SEPP (AQM) are odour-based and may be used during an investigation of excessive odour emissions.

4.4 Monitoring locations

Visual and odour monitoring is conducted in the plant area and premises perimeter.

Thermal oxidiser operation is monitored at the flue discharge point and recorded using the PLC.

Water in the cooling tower is monitored direct from the unit.

4.5 Frequency and timing

4.5.1 Fugitive discharge monitoring

To ensure only permitted and suitable wastes are treated, a waste receipt monitoring program will be implemented to screen incoming wastes for a full range of contaminants. Waste oils from regular customers are well understood based on their source and historic analysis results. The testing for these wastes has been set at one screening analysis per five batches. A sample from each consignment sent by a new supplier will be tested. A sample of each batch will be retained.

Fugitive discharge monitoring is conducted during the site walk around, conducted at the start of each operating shift. Additional, ad hoc, monitoring is conducted by all site personnel when in the plant area.

Non-destructive integrity testing of the vapour capture equipment is conducted during the annual site maintenance shutdown.

4.5.2 Thermal oxidiser monitoring and sampling

To demonstrate that the required combustion efficiency is being achieved, Oliebollen Oil will conduct continuous temperature and carbon monoxide monitoring of flue gases.

Stack testing for all licence condition parameters will be conducted three times a year to provide a good idea of trends over time. However, the risk register indicates that the level of risk of combustion gases exceeding licence limits in the air discharge is high. Therefore, continual monitoring of the thermal oxidiser for treating exhaust air is required. The sampling will be conducted while the oil recycling plant is operating normally and the thermal oxidiser is at the nominal temperature and carbon monoxide operating levels. The correlation of achievement of the required discharge rates and the proxy operating indicators (temperature and carbon monoxide) will be checked. If a discrepancy is detected, further assessment will be made in consultation with the manufacturers of the thermal oxidiser.

4.5.3 Cooling tower inspection

Inspection of the cooling tower is conducted daily as part of the standard site inspection. It is also regularly monitored by the cooling tower maintenance contractor.

4.6 Quality assurance and quality control measures

4.6.1 Sample collection and analysis

Sampling from the thermal oxidiser will be conducted by an air sampling consultant with suitable experience in isokinetic sampling from this type of equipment. Analyses will be conducted by a NATA accredited laboratory selected by the consultant. The consultant and laboratory will be required to implement quality assurance and quality control procedures that meet or exceed the requirements of: EPA Victoria (2002), *A guide to the sampling and analysis or air emissions and air quality* (publication 440.1).

Maintenance and calibration of the continual temperature and carbon monoxide monitor fitted to the thermal oxidiser will be conducted in accordance with the manufacturer's specification.

4.6.2 Data management

All continual monitoring data are stored in the PLC database. Back-up electronic copies are held in an independent location. Data entered on databases are checked by site personnel for integrity.

4.7 Analysis of monitoring results

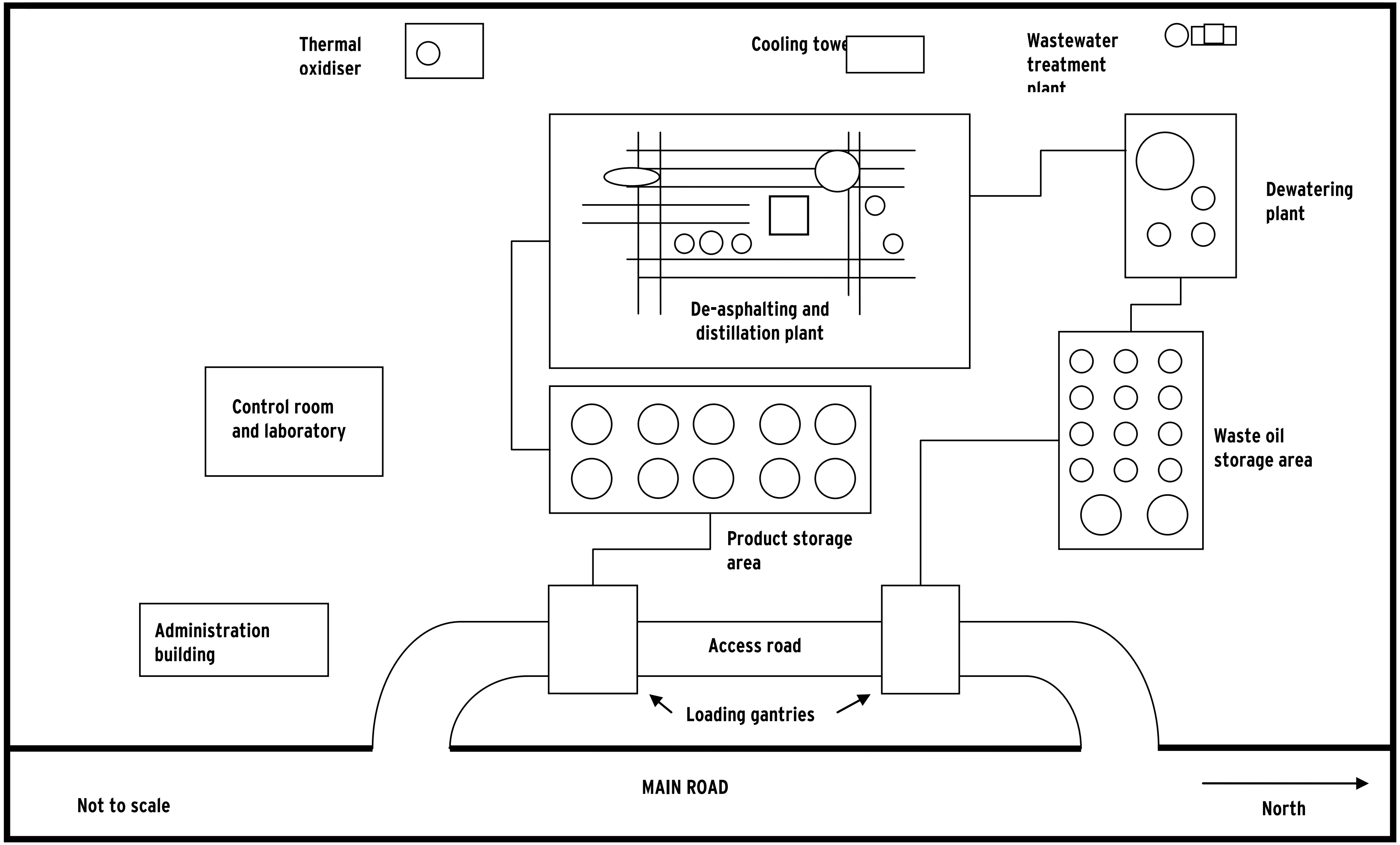
The thermal oxidiser monitoring results are assessed for attainment of the licence conditions and for potential drift in operating conditions in the thermal oxidiser. Where a sampling result indicates that a licence condition limit is being encroached, prompt action will be taken to determine the cause of the increase in discharge of that parameter and to identify the measures required to reverse that trend. Where a result is in breach of the licence condition, the plant manager will be immediately informed and will inform EPA of the issue. Operations at the plant will be immediately modified to reduce the load on the thermal oxidiser and the unit checked to ensure required operational conditions are being achieved. Investigations will be implemented to determine the reason for the exceedance.

Results from the year's monitoring program will be summarised and presented to the authorised representative of Oliebollen Oil for inclusion in the APS.

ATTACHMENT A: ENVIRONMENTAL MONITORING MATRIX

Item	Monitoring location	Discharge indicator	Risk rating	Monitoring type	Sampling frequency	Analyses required	Responsibility
4	Thermal oxidiser	Odour, VOCs and smoke	Very high	Thermal oxidiser instrumentation	Continuous	Thermal oxidiser exhaust gas temperature and carbon monoxide concentration	Plant operator
4	Thermal oxidiser	Odour, VOCs and smoke	Very high	Thermal oxidiser flue	At the start of each shift	Visual inspection of exhaust gas for soot or smoke	Plant operator
5	Thermal oxidiser	Combustion gases	Very high	Thermal oxidiser instrumentation	Six monthly	Sampling of thermal oxidiser exhaust gas and testing of licence condition requirements	Contractor, to be engaged by site manager
1, 2, 3, 4	Selected publically accessible locations around the site	Odour, smoke	Very high	Sniffing and visual observation	Weekly	Checking for odours, looking for smoke. To be done at the start of the shift, before entering the site.	Shift foreman or delegated site employee with a good sense of smell
3	Vapour recovery system	Odour, VOCs	High	Inspection of all piping and fittings.	At the start of each shift	Visual inspection	Shift foreman
1	Wastewater treatment plant	Odour	Medium	Inspection of water in wastewater treatment plant	Daily	Visual inspection of water condition and assessment of odours	Plant operator
2	Cooling tower	Odour	Low	Inspection of water in cooling tower	Daily	Visual inspection of water condition and assessment of odours	Plant operator

ATTACHMENT B: PREMISES PLAN



CHANGES MADE TO 1321.1 LICENCE ASSESSMENT GUIDELINES

A summary of the changes made to the previous release of this publication, 1321.1, is provided below.

The main thrust of the changes was to better align the document with AS 31000:2009 *(Risk management — Principles and guidelines)*, ISO 31010 *(Risk management – Risk assessment techniques)* and HB 203:2006 *(Environmental risk management – Principles and process)*.

Two further case studies using examples of smaller facilities with less complex monitoring requirements were added.

Section	Changes
1	Some changes to expression. Final paragraph added, inviting the reader to skip to the simpler case studies.
4.1, 4.1.1	Slight changes to wording.
4.2	Number of dot points changed to four and heading changed. These dot points are used for the subsequent third-level headings.
Table 1	Expanded to provide more detailed information.
Text box 5	Simplified the information provided.
4.2.1	Introduced conceptual site model earlier in the section.
4.2.4	Removed section on risk pathways to reduce the complexity of the section.
4.3	Dot points included to clarify the process.
Table 2	Simplified category descriptions to relate to frequency alone.
Table 3	Category descriptions amended to change onus from health and safety to onsite and offsite environmental impacts, then health.
4.3.3	Additional explanatory text included to reinforce the point that the risk matrix shown is an example only. This has been reinforced by inclusion of a second risk matrix that has a different array of risk outcomes. Also included a time scale for action for each of the risk ratings.
Table 5	Example added to the example risk register.
5.1.4	Corrected reference to AOX.
Appendix A **Case study 1**	'The Shearer's Back Hotel' added as a case study in order to provide an example to follow for those with a relatively simple licence. An example of a three-by-three risk matrix has been included to show how these can be set up to suit the situation. The 'traffic light' — red, amber green — concept was also used to keep it simple. The risk register also included a 'red' risk, to show how the risk assessment can identify activities that require immediate attention. The case study includes a cross-check to ensure that the monitoring program covers all licence conditions.
Case study 2	A second new case study, 'Tiger Tanks', is included to provide a slightly more industrial example with conditional monitoring required. Again, the traffic light matrix was used and a 'red' risk rating was included in the risk register as an example of an issue requiring immediate action.
Case study 3	The Bourke Sewage Treatment Plant' is largely unchanged apart from the risk matrix being changed to the second five-by-five example given earlier in the publication.
Case study 4	The name of the case study facility was changed from 'Bardvark Oil' to 'Oliebollen Oil'.
	The environmental monitoring matrix has been modified to include item numbers and discharge indicators. The risk matrix has also been changed to the second five-by-five example given earlier in the publication.

EPA
VICTORIA