GUIDELINES FOR SEWERAGE SYSTEMS

Acceptance of Trade Waste (Industrial Waste)

November 1994

Agriculture and Resource Management Council of Australia and New Zealand

Australian and New Zealand Environment and Conservation Council

Copies of this publication may be obtained from:

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Tel: (06) 274 1428
Fax: (06) 274 1858

ISBN 0 642 19556 0
ISSN 1038 7072

Printed on recycled paper.

Printed in Australia for the Agriculture and Resource Management Council of Australia and New Zealand, and the Australian and New Zealand Environment and Conservation Council.

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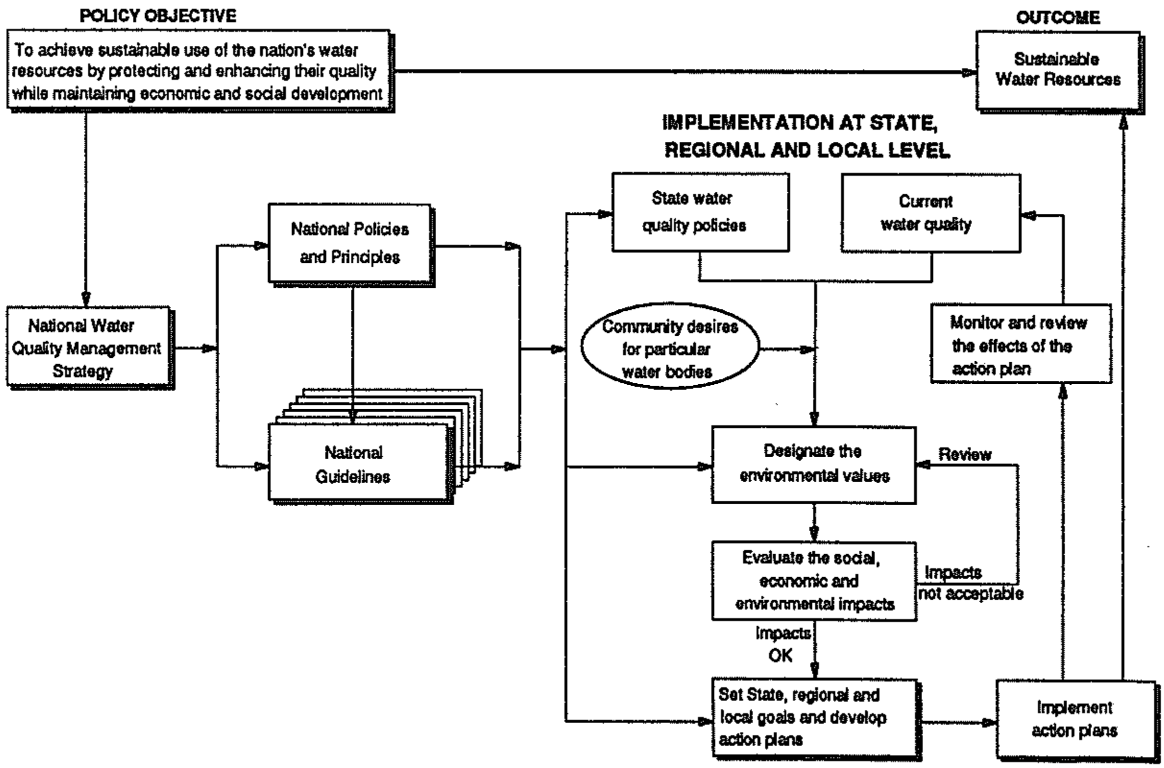
PREAMBLE

A National Water Quality Management Strategy is being jointly developed by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and the Australian and New Zealand Environment and Conservation Council (ANZECC). The National Health and Medical Research Council is involved in aspects of the Strategy which affect public health.

The Strategy's philosophies and policies are set out in the paper titled *Water Quality Management - An Outline of the Policies.* More detailed information is provided in the resource document, *Policies and Principles - A Reference Document.* The principles for the transferral of national policies and guidelines into action plans at the state, regional and local levels are set out in the *Implementation Guidelines.*

Management of water resources is recognised as a state and territory responsibility and it is proposed, therefore, that implementation of the National Strategy will occur after considering:

- the national guidelines,
- state and territory water policies,
- community preferences on the use and values of local waters,
- the current water quality of local waters,
- the economic and social impacts of maintaining current water quality or of meeting new local water quality goals.



NATIONAL WATER QUALITY MANAGEMENT STRATEGY

The Strategy uses the concept of environmental values to set local water quality targets established in partnership with the community and government. These targets aim to meet the community's desires and its ability to achieve them. The process involves the community working with government to develop goals for waters throughout Australia.

National Guidelines will be available to assist the community and catchment managers, environment protection agencies, water authorities and local governments to develop action plans for the delivery of sustainable water resources at the local level. Further guidelines will help communities and water authorities achieve consistency for the level of service provided by local water and sewerage systems. The *Implementation Guidelines* provides more detail on developing levels of service.

The following Guidelines and documents form part of the National Strategy:

Paper No.	Title
Policies and Process for Water Quality Management	
1.	Water Quality Management - An Outline of the Policies
2.	Policies and Principles - A Reference Document
3.	Implementation Guidelines
Water Quality Benchmarks	
4.	Australian Water Quality Guidelines for Fresh and Marine Waters
5.	Australian Drinking Water Guidelines - Summary
6.	Australian Drinking Water Guidelines
7.	Monitoring and Reporting Water Quality
Groundwater Management	
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13.	Guidelines for Sewerage Systems - Sludge (Biosolids) Management
14.	Guidelines for Sewerage Systems - Use of Reclaimed Water
15.	Guidelines for Sewerage Systems - Sewerage System Overflows
16.	Effluent Management Guidelines for Farm Dairies and Dairy Processing Plants
17.	Effluent Management Guidelines for Piggeries
18.	Effluent Management Guidelines for Wool Scouring
19.	Effluent Management Guidelines for Tanning and Related Industries
20.	Effluent Management Guidelines for Wineries and Distilleries

GLOSSARY

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand is a measure of the biological consumption of oxygen in water, especially as a result of the breakdown of organic matter by bacteria. [Refer to the relevant method in the latest edition of *Standard Methods for the Examination of Water and Wastewater* (APHA-AWWA-WPCF)].

Domestic Wastewater

Domestic wastewater is the water borne waste derived from human origin comprising faecal matter, urine and liquid household waste from water closet pans, sinks, baths, basins and similar fixtures designed for use in private dwellings.

Effluent

The water discharged following a wastewater treatment process. (e.g., secondary effluent)

Hazardous Waste

Any waste containing quantities of a substance which may present danger to the life or health of living organisms when released into the environment, or to the safety of humans or equipment if incorrectly handled.

Heavy Metals

Metals of high atomic weight which in high concentrations can exert a toxic effect. The main heavy metals include cadmium, chromium, copper, lead, mercury, nickel and zinc.

Industrial Waste

Refer to "Trade Waste".

Primary Treatment

Wastewater treatment which involves sedimentation (sometimes preceded by screening and grit removal) followed by sludge digestion or other means of sludge disposal.

Secondary Treatment

Treatment of wastewater by biological aerobic processes to remove organic matter.

Sewerage Authority

Sewerage authority is the appointed body responsible for the conveyance, treatment and disposal of wastewater.

Sewerage System

Sewerage system is the network of collection, conveyance, pumping, treatment and disposal facilities owned and/or operated by a sewerage authority.

Sludge

The solids which are removed from wastewater by primary and secondary treatment.

Surfactant

A surface active agent found in detergents.

Suspended Solids (SS)

Suspended solids shall mean the insoluble solid matter suspended in wastewater under conditions normally found in sewers that is separable by laboratory filtration [Refer to the relevant method in the latest edition of *Standard Methods for the Examination of Water and Wastewater* (APHA-AWWA-WPCF)].

Tertiary Treatment

Processes used to further improve secondary effluent quality prior to disposal or reuse. Such processes include sand filtration, oxidation pond retention, disinfection, nutrient removal and the use of wetland filters.

Trade Waste (Industrial Waste)

Trade Waste is the liquid waste generated from any industry, business, trade, or manufacturing process. It does not include domestic wastewater. For the purpose of this document the terms Trade Waste and Industrial Waste are interchangeable.

Trade Waste Generator

Trade Waste Generator shall mean any person, company or body whose activity produces or has the potential to produce Trade Waste.

Waste Reduction

Waste reduction means the adoption of practices or processes which reduce to the maximum extent feasible, the quantity of trade waste generated and/or the quantity of trade waste which requires subsequent treatment, storage, or disposal.

1. INTRODUCTION

1.1 Purpose

This document provides national guidelines for trade wastes discharged to sewer and can assist sewerage authorities with the implementation of their trade waste management programs.

These guidelines are a reference point for the community, industry, environmental groups and sewerage authorities.

1.2 Terminology

Many of the acts and by-laws which relate to disposal of wastes to sewers use the term "Industrial Waste" to describe the liquid waste generated from any industry, business, trade or manufacturing process. For the purposes of this document, the terms "Industrial Waste" and "Trade Waste" are to be treated as being interchangeable.

1.3 Related Documents

The National Water Quality Management Strategy has a number of guidelines dealing with Sewerage Systems. The guidelines cover:

- Acceptance of Trade Waste (Industrial Waste)
- Effluent Management
- Sludge (Biosolids) Management
- Use of Reclaimed Water
- Sewerage System Overflows

This document deals with the Acceptance of Trade Waste (Industrial Waste).

1.4 Background

Historically, sewerage systems in Australia were developed in response to community and Government aspirations to improve general public health. Consequently, the systems were designed to safely transport, treat and dispose of wastes which were essentially domestic in nature.

Over time, the industrial and commercial base of many towns and cities has expanded. Generally the wastes from these activities have been accepted into the sewerage system as a service to industry and because this was the most appropriate method for disposal.

In some instances, these non-domestic or trade wastes have, even in small concentrations, proved incompatible with the intended function of the sewerage system. This has occasionally resulted in damage to system components, interruption of the treatment process and, in some cases, environmental degradation.

Authorities have also incurred additional costs in handling these wastes. These costs have not always been recovered through the normal charging arrangements. As a result, individual authorities have developed their own trade waste programs to deal with these issues on a local basis.

ARMCANZ and ANZECC aim to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development. This will be achieved through a strategy based on national guidelines with local implementation. The proposed management approach explicitly identifies community preferences with respect to local resource use and their implications in terms of water quality criteria.

Shifts in community awareness, the desire for better environmental protection and the economic necessity for more equitable reconciliation of costs now require that a uniform approach to trade waste management be implemented.

Communities are increasingly wanting to participate in the debate on the levels of service and the cost of services provided by water authorities. Further information on community involvement is available in the Strategy document, the *Implementation Guidelines*.

These guidelines have been prepared to foster a consistent approach for the acceptance of trade wastes to sewerage systems across Australia. ARMCANZ and ANZECC will review the guidelines as required, to ensure that advances in science, technology and community expectations are taken into consideration.

2. TRADE WASTE ACCEPTANCE PRINCIPLES

2.1 Trade Waste Control Programs

Trade waste should be managed to:

- minimise the cost to the community of processing trade waste;
- ensure environmental protection; and
- encourage waste minimisation.

Generally, where a sewer and treatment plant capacity are available, conforming trade waste should be discharged to that system with the approval of the local sewerage authority.

Trade waste control programs are needed to eliminate problems which can occur when trade waste is discharged into a sewerage system. Some examples are shown in Figure 1 and include:

- Industrial wastewater can corrode pipes and equipment in both the sewerage collection system and the treatment plant.
- Greases, fats and other suspended matter can cause sewer blockages resulting in flooding of upstream users and spills to the environment. An excess of these materials can accumulate within the treatment plant causing odours, reduced plant efficiency, increased maintenance, higher costs and detrimental discharges to the environment.
- Discharges can hydraulically overload sewers and treatment plants so that wastewater does not receive adequate treatment.
- Highly volatile wastes, which may be flammable or toxic, can endanger operations and maintenance personnel and cause damage to the sewerage system.
- Some wastes (individually or combined), may release toxic gases posing a public health hazard and/or affecting the environment. Long term exposure to volatile and toxic compounds in wastewater poses health risks to personnel.
- Wastes containing toxic materials, heavy metals, pesticides or persistent organic compounds can contaminate sludges thereby limiting reuse and disposal options and/or making options more expensive.

- Substances may pass through the treatment plant, untreated or partially treated, polluting the receiving waters and posing a threat to aquatic life, or rendering a watercourse unsuitable as a supply of drinking water or as a recreational resource. These substances should not compromise the environmental values of the receiving waters. The environmental values are described in *Australian Water Quality Guidelines for Fresh and Marine Waters*.

The goal of local trade waste control programs, therefore, is to promote an appropriate service to industrial and commercial customers and to protect the community, the environment, the sewerage collection system and the wastewater treatment process from adverse effects which may occur when trade waste is discharged into a sewerage system. This protection can be achieved by regulating trade waste generators and ensuring that effective waste management practices and appropriate pollution control technologies are used.

The level of control and extent of the required trade waste pre-treatment depends on:

- the nature and quantity of pollutants present in the wastewater,
- the type of sewerage system,
- the capacity and effectiveness of the treatment plant,
- the treatment plant's effluent and sludge disposal/reuse methods,
- the environmental values (beneficial uses) of the receiving environment,
- the licence conditions set by the regulatory authority.

2.2 Trade Waste Acceptance Principles

The principles governing the acceptance or non-acceptance of trade wastes into sewers are that:

- *The safety of operations and maintenance personnel must be protected.*

- *The receiving environment must be protected. The authority must be able to ensure that the quality of the effluent and sludge from its treatment plants conforms to the licence conditions set by regulatory authorities.*

- *Wastes accepted into the authority's sewerage system must not be inhibitory or toxic to the processes in use at the treatment plants.*

- *Wastes accepted into the sewerage system should not adversely affect the fabric or operation of the sewerage system.*

- *Cleaner production, waste minimisation, recycling and reuse should be encouraged.*

- *Wastes accepted into the sewerage system should not limit the reuse of the effluent or sludge as intended by the authority.*

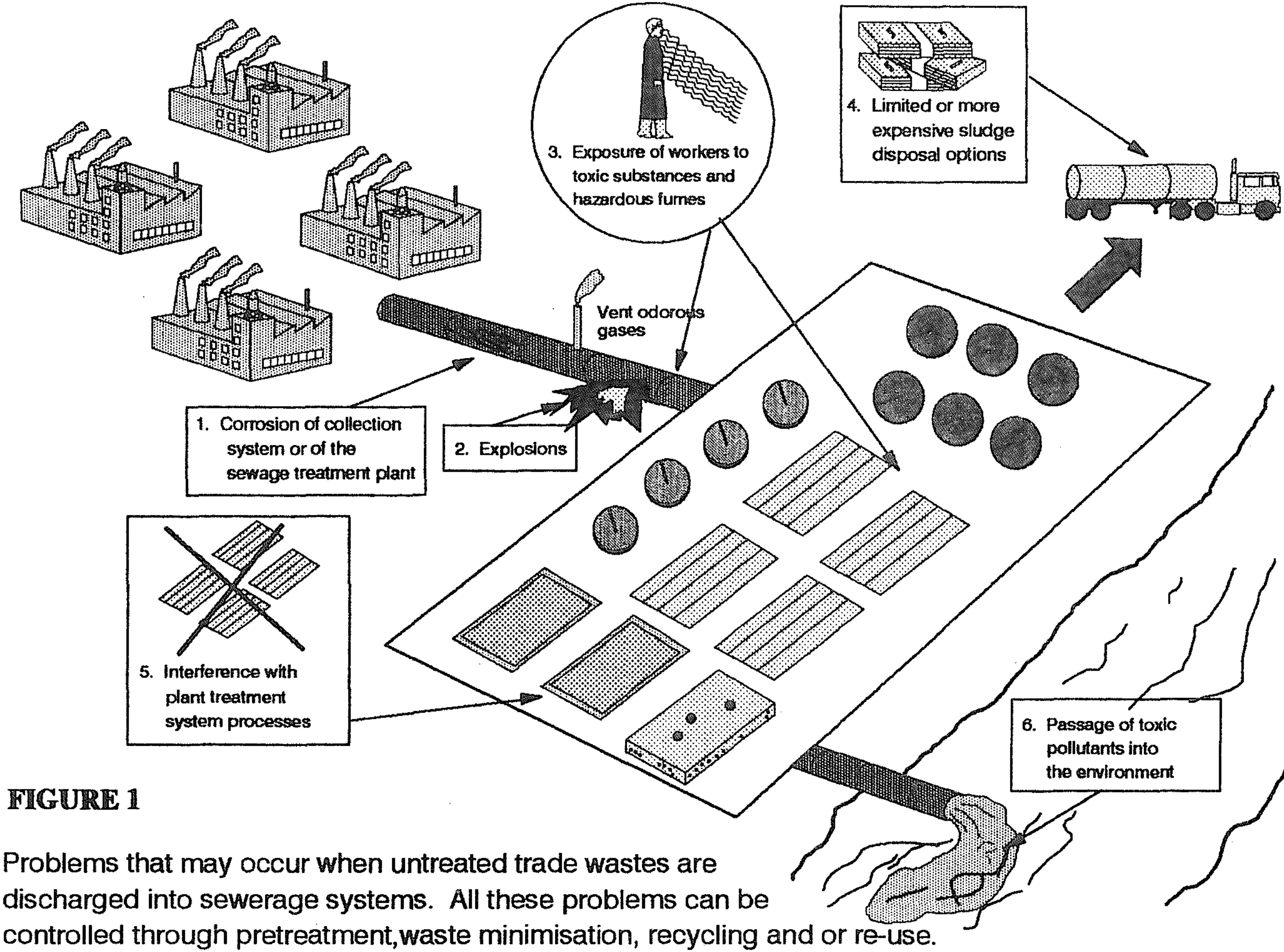

FIGURE 1

Problems that may occur when untreated trade wastes are discharged into sewerage systems. All these problems can be controlled through pretreatment,waste minimisation, recycling and or re-use.

3. NATIONAL ACCEPTANCE GUIDELINES

The national acceptance guidelines have been developed to support a uniform national approach to trade waste management. These guidelines follow the direction of *Policies and Principles - A Reference Document* and implement best management practices and, where appropriate, accepted modern technology. As such, they need to be varied to suit local conditions.

Authorities are still responsible for evaluating the need for, and the development of, local acceptance criteria. Considerable benefits can be gained from early discussions with all sections of the local community and with organisations associated with industrial and commercial processes in the local area.

These guidelines for the Acceptance of Trade Waste are a mechanism for:

- promoting cooperation between authorities in establishing a uniform approach to trade waste management.

- encouraging a uniform approach to industry so that appropriate technologies and codes of practice can be developed on a national scale.

- assisting smaller authorities who may not have the resources to monitor developments in trade waste management or environmental protection.

- assisting industries and authorities to meet community expectations in relation to public health and environmental protection.

The National Acceptance Guidelines are listed in Appendix 1.

3.1 Implementation of the National Acceptance Guidelines

The national acceptance guidelines should be adopted by authorities as the basis for acceptance of trade waste discharged to sewer. For some parameters there are no specific values provided since the value will depend on the treatment plant (e.g. Tables 1a, 1b and 1c).

For other parameters (e.g. Tables 2-4), individual authorities can impose local criteria which are stricter than the national acceptance guidelines. However, they should not allow less stringent levels of control unless it has been demonstrated on a scientific basis that a less strict level of control will not compromise any of the governing trade waste acceptance criteria for sewerage systems under their control.

In some locations, application of the national acceptance guidelines may not eliminate health and environmental problems associated with certain trade waste discharges. Site specific problems may persist and require further measures. In these cases the need to protect the environment and public health will take precedence over the principle of equity. Authorities may impose more stringent limits to address these local problems.

4. TRADE WASTE MANAGEMENT PROGRAM

A trade waste management program comprises the legal, technical and administrative framework for achieving effective control of trade waste discharges.

Local trade waste management programs should be preventative rather than reactive. The specifics may vary amongst authorities, depending on industry type and number, community size, wastewater treatment technology and sensitivity of the receiving environment to treated effluent and sludge.

The program should include the following elements in order to be effective in controlling trade waste discharges and encouraging sound waste management practices.

4.1 Legislation

Adequate trade waste acceptance legislation allows:

- The implementation of an effective trade waste management program,
- Monitoring and control of trade waste discharges,
- The provision of a clear legal framework within which trade waste generators are able to negotiate and administer their management programs.

Specific aspects which should be considered in the development of local legislation are included at Appendix 2.

4.2 Trade Waste Surveys

A sewerage authority should conduct surveys of its own sewerage system and of its trade waste generators to:

- identify the characteristics and associated mass loads and the sources of these loads within its system,

- locate all possible trade waste generators,

- determine the volume and characteristics of wastes discharged, and

- identify industries that do not discharge trade waste to sewer but which have the potential to contaminate the sewerage system by accidental spillages.

Information gathered from the survey is essential for the development of an effective local trade waste management program. It provides the basis for most other activities, such as determining the source of problems, developing local limits for particular discharges, pursuing waste minimisation programs, assessing sampling and analysis needs (at waste generators' site and within the sewerage system) and estimating required personnel and equipment. Surveys should be conducted on a regular basis to ensure the data is kept up to date.

4.3 Procedures

Sewerage authorities should develop policies and procedures to implement their trade waste management program. For example, procedures to:

- identify and locate all possible trade waste generators.

- obtain information regarding the quantity and quality of trade waste being generated.

- assess and approve applications to discharge trade waste to sewer.

- notify trade waste generators of pre-treatment requirements.

- specify the sampling frequency and regime (ie discrete or composite) for trade waste.

- specify standard methods for trade waste analysis.

- monitor and inspect trade waste generators.

- deal with non-compliance (See Appendix 2).

- develop and implement trade waste charging procedures.

4.4 Compliance Monitoring and Inspection

Compliance monitoring and inspection are essential components of an effective trade waste management program. They can be used to determine:

- compliance with set standards and requirements,

- trade waste charges,

- the effectiveness of the trade waste management program,

- modification and development requirements for the sewerage system,

- modifications to the management program

The frequency and extensiveness of monitoring and inspection depends on the potential impact the waste can have on the sewerage system and the environment.

Information on different types of monitoring which can be incorporated in a management program is included at Appendix 3.

4.5 Trade Waste Charging

Authorities are introducing "pay for service" tariffs as part of a trend towards sound commercial principles. These tariffs are designed to reflect the true cost of the service provided and ideally should not involve cross-subsidies. Additionally, some authorities are introducing pricing incentives to encourage waste minimisation.

Authorities around Australia have a variety of tariff structures. However, variations of the Quantity - Quality approach are now most commonly used, particularly by the larger authorities. These tariffs are based on the volume discharged and the amount of contaminants in the discharge.

For a sewerage authority, the three fundamental cost categories are:

- Transmission costs - including the capital and operating costs of mains and pump stations.

- Treatment, disposal and downstream monitoring costs - including both capital and operating costs.

- Administration costs - including costs associated with administration, salaries and overheads for the sewerage system.

Any tariff structure should reflect these costs to an authority. A multi-part tariff with the following components can be structured to reflect all of the costs:

- An annual lump sum service charge.

- A set of unit charges incorporating the capital and operating costs for transmission, treatment and disposal (including charges for volume, Suspended Solids and Biochemical Oxygen Demand as well as charges for other components such as Nitrogen and Phosphorus).

- A set of unit charges covering costs associated with elements that result in damage, repair or maintenance of the system (including oil and grease, sulphate, acid or alkaline discharges).

- A set of management fees to cover costs associated with the operation of the trade waste activities (including establishment costs, annual licence, administration costs, sampling costs, inspection costs and environmental monitoring costs).

- Incentive schemes to encourage waste minimisation and the introduction of cleaner technology (including performance bonds and penalty charges).

4.6 Resources

The authority should have sufficient resources (funds, equipment and personnel) to operate an effective and ongoing trade waste management program.

Requirements will vary depending on the complexity of the control program, the number and type of waste generators and the quantity and quality of wastes discharged.

Trade waste control programs also require comprehensive data management systems. Large authorities serving many waste generators may require a computerised data management system. The data base should be used to record the discharge of each generator and record the actual levels detected in wastewater samples. This allows for a rapid comparison of approved and observed discharges and the automatic detection of violations.

The data base can also assist authorities to determine the source of problems, calculate local limits, plan system expansions and to coordinate field operations.

Smaller authorities may prefer a manual card system, but it is essential for all authorities to have an effective records system in place.

4.7 Local Acceptance Criteria

An overview of the local acceptance criteria development process is presented in Figure 2. Local acceptance criteria should, at a minimum, be based on meeting national, state and local requirements. Development of local acceptance criteria is not a once only event. These criteria should be regularly reviewed to respond to changes in national and state regulations, environmental protection criteria, sewerage system design and operation and the total amount of waste contributed by industry.

The main concerns to the authority, in developing and reviewing local criteria, include:

- impacts on the receiving environment
- effects on treatment processes
- compliance with licence conditions set by the regulating authority
- promotion of an ecologically sustainable service to industrial and commercial customers
- development of community and trade waste generators' confidence in the authority's management program
- protection of the occupational health and safety of operations and maintenance personnel
- protection of public health and safety
- protection of assets
- potential reuse of effluent and sludge

Methods for determining local acceptance criteria are shown in Appendix 4.

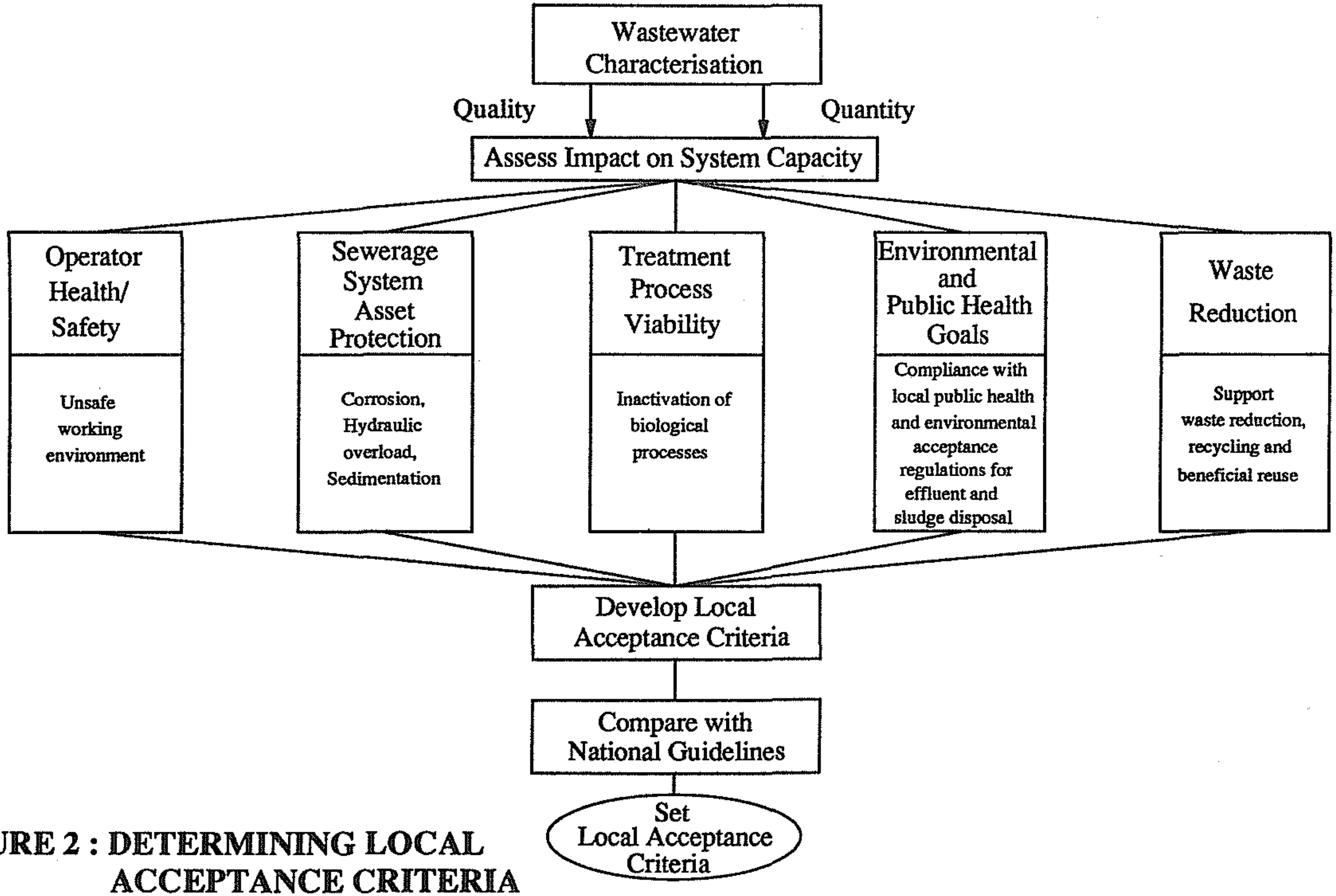

FIGURE 2 : DETERMINING LOCAL ACCEPTANCE CRITERIA

5. TRADE WASTE GENERATOR'S RESPONSIBILITIES

The primary responsibility of trade waste generators is to ensure that their waste management practices meet the requirements of the authority and do not risk public health or environmental degradation.

The generator should be responsible for the financing, installation and subsequent operation and maintenance of any trade waste pre-treatment plant in accordance with the local sewerage authorities' requirements. The generator must also employ qualified operators where required and provide ongoing specialist training.

These responsibilities can be achieved by incorporating quality assurance procedures in wastewater management practices. Consistent compliance monitoring and record keeping by the generator is essential to this process.

The generator is to ensure that the design of the pre-treatment plant incorporates appropriate technology and best management practices. Wherever possible, plants should be constructed above ground to facilitate access for supervision, operation and maintenance.

Plants should incorporate measures to prevent and/or contain spills and leaks. Such measures may include:

- ensuring the plant and equipment is compatible with the chemical passing through it;
- ensuring the plant and equipment is contained within a bunded area with underground seepage protection;
- installation of alarm systems to detect unauthorised discharges;
- installation of automatic isolation devices to prevent unauthorised discharge, flows, etc.

Response procedures with detailed instructions in the event of spills and leaks should be developed and included in any agreement where applicable.

Waste produced by the generator, either from the production processes or from trade waste pre-treatment, that is not acceptable for discharge to sewer, is to be disposed of in accordance with the requirements of the appropriate regulatory authority. Irrespective of whether the waste is discharged direct to sewer or hauled to an authorised discharge site, the generator must comply with the requirements of the authority.

All waste generators are encouraged to undertake a waste audit and develop a waste management plan.

APPENDIX 1

NATIONAL ACCEPTANCE GUIDELINES

Use of Tables

The tables list the national acceptance guidelines. These guidelines are the basis for the development of local acceptance criteria. The local acceptance criteria should aim to:

- minimise the cost to the community of processing trade waste;
- ensure environmental protection; and
- encourage waste minimisation.

Refer to Sections 3 and 4 for further information.

Tables 1a and 1b give guidelines suitable for most sewerage systems. However, local acceptance criteria should be determined after considering local conditions.

Table 1c lists Restricted Substances.

Tables 2, 3 and 4 are recommended maximum values to be applied irrespective of the type and capacity of the sewerage system, although alternative values may be imposed by the local sewerage authority where the local sewerage authority has an appropriate basis to nominate alternative criteria. In some locations, applying the tabulated guideline values may not eliminate public health or environmental problems and therefore more stringent limits may be required.

For small dischargers (flows of less than 3 kL/day) a mass load approach may be used. The daily mass load of a substance (**m** in g/day) is obtained from the guideline values specified in Tables 1b, 2 and 4 (**a** in mg/L) by the application of the following formula:

$$\mathbf{m = 3\ a}$$

A sewerage authority may decide that dischargers are not required to treat their wastes if the daily mass load of a substance discharged in the waste is less than the mass load (m) described above.

All local acceptance criteria shall apply at the sampling location as defined in Appendix 3.

Dilution Prohibition

Wastes shall not be diluted with potable water, or by water from any bore, ground or storm water source or from any non process source.

General Acceptance Guidelines

The parameters listed in Table 1a and 1b are not absolute values. Authorities should determine local acceptance criteria on the basis of the following local conditions:

- the hydraulic capacity of the sewerage system,
- the capacity of the treatment plant,
- the existing and projected mass load on the treatment plant,
- the type of treatment plant and degree of treatment,
- the proximity of the trade waste generator to the treatment plant and other sewerage system facilities such as pumping stations,
- the available options for effluent re-use and beneficial use of sludges,
- the receiving water and environment protection requirements.

The values given in the tables are indicative only and reflect the sewer acceptance requirements of major Australian sewerage authorities. They have been included for general guidance.

Specific Acceptance Guidelines

The guidelines given in Table 2 are to be considered as acceptable, although alternative criteria may be imposed by the local sewerage authority.

The guidelines may be amended where the local sewerage authority has an appropriate scientific basis to nominate alternative criteria. To assist in future revisions of these guidelines, the local sewerage authority setting such values is requested to forward details for information to:

The Secretary
Agriculture and Resource Management Council of Australia and New Zealand.
c/- Department of Primary Industries and Energy
GPO Box 858
CANBERRA ACT 2601

Specific Acceptance Guidelines for Metals

Table 3 lists the guidelines for metals.

Metals have the potential to:

- Impair the treatment processes
- Impact adversely on the receiving environment
- Limit the reuse of sludge and effluent.

A sewerage authority may elect to apply mass load criteria rather than concentrations for both small volume and very large waste generators. Figure 3 illustrates how this approach is applied.

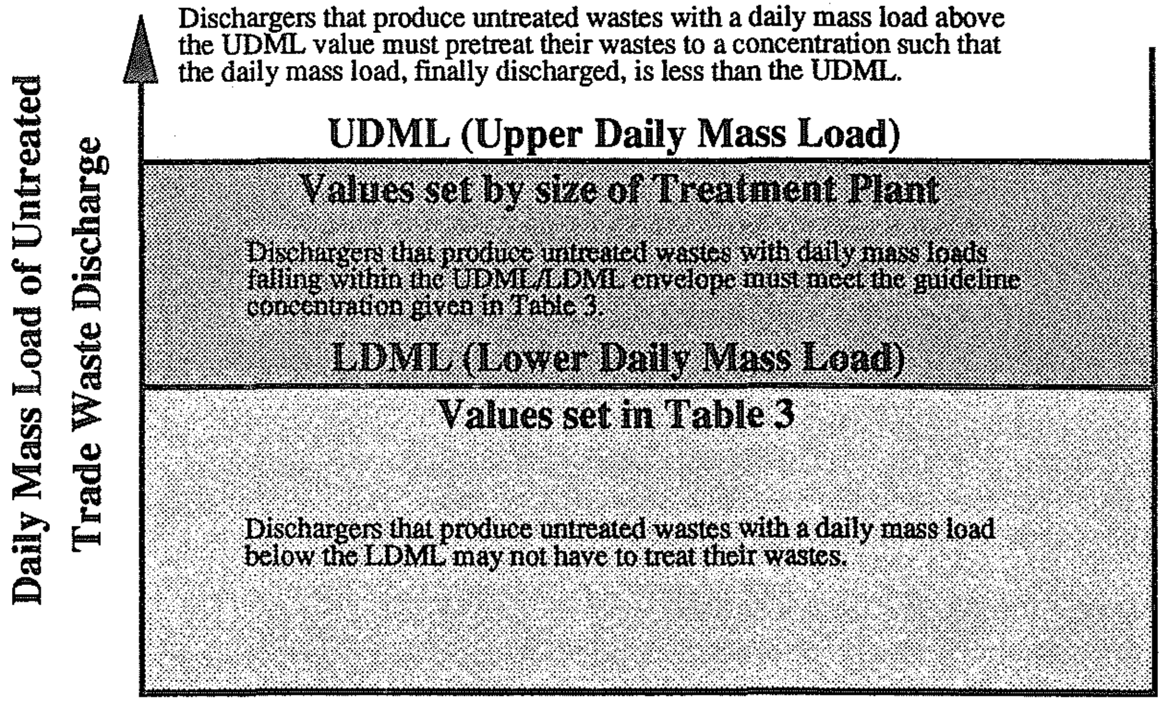

Figure 3 Daily Mass Loads

The mass loadings allow small volume generators to install appropriate technology which may produce an effluent not complying with the concentration value. However, due to the small amounts involved, the impact of such waste discharges will be minimal.

Sewerage authorities should be aware of the cumulative effect of a large number of small trade waste generators whose discharges have similar characteristics.

Where a trade waste generator exceeds the lower daily mass load, more sophisticated treatment must be installed to meet the concentration value.

An upper daily mass load should be applied for very large waste generators. This upper daily mass load is a function of the size of the treatment plant. In addition, for treatment plants serving less than 25,000 persons the mass loading principle may be inapplicable and an impact assessment calculation should be performed (see Appendix 4, example 2).

For Table 3, the lower daily mass load limits, below which treatment may not be required, have been based on either the concentration value and a 3 kL/day flow or where known, the levels considered to be generally non-inhibitory to sludge reuse.

Conventional wastewater treatment processes do not "treat" metals. Most metals are retained in the sludges produced during treatment and therefore, the concentration of metals can limit the subsequent uses of the sludge. (Refer to the *Guidelines for Sewerage Systems - Sludge (Biosolids) Management*)

A percentage of incoming metals (e.g. 10-40%) passes through the treatment plant and remains in the treated effluent. This may limit the use of the effluent or, more commonly, the acceptability of the effluent for discharge into a receiving aquatic environment.

The guideline values given in Table 3 are to be considered as acceptable, although alternative values may be imposed by the local sewerage authority where the local sewerage authority has an appropriate scientific basis to nominate alternative criteria.

To assist in future revisions of these guidelines, the local sewerage authority setting such values is requested to forward details for information to the address given on Page 18.

Specific Acceptance Guidelines for Organic Compounds

Sewerage authorities should not accept other organic compounds without the proposed discharger providing demonstrable evidence on their biodegradability and toxicity. Organic compounds not included in this table are prohibited until specific approval has been obtained from the local authority.

The term "Pesticides" covers a wide range of substances having varying uses, toxicities and persistence in the environment. The guideline value of 1.0 mg/L should be used in the absence of site specific information. The determination of site specific pesticide limits must take into account the following issues:

- toxicity of the pesticide
- biodegradability (ability to be treated)
- retention times within the treatment system
- bioaccumulation
- persistency (duration in the environment).

The guideline values given in Table 4 are to be considered as acceptable, although alternative values may be imposed by the local sewerage authority where the local sewerage authority has an appropriate scientific basis to nominate alternative criteria.

To assist in future revisions of these guidelines, the local sewerage authority setting such values is requested to forward details for information to the address given on Page 18.

Table 1a

NO RECOMMENDED GUIDELINES

CRITERIA TO BE SET BY THE LOCAL AUTHORITY

PARAMETER	REMARKS
Colour	Colour may cause - aesthetic impairment of receiving water; - adverse effects on lagoon treatment processes. Where potential for such problems exists, a level of colour which is rendered not noticeable after the predicted dilution is desirable. For most small discharges, 100 dilutions may be used as a guideline. Biodegradability of the colour may be an important factor where secondary treatment is used.
BOD_5 (Biochemical Oxygen Demand)	Will be determined by the capacity of the treatment plant. Where such capacity is limited, a limit of 600 mg/L may be used as a guideline. High BOD_5 also increases the potential for the generation of sulphides in the wastewater.
COD (Chemical Oxygen Demand)	Same as for BOD_5. Where treatment plant capacity is limited, a limit of 1500 mg/L may be used as a guideline.
TOC (Total Organic Carbon)	Same as for BOD_5. Where treatment plant capacity is limited, a limit of 1200 mg/L may be used as a guideline.
TDS (Total Dissolved Solids)	High TDS reduces effluent options and may contribute to soil salinity. Where potential for such problems exist, a limit of 10,000 mg/L may be used as a guideline.
SS (Suspended Solids)	High SS can: - cause sewer blockages; - overload the treatment processes. Where potential for such problems exists, a limit of 600 mg/L may be used as a guideline.

NOTE: Sewerage authorities are responsible for evaluating the need for, and the development of, local acceptance criteria (refer to Sections 3 and 6 of this document).

Table 1b

GENERAL ACCEPTANCE GUIDELINES

CRITERIA TO BE SET BY THE LOCAL AUTHORITY

PARAMETER	GUIDELINE VALUE	REMARKS
Temperature	< 38°C	Higher temperatures: - cause increased damage to sewer structures; - increase the potential for anaerobic conditions to form in the wastewater; - promote the release of gases such as H_2S and NH_3; - can adversely affect the safety of operations and maintenance personnel.
pH	6-10	Extremes of pH: - can adversely affect biological treatment processes; - can adversely affect the safety of operations and maintenance personnel; - cause corrosion of sewer structures; - increase the potential for the release of toxic gases such as H_2S and HCN.
Gross Solids	Non faecal gross solids shall have a maximum linear dimension of less than 20 mm and a quiescent settling velocity of less than 3 m/hr.	Gross solids can cause sewer blockages.
Grease and Oil (Total)	200 mg/L	Grease and Oil: - can cause sewer blockages; - may adversely effect the treatment processes; - may impair the aesthetics of the receiving water.
Beach Grease	100 mg/L	Beach grease may impair the aesthetics of the receiving water. Beach grease is defined as saturated fats with carbon chain lengths of C=16 (Palmitic) and C=18 (Stearic). Beach grease will be removed by secondary biological treatment.

Table 1b (continued)

PARAMETER	GUIDELINE VALUE	REMARKS
MBAS (Methylene blue active substances)	500 mg/L	MBAS is a measure of anionic surfactants. High MBAS can: - adversely affect the efficiency of activated sludge plants; - impair the aesthetics of receiving waters.
Ammonia plus Ammoniacal ion (measured as N)	100 mg/L	High ammonia: - may adversely affect the safety of operations and maintenance personnel; - may significantly contribute to the nutrient load discharged to the receiving environment. Higher values may be allowed subject to local pH and temperature conditions.
Kjeldahl Nitrogen	150 mg/L	High Kjeldahl Nitrogen may significantly contribute to the nutrient load discharged to the receiving environment.
Total Phosphorus (as P)	50 mg/L	High Phosphorus may significantly contribute to the nutrient loading discharged to the receiving environment.
Sulphate (measured as SO_4)	2000 mg/L	Sulphate: - may increase the potential for the generation of sulphides in the wastewater; - may adversely affect sewer structures.
Sulphite (measured as SO_2)	100 mg/L	Sulphite is a strong reducing agent and removes dissolved oxygen thereby increasing the potential for anaerobic conditions to form in the wastewater. In particular, values will need to be set on a case by case basis if the discharge is to a sewer receiving oxygen injection. Higher values may be allowed subject to local pH and temperature conditions. Mass values are dependant on the treatment plant capacity. Sulphite also has potential to release SO_2 gas and thus adversely affect the safety of operations and maintenance personnel.

Table 1b (continued)

PARAMETER	GUIDELINE VALUE	REMARKS
Chlorine (measured as Cl_2)	10 mg/L	Chlorine: - can adversely affect the safety of operations and maintenance personnel; - can cause corrosion of sewer structures.
Aluminium	100 mg/L	Aluminium compounds, particularly in the presence of calcium salts, have the potential to precipitate as a scale which may cause a sewer blockage.
Iron	100 mg/L	Iron salts may precipitate and cause a sewer blockage. High concentrations of ferric iron may also present colour problems depending on local conditions.
Manganese	100 mg/L	Mass limits depend on the capacity of the treatment plant.
Molybdenum	-	Value is dependent on sludge guidelines.

Table 1c

RESTRICTED SUBSTANCES

CRITERIA TO BE SET BY THE LOCAL AUTHORITY

PARAMETER	REMARKS
Flammable and/or Explosive Substances	Where such substances are present, the discharger will be required to demonstrate to the satisfaction of the local sewerage authority that there is no possibility of explosion or fires occurring in the sewerage system. In all cases the discharge must not exceed 10% of the lower explosive limit at 25°C.
Radioactive Substances	Such wastes must comply with standards specified under any relevant state act or regulations for control of radioactive substances.
Medical & Infectious Wastes	Pathological, infectious and cytotoxic wastes are prohibited except as allowed for under the *National Guidelines for the Management of Clinical and Related Wastes* produced by the National Health and Medical Research Council, 1988. No person shall discharge solid wastes from any hospital, clinic, surgery, laboratory or any other medical or veterinary facility to the sewers including but not limited to hypodermic needles, syringes, instruments, utensils, swabs, dressings, bandages, paper and plastic items of a disposable nature and any noticeable portion of human or animal anatomy.
Genetically Engineered Organisms	Dischargers must notify and obtain the permission of the local sewerage authority prior to the discharge of genetically engineered organisms. Local sewerage authorities, if not already in receipt of information from the Genetic Manipulation Advisory Committee (GMAC) about this application, should refer the application to GMAC for comment. GMAC has issued guidelines on the disposal of Genetically Engineered Organisms. For further information, contact: Genetic Manipulation Advisory Committee GPO Box 2183 Canberra ACT 2601 Telephone 06 275 3663

Table 1c (continued)

PARAMETER	REMARKS
Halogenated Aromatic Hydrocarbons (HAHs) Polychlorinated biphenyls (PCBs) Polybrominated biphenyls (PBBs)	Because of their stability, persistence and ability to bioaccumulate in animal tissue, these compounds have been severely restricted by health and environmental regulators. In some instances, these compounds still occur in the environment. The maximum concentration for these compounds in trade waste (industrial waste) discharged to sewer is 0.002 mg/L.
Other Substances	Other substances to be controlled in discharges to sewer are those which: - are persistent and/or toxic; - pass through a treatment plant untreated or partially treated and affect the receiving environment; - are deleterious to the sewerage system, employees of the sewerage authority and/or the public; - inhibit process efficiency or make collection and treatment of wastewater more expensive; - could lead to contamination of the wastewater treatment site.
Rainwater and Uncontaminated Water Prohibition	Any rainwater, groundwater, yard drainage or any other uncontaminated water should not be permitted directly or indirectly into sewerage systems except where prior approval is granted by the sewerage authority. Where such water is unavoidably mixed with process wastewaters or no other method of disposal is feasible, the sewerage authority may need to place flow rate restrictions or direct the wastewater to be stored for subsequent discharge to sewer at such time as hydraulic capacity in the sewerage system is available.

NOTE: The types of substances listed above may be hazardous and their discharge should be controlled, or in certain cases prohibited.

Relevant state acts also apply to some of these substances (e.g. radioactive substances).

Genetically Engineered Organisms should not be confused with Dried Bacterial Cultures. The latter are mixtures of bacteria and enzymes which are derived from selective culture of specific organisms and are available as additives to biological processes.

Table 2

SPECIFIC ACCEPTANCE GUIDELINES

PARAMETER	GUIDELINE VALUE	REMARKS
Boron (as B)	100 mg/L	Boron is not removed by conventional treatment. High concentrations in effluent may restrict irrigation applications.
Bromine (as Br_2)	10 mg/L	High concentrations may adversely affect the safety of operations and maintenance personnel.
Fluoride (as F^-)	30 mg/L	Fluoride is not removed by conventional treatment, however pre-treatment can easily and economically reduce concentrations to below 20 mg/L.
Cyanide - weak acid dissociable (as CN^-)	5 mg/L	Cyanide may produce toxic atmospheres in the sewer and adversely affect the safety of operations and maintenance personnel.
Sulphide - Total (as S^{2-})	5 mg/L	Sulphides in wastewater may: - cause corrosion of sewer structures; - generate odours in sewers which could cause public nuisance; - result in sewer gases which could adversely affect the safety of operations and maintenance personnel.

Table 3

SPECIFIC ACCEPTANCE GUIDELINES FOR METALS

PARAMETER	GUIDELINE VALUE (mg/L)	LOWER DAILY MASS LOAD (g/day)
Arsenic (As)	5	15
Cadmium (Cd)	2	6
Chromium (Cr)		
Total	20	# 75
Hexavalent	10	
Cobalt (Co)	10	30
Copper (Cu)	10	75
Lead (Pb)	10	30
Mercury (Hg)	0.05	0.15
Nickel (Ni)	10	30
Selenium (Se)	5	15
Silver (Ag)	5	15
Tin (Sn)	10	30
Zinc (Zn)	10	75

When considering discharges below the lower daily mass load, authorities should ensure that waste generators reduce hexavalent chromium to trivalent chromium.

Notes on Table 3

A Mass Load approach has been adopted for metals.

The Guideline Values given above apply to dischargers having a daily mass load falling between the Lower Daily Mass Load (LDML) and the Upper Daily Mass Load (UDML) for the particular treatment plant.

For small dischargers, having a daily mass load below the LDML given in Table 3, there is no guideline value for concentration.

The value of the UDML is dependent on the load on the treatment plant and is therefore a site specific value.

Dischargers whose untreated wastes would have a daily mass load exceeding the UDML will be required to treat their wastes to a higher quality in order to meet the UDML. This may involve treating to a lower concentration than the guideline value shown in Table 3

Table 4

SPECIFIC ACCEPTANCE GUIDELINES FOR ORGANIC COMPOUNDS

PARAMETER	GUIDELINE VALUE	REMARKS
Formaldehyde (As HCHO)	50 mg/L	Formaldehyde in the sewer atmosphere can adversely affect the safety of operations and maintenance personnel.
Phenolic Compounds (As Phenols)	100 mg/L	Phenols may adversely affect biological treatment processes. They may not be completely removed by conventional treatment and subsequently may impact on the receiving environment.
Pentachlorophenol	5 mg/L	Pentachlorophenol - can adversely affect the biological treatment process; - may impair the quality of the receiving environment.
Petroleum Hydrocarbons	30 mg/L	Petroleum hydrocarbons may adversely affect the safety of operations and maintenance personnel.
Halogenated Aliphatic Compounds	5 mg/L	Because of their stability and chemical properties these compounds: - may adversely affect the treatment processes; - may impair the quality of the receiving environment; - may adversely affect the safety of operations and maintenance personnel.
Polynuclear Aromatic Hydrocarbons (PAHs)	5 mg/L	Many of these substances have been demonstrated to have an adverse effect on the health of animals. Some are also persistent and are not degraded by conventional treatment processes.
Pesticides (General) (Includes Insecticides, Herbicides, Fungicides)	1.0 mg/L	This category covers all pesticides other than those that are specifically listed below. Pesticides: - may adversely affect the treatment processes; - may impair the quality of the receiving environment; - may adversely affect the safety of operations and maintenance personnel.

Table 4 (continued)

PARAMETER	GUIDELINE VALUE	REMARKS
Organophosphate Pesticides Azinphos-methyl Azinphos-ethyl Coumaphos Demeton Dichlorvos Dimehoate Disulfoton Fenitrothion Fenthion Malathion Methamidophos Mevinphos Omethoate Oxydemeton-methyl Parathion Triazophos Trichlorfon	0.1 mg/L	Other organophosphate pesticides are covered by the preceding Pesticides (General) category. This list includes substances on the following lists of environmental toxicants: UK Red List; UK Candidate List; EC Priority Hazard List; and North Sea Agreement, App. 1D
Organochlorine Pesticides Aldrin Chlordane DDT Dieldrin Heptachlor Lindane	 0.001 mg/L 0.006 mg/L 0.003 mg/L 0.001 mg/L 0.003 mg/L 0.100 mg/L	 Organochlorine pesticides are particularly persistent in the environment and their use has been severely limited by regulatory authorities.

Note: This table must be read in conjunction with notes on page 20 "Specific Acceptance Criteria for Organic Compounds"

APPENDIX 2

LEGISLATION

The ability to develop and implement an effective trade waste control program depends on adequate legal power to enable the sewerage authority to control trade waste generators. It must also include realistic penalties for non-compliance.

The sewerage authority must be able to:

- Deny or impose requirements on existing, new, increased or varied contributions of trade waste discharged to a sewerage system.

- Establish and enforce deadlines for the installation by waste generators of any pre-treatment facility or technology needed to meet applicable discharge criteria. Waste generators should provide timely notice to the sewerage authority of any change in the quantity and/or quality of their waste discharged to the sewerage system.

- Control through permits, agreements or other means, the discharge of trade waste to the sewerage system. These can be used to establish a legal framework for controlling the quantity and quality of waste discharged, administering and enforcing pre-treatment standards and requirements or any other relevant waste management practices. Permits etc. should be flexible to allow for changes in environmental regulation, problems with the sewerage system and changes in the waste generator's plant process.

- Carry out inspections, surveillance and monitoring needed to determine compliance or non-compliance with applicable criteria and practices. Sewerage authority staff should have the authority to enter waste generating premises for the purpose of inspecting, sampling and monitoring waste discharges. They should be allowed to enter the premises at any reasonable time, day and night, without prior notice for the purpose of inspecting, sampling and monitoring activities. This may also be necessary to deal with emergency situations, suspected illegal out of hours discharges, and cases of suspected tampering with pre-treatment and monitoring equipment.

- Set penalties for non-compliance and/or collect liquidated damages. Offences can be categorised depending on the seriousness, for example:

  a) The most serious offence would be for persistent, wilful or deliberate breach of regulations, e.g. illegal dumping, or negligent or reckless action which causes serious damage or impairment of the treatment process, environmental pollution, etc. This would be a criminal offence to be settled in court.

b) Other offences, e.g. accidental but not negligent breach of permit conditions or terms in an agreement) should attract a less serious penalty. An example is to penalise by moving into a higher charging bracket for the accounting period for discharge of an over-strength waste.

c) For minor offences, an infringement system with on-the-spot fines could be used.

A formal procedure for dealing with non-compliance should apply. For example:

- a verbal warning to check that the discharger clearly understands the obligations,

- a letter pointing out the breach and the authority's timeframe for resolving the problem,

- a notice of intended prosecution or termination of discharge if an offence under a specific regulation is not remedied within a specified time,

- implementation of legal proceedings.

Sewerage authorities should have the power to order waste generators to halt immediately any actual or potential discharge to the sewerage system which may have an adverse effect on public health, occupational health and safety of employees, the environment or the sewerage system. If the waste generator fails to comply with such orders, the sewerage authority should be able to take any steps necessary, including severance of the sewer connection to prevent further discharge. Where a waste generator is ordered to cease discharge, environment authorities should be informed immediately, so that proper disposal of the waste may be arranged.

In all cases, the "offender" should be required to pay for damage or remedial action, e.g. clearing of a blocked sewer, renovation of an acid-damaged sewer, anti-foam oil to combat a detergent spillage, etc.

Penalties should be commensurate with the seriousness of the offence, and fines should be in line with penalties under comparatively similar state environmental legislation. Penalties should be greater than the "savings" in committing the offence, and therefore act as a financial deterrent.

Legislation which places the onus of proof on the discharger should be facilitated, e.g. a trade waste inspector issues a non-compliance certificate to a person for discharging trade waste without a permit - the defendant must demonstrate possession of a permit or that no trade waste is generated.

APPENDIX 3

MONITORING

Monitoring should be undertaken to meet two key objectives:

- to ensure that the processes of the trade waste discharger (including the operation of plant and equipment) are operating effectively and efficiently. (It makes economic sense to monitor for effectiveness and efficiency as faulty plant and equipment could be costly financially.)

- to demonstrate compliance with the sewerage authority's regulatory (licensing) requirements.

Some of the key components of monitoring for regulatory purposes are discussed below.

Scheduled Monitoring

Scheduled monitoring involves an arranged site visit made with the waste generator. The monitoring schedule should include:

- a thorough sampling and inspection in accordance with a predetermined schedule at least once a year,

- inspection of processes and plant operations to ensure significant changes have not been carried out, pre-treatment facilities are being operated properly and that no intentional dilution of wastewater is occurring,

- collection of composite samples and checks of flow rate measurements.

Unscheduled Monitoring

Unscheduled monitoring involves an unannounced site visit and is used to spot check all waste generators to verify compliance. Monitoring is performed during and outside working hours. Grab samples may be taken and flow measurement equipment checked. Inspection of process etc. may be undertaken as required.

Investigative Monitoring

Investigative monitoring is conducted in response to a known or suspected violation discovered during a monitoring program, public complaint or problems detected within the sewerage system. Monitoring may be undertaken within the sewerage system and/or at the waste generating premises.

Self Monitoring

Self monitoring may be beneficial for waste generators. This involves the generators carrying out their own sampling and analysis (self monitoring) and sending the results to the sewerage authority. Sewerage authorities should still perform their own monitoring programs in order to verify self monitoring data.

Sampling Locations

Sampling locations need to be specified in the trade waste agreement or licence. Where practicable a sampling location should be at the closest point of discharge to the sewerage authority's sewer upstream of where the sewer is joined by any sewer transporting domestic type waste.

Combined Waste Streams

Where separate waste streams or uncontaminated water are combined, the sewerage authority or trade waste generator may monitor either the segregated waste streams or the combined wastewater. If it is chosen to monitor the combined wastewater, the sewerage authority may apply a discharge limit calculated using the combined waste streams.

Sampling

Samples should be taken by appropriately trained staff using sampling equipment and methods that are valid for the analysis required. The samples may be split for comparison at the request of either party.

Analysis

Any samples taken should be analysed by qualified scientists in validated laboratories (Generally such validation takes the form of requiring the laboratory to be NATA Registered for the parameter to be analysed. Validation may also include a requirement to participate in inter laboratory comparison studies such as the WaterTest program conducted by TELARC New Zealand).

Analyses should be performed in accordance with techniques described in the latest edition of *Standard Methods for the Examination of Water and Wastewater* (APHA-AWWA-WPCF) or techniques described in any relevant Australian Standard or other techniques accepted by the local authority.

APPENDIX 4

DEVELOPING LOCAL ACCEPTANCE CRITERIA

When developing local acceptance criteria, each substance should be evaluated for its impact on the receiving environment, sludge quality, the treatment process, sewerage system and occupational health and safety. For each of these factors, an acceptable pollutant concentration or mass load can be determined and the most stringent concentration or mass load can then be used for that pollutant. This can then be translated into local acceptance criteria for individual trade waste generators discharging the pollutant into the sewerage system. The basic steps used in developing local acceptance criteria are illustrated in Figure 3.

Factors Affecting Acceptance Conditions

Factors affecting trade waste acceptance criteria for a specific sewerage system are:

- The types and quantity of waste generated including the toxicity, persistency, hazard level and ability to be treated.
- The available trade waste treatment technology including its effectiveness, reliability and any by-products produced.
- The type and effectiveness of the authority's sewerage system including the hydraulic capacity of sewers and pumping stations and the degree of treatment (i.e., no treatment, primary treatment or secondary treatment).
- The effluent disposal method including disposal to surface waters (rivers, streams and lakes), ocean, irrigation, non-potable reuse and evaporative systems.
- The sludge disposal method including disposal to landfill, incineration and agricultural uses.
- The local and downstream environmental conditions as well as criteria set by the regulatory authority.
- The expectations of the community.
- The necessity to comply with occupational health and safety requirements.
- The margin of safety and/or other physical controls necessary to cater for contingencies such as accidents and spillages.

Occupational Health and Safety Requirements

Occupational health and safety requirements are initially assessed at the point of discharge to the sewerage authority's sewerage system. In general, the primary consideration is with the generation of toxic or flammable gases. However, in some circumstances, physical contact with substances may need to be considered.

Atmospheric exposure standards are set by national and state health and safety bodies and scientific interpretation is often required in order to relate these atmospheric concentrations to wastewater concentrations.

In addition to assessment at the point of discharge, the downstream mixing effects of two or more trade waste discharges may need to be considered

Sewerage System Requirements

The impact of a trade waste on the sewerage system is initially assessed at the point of discharge to the sewerage system. Usually, the principal concerns are the hydraulic capacity of the sewer and the effects on the materials used to construct the components of the sewerage system. Depending on the nature and volume of the discharge, potential downstream effects may also need to be considered.

Treatment and Disposal Requirements

There is a large variation in treatment plant performance. Consequently, determinations of individual plant inhibition and removal data for specific pollutants is desirable. However, if this data is not available, information from the following tables may be used.

Table 5 lists typical threshold concentrations for several common pollutants in wastewater which inhibit activated sludge processes, nitrification processes and anaerobic sludge digestion.

Table 6 lists typical removal rates through primary and secondary treatment processes for several common pollutants.

The domestic contribution of the pollutant should be taken into account when determining local acceptance criteria for trade waste generators.

Table 7 lists typical background concentrations of heavy metals found in domestic wastewater from non-industrial sources.

Example 1 - Derivation of Local Concentration Criteria for Metals

The derivation of local concentration criteria for copper for an activated sludge plant with anaerobic digestion of sludge is shown below.

The treatment plant characteristics used are actual data derived from sampling of the Port Adelaide Sewage Treatment Plant (see Fig. 4).

Treatment Plant Characteristics:

- Average influent flow	= 37 ML/day
- Sludge flow to sludge digestion	= 0.45 ML/day at 2.5% solid
- Sludge flow to ultimate disposal	= 0.25 ML/day at 2.7% solid
- Primary treatment removal rate for copper	= 20%*
- Combined Primary and Secondary treatment removal rate for copper	= 80%*
- Non industrial contribution for plant's copper inflow	= 0.10 mg/L
- Total flow of industrial waste generators discharging copper	= 0.73 ML/day

* The equation for removal rate (efficiency) of a substance across a treatment plant or a specific section of the plant is:

$$R = \frac{(Co - Ce) \times 100}{Co}$$

where **R** = Removal rate (percent)
Co = Influent pollutant loading (kg/day)
Ce = Effluent pollutant loading (kg/day)

If removal rates are not available, use Table 6 as an estimate.

Final Discharge Criteria:

- Assume final effluent discharge criteria to the environment	= 40 ug/L
- Sludge land disposal criteria	= 1200 mg/kg of dry sludge (Ref. 9)
- National acceptance guideline	= 10 mg/L (Table 3)

Treatment Plant Inhibition (Table 5)

- Activated sludge (aeration)	= 1.0 mg/L
- Anaerobic digestion	= 20 mg/L.

Procedure

1. Determine the maximum allowable concentration of copper in the plant influent to:

   a. Avoid activated sludge process inhibition.
   b. Avoid anaerobic digestion inhibition.
   c. Comply with final effluent discharge criteria.
   d. Comply with sludge land disposal criteria.

2. Using the most stringent influent copper concentration:

   - Calculate the total allowable copper mass inflow.
   - Determine the non industrial copper mass inflow.
   - Subtract the non industrial copper mass inflow from the total allowable copper mass inflow to calculate the copper mass inflow available to industrial sources.
   - Divide the available industrial copper mass inflow by the industrial flow to obtain the allowable industrial copper waste discharge concentration.

3. Compare the resultant discharge concentration to the national acceptance guidelines and adopt an appropriate (more stringent if necessary) industrial discharge concentration for copper.

1. Determine Maximum Allowable Concentration of Copper in Plant Influent to:

a. Avoid activated sludge process inhibition

$$\text{Maximum influent concentration} = \frac{\text{Inhibition Concentration}}{1 - \text{primary treatment removal rate}}$$

$$= \frac{1.0}{(1 - 0.2)}$$

$$= 1.25 \text{ mg/L}$$

Hence the maximum allowable concentration of copper in the plant influent to avoid activated sludge process inhibition is 1.25 mg/L.

b. Avoid anaerobic digestion inhibition

The maximum copper permitted into the digester before inhibition occurs is equal to the sludge flow to the digester multiplied by the maximum copper concentration permitted.

$$\text{Maximum copper} = 0.45 \times 10^6 \times 20 \text{ mg/L}$$

$$= 9.0 \times 10^6 \text{ mg/day}$$

Total copper removed (by primary & secondary treatment) and entering anaerobic digester plant.

Total copper removed = 80% influent copper

$$\text{Maximum influent concentration} = \frac{\left[\begin{array}{l}\text{daily max. copper entering} \\ \text{anaerobic digester (mg/day)}\end{array}\right]}{\text{daily influent flow (L/day)} \times 0.8}$$

$$= \frac{9.0 \times 10^6}{37 \times 10^6 \times 0.8}$$

$$= 0.3 \text{ mg/L.}$$

Hence the maximum allowable concentration of copper in the plant influent to avoid anaerobic digestion inhibition is 0.3 mg/L.

c. Comply with final effluent discharge criteria.

$$\text{Maximum influent concentration} = \frac{\text{effluent quality standard}}{(1 - \text{secondary treatment removal rate})}$$

$$= \frac{40\ \mu\text{g/L}}{(1 - 0.8)}$$

$$= 0.2 \text{ mg/L}$$

Hence the maximum allowable concentration of copper in the plant influent to comply with final effluent discharge criteria is 0.2 mg/L.

d. Comply with sludge land disposal criteria.

$$\text{Total dry sludge produced per day} = \text{Sludge flow} \times \text{concentration}$$

$$= \frac{(0.25) \times 10^6 \times 2.7}{100}$$

$$= 6750 \text{ kg/day.}$$

Maximum allowable copper concentration in sludge is 1200 mg/kg

Hence maximum allowable copper production per day = allowable copper concentration multiplied by the sludge mass.

$$\text{Maximum allowable copper production} = 1200 \text{ mg/kg} \times 6750 \text{ kg/day}$$

$$= 8.1 \times 10^6 \text{ mg/day.}$$

Total copper removed and entering sludge = 80% influent copper

$$\text{Maximum influent concentration} = \frac{\text{daily maximum copper in sludge}}{\text{daily influent flow (L/day)} \times 0.8}$$

$$= \frac{8.1 \times 10^6}{37 \times 10^6 \times 0.8}$$

$$= 0.27 \text{ mg/L}$$

Hence the maximum allowable concentration of copper in the plant influent to comply with sludge land disposal criteria is 0.27 mg/L.

Summary

- Value to avoid activated sludge process inhibition is 1.25 mg/L.
- Value to avoid anaerobic digestion inhibition is 0.3 mg/L.
- Value to comply with final effluent discharge criteria is 0.2 mg/L.
- Value to comply with sludge land disposal criteria is 0.27 mg/L.

Select the Most Stringent Value

In this example, compliance with the final effluent discharge criteria determines the maximum allowable concentration of copper in the treatment plant influent (i.e., 0.2 mg/L).

2. Determine the Allowable Industrial Copper Waste Discharge Concentration

After calculating the maximum allowable influent concentration (0.2 mg/L) of copper, the background copper (non industrial contribution) component should be deducted to obtain the allowable industrial copper mass inflow.

Total allowable copper inflow ($0.2 \times 37 \times 10^6$)	=	7.4 kg/day
Non industrial copper inflow ($0.10 \times 37 \times 10^6$)	=	3.7 kg/day
Industrial copper inflow	=	(7.4 - 3.7) kg/day
	=	3.7 kg/day.

Now determine the allowable industrial copper waste discharge concentration

$$= \frac{\text{total industrial copper influent}}{\text{total industrial flow with copper}}$$

$$= \frac{3.7 \text{ kg/day}}{0.73 \text{ ML/day}}$$

$$= 5.1 \text{ mg/L}$$

3. Compare With the National Acceptance Guidelines

National acceptance criteria = 10 mg/L which exceeds 5.1 mg/L.

For the Port Adelaide Sewage Treatment Plant, the concentration acceptance criteria for copper discharging into the sewerage system by trade waste generators is therefore 5 mg/L.

This industrial copper discharge concentration can only be increased by reducing the level of non-industrial discharge.

Note

In this example, because the total industrial flow to the treatment plant is known (0.73 ML/day), the total allowable industrial copper contribution (3.7 kg/day) can be converted to a concentration limit.

The assumption made in this example is that the industrial flow is known and will not increase.

Often this is not the case. It is then not possible to set a concentration limit for all industrial dischargers, as the number of dischargers and the industrial flow will increase over time. It is necessary to set mass limits for a single industrial discharger based on the expected total number of dischargers (present and future). This can be done as follows:

- determine the total allowable industrial metal contribution
- estimate the total number of present and future industrial dischargers
- allocate the allowable mass discharge for each discharger by dividing the total allowable industrial discharge by the number of dischargers. This gives the Upper Daily Mass Load (UDML, see pp 19 and 28) for each discharger.

For example, if the total acceptable industrial load from all dischargers to a treatment plant was 10 kg/day, and the estimated total number of present and future dischargers was 25, then UDML for **each** discharger could be set at 10/25 kg/day = 0.4 kg/day. Concentration limits would be applied as per Table 3 for mass loads which exceed the Lower Daily Mass Load (LDML).

The above approach apportions the allowable load equally to all industrial dischargers. If the sewerage authority wishes, the allowable UDML may be apportioned differently among dischargers. For example a large volume discharger may be given a higher UDML than a smaller one. This is a choice for the authority.

The total allowable industrial load would need to be periodically reviewed, as the total and domestic load to the treatment plant changed over time. This could result in changes to the UDML for individual industrial dischargers.

FIGURE 3

BASIC STEPS IN DEVELOPING LOCAL ACCEPTANCE CRITERIA

Occupational Health and Safety

Assess at Point of Discharge:

- ***possible effects on maintenance personnel and the general community (from the release of gases).***

Sewerage System Requirements

Assess at Point of Discharge the possible impact on:

- ***materials of construction***
- ***hydraulic capacity***
- ***pumping station capacity and operations***

Treatment and Disposal Requirements

Activated Sludge	**Anaerobic Digestion**	**Nation, State or Local Water Quality Requirement**	**Sludge Disposal**
1. Determine Inhibitory Concentration Value	1. Determine Inhibitory Concentration Value	1. Calculate Influent Concentration which will allow compliance with national, state requirements and/or protect water quality.	1. Determine Sludge Disposal Method
2. Calculate Influent Concentration that is not Inhibitory to this Process	2. Calculate Influent Concentration that is not Inhibitory to this Process		2. Calculate Influent Concentration that will allow Disposal Option

↓

Select Most Stringent Value

↓

Calculate Total Load Available for Trade Waste Generators

↓

Apportion Load (Acceptance Limits) between Trade Waste Generators

Note: Apportionment of load between Trade Waste Generators should take into consideration future requirements generated by additional dischargers.

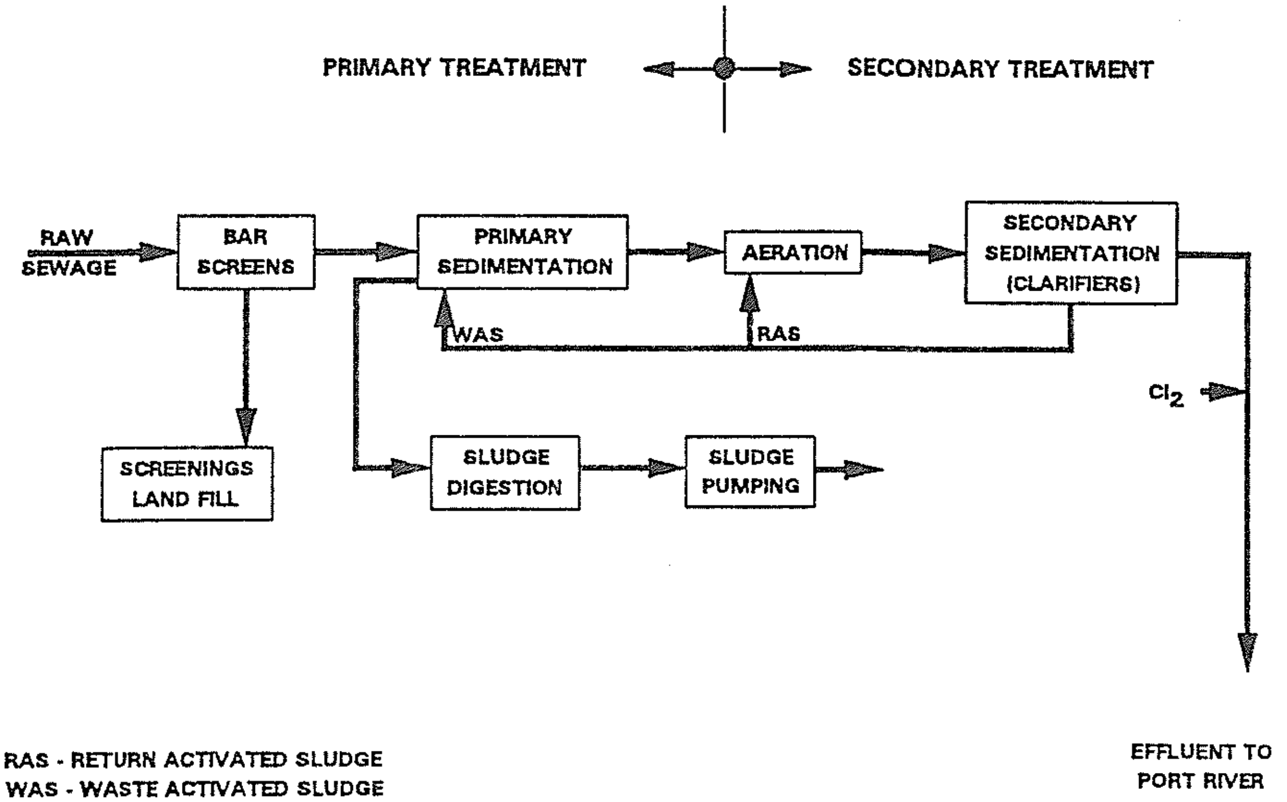

FIGURE 4 : LAYOUT OF PORT ADELAIDE S.T.W. SITE

Example 2 - Derivation of Local Mass Criteria

In this example, local mass criteria specific to a treatment plant are derived for nickel. Unlike Example 1, the total industrial flow is not known in this case, as criteria are being set to cater for future industrial discharge. Mass criteria for industrial dischargers are determined in the following way:

1. The total acceptable mass discharge to the wastewater treatment plant is determined, based on maintaining acceptable metals levels that do not compromise wastewater treatment or disposal. This involves determining individually the acceptable total mass discharge and hence maximum metal concentration in the incoming wastewater to meet the following conditions:

   a. avoid inhibition of activated sludge
   b. avoid inhibition of anaerobic digestion
   c. avoid inhibition of nitrification
   d. comply with effluent discharge criteria
   e. comply with sludge disposal criteria

   The most stringent of the 5 conditions above will determine the maximum allowable mass load of nickel to the treatment plant.

2. The domestic contribution is determined, and this is subtracted from the total acceptable mass load determined in step 1 to obtain the allowable mass discharge from all industrial sources.

3. The total allowable industrial discharge is divided amongst the anticipated number of industrial dischargers to obtain the allowable mass load from one discharger. This is the Upper Daily Mass Load (UDML) for one discharger. This can be incorporated into the local acceptance criterion.

Treatment Plant Characteristics

- Daily flow to treatment plant	= 37,500 kL/day
- Concentration of nickel in raw wastewater	= 0.015 mg/L
- Sludge flow to digester	= 500 kL/day at 2.5% dry solids
- Sludge production (after digestion)	= 6,500 kg/day dry solids
- Removal of nickel in primary treatment	= 35%
- Total plant removal of nickel	= 72%

Treatment Process Inhibition Levels (Table 5)

- Activated sludge	= 1 mg/L
- Anaerobic digestion	= 20 mg/L
- Nitrification	= 0.25 mg/L

Discharge Criteria

- Maximum effluent concentration of nickel = 0.075 mg/L
- Maximum concentration in digested sludge = 100 mg/kg dry solids (Ref 9)

1. Determine Allowable Influent Concentration to Meet Conditions a-e Above:

a. Avoiding activated sludge inhibition

$$\text{Maximum influent concentration} = \frac{\text{Inhibition concentration}}{\text{(1- primary treatment removal rate)}}$$

$$= 1.0/(1-0.35)$$

$$= 1.54 \text{ mg/L}$$

b. Avoiding anaerobic digestion inhibition

Maximum nickel load to digester = daily flow to digester multiplied by the maximum copper concentration to avoid inhibition.

$$= 500 \times 10^3 \text{ L/day} \times 20 \text{ mg/L}$$
$$= 1 \times 10^7 \text{ mg/day}$$

As plant removal of nickel is 72%, 1×10^7 mg/day nickel represents 72% of the allowable daily inflow.

$$\text{Maximum influent concentration} = \frac{\text{(daily max. nickel entering digester (mg/day))}}{\text{daily influent flow (L/day) x plant removal rate}}$$

$$= \frac{1 \times 10^7}{37{,}500 \times 10^3 \times 0.72}$$

$$= 0.37 \text{ mg/L}$$

c. Avoiding nitrification inhibition

$$\text{Maximum influent concentration} = \frac{\text{Inhibition concentration}}{\text{(1- primary treatment removal rate)}}$$

$$= \frac{0.25}{(1 - 0.35)}$$

$$= 0.38 \text{ mg/L}$$

d. Compliance with effluent discharge criteria

Maximum influent concentration $= \dfrac{\text{effluent criterion}}{1 - \text{plant removal rate}}$

$= \dfrac{0.075}{1 - 0.72}$

= 0.27 mg/L

e. Compliance with sludge disposal criteria

Sludge solids from digester = 6,500 kg/day dry solids
Maximum nickel concentration = 100 mg/kg dry solids

Hence maximum nickel mass from digester = 6,500 x 100
= 650,000 mg/day

This is also the maximum allowable nickel load to the digester, as nickel is not broken down in the process.

As the treatment plant removes 72% of total incoming nickel, the allowable daily mass load to the plant

= 650,000/0.72
= 903,000 mg/day

As the daily inflow is 37,500 kL, the maximum allowable daily mass load to avoid exceeding the sludge disposal criterion

$= \dfrac{903{,}000}{37{,}500 \times 10^3}$

= 0.024 mg/L

From the above calculations, it is apparent that sludge disposal is the limiting factor which determines the allowable influent nickel load. The maximum allowable concentration of nickel in the influent is 0.024 mg/L. At an inflow of 37,500 kL/day, this equates to a daily mass load of 900 g nickel.

2. Determine the Allowable Mass Load From All Industrial Sources

From Step 1, the maximum allowable daily nickel load from all sources is 900 g.

Given a daily inflow of 37,500 kL and a concentration of 0.015 mg/L nickel, the current load of nickel from domestic sources is 560 g/day.

Hence the total industrial contribution cannot exceed (900 - 560) g/day
= 340 g/day

3. Determine the Allowable Mass Load For One Discharger

The total industrial load from all industrial dischargers must not exceed 340 g/day. If a maximum of 6 industrial dischargers is expected, then the Upper Daily Mass Load (UDML) for each discharger must not exceed 57 g/day.

The calculated upper daily mass load of 57 g/day can be used along with the guidelines in Table 3 to establish a comprehensive local acceptance criterion for nickel as follows:

For mass discharges below 30 g/day, no concentration limit applies.
For mass discharges between 30 and 57 g/day, the concentration must not exceed 10 mg/L.
The mass discharge must not exceed 57 g/day, irrespective of concentration.

Note

The above calculation ignores the additional flow contribution of new industrial dischargers. This is normally small in comparison to the overall flow, and so has only a limited effect on the calculated concentrations. If the volume of the industrial discharge is significant compared to the total, it can be incorporated in the calculations. It is omitted from the example above for clarity.

TABLE 5

COMPOUNDS INHIBITING BIOLOGICAL PROCESSES
(in mg/L)

NI = No Inhibition at the nominated concentrations.
- indicates that data is not available.

POLLUTANT	ACTIVATED SLUDGE	ANAEROBIC DIGESTION	NITRIFICATION
Acenaphthene	NI# at 10	-	-
Acrolein	NI at 62	-	-
Acrylonitrile	NI at 152	5	-
Ammonia	480	1500-3000	-
Arsenic	0.04-0.4	0.1-1	-
Benzene	125	-	-
Benzidine	5	5	-
Boron	0.05-10	2	-
Cadmium	0.5-10	0.02-1	5-9
Calcium	2500	-	-
Carbon tetrachloride	NI at 10	2.9	-
Chlorobenzene	NI at 1	0.96	-
1,2,4-trichlorobenzene	NI at 6	-	-
Hexachlorobenzene	5	-	-
1,2-dichloroethane	NI at 258	1	-
1,1,1-trichloroethane	NI at 10	-	-
Hexachloroethane	NI at 10	-	-
1,1-dichloroethane	NI at 10	-	-
1,1,2-trichloroethane	NI at 5	-	-
1,1,2,2-tetrachloroethane	NI at 201	20	-
Bis-(2-chloroethyl)ether	NI at 10	-	-
2-chloroethyl vinyl ether	NI at 10	-	-
2-chloronaphthalene	NI at 10	-	-
2,4,6-trichlorophenol	50	-	-
Para-chloro-meta-cresol	NI at 10	-	-
Chloroform	NI at 10	1	10
2-chlorophenol	NI at 10	-	-
1,2-dichlorobenzene	5	0.23	-
1,3-dichlorobenzene	5	-	-
1,4-dichlorobenzene	5	1.4	-

Table 5 (continued)

POLLUTANT	ACTIVATED SLUDGE	ANAEROBIC DIGESTION	NITRIFICATION
1,1-dichloroethylene	NI at 10	-	-
1,2-trans-dichloroethylene	NI at 10	-	-
2,4-dichlorophenol	NI at 75	-	-
1,2-dichloropropane	NI at 182	-	-
1,3-dichloropropylene	NI at 10	-	-
2,4-dimethylphenol	NI at 10	-	-
2,4-dinitrotoluene	5	-	-
2,6-dinitrotoluene	5	-	-
1,2-diphenylhydrazine	5	-	-
Ethylbenzene	NI at 10	-	-
Fluoroanthene	NI at 5	-	-
bis-(2-chloroisopropyl)ether	NI at 10	-	-
Chloride	-	20000	180
Chloromethane	NI at 180	3.3	-
Methylene chloride	-	100	-
Chloroform	NI at 10	-	-
Dichlorobromomethane	NI at 10	-	-
Trichlorofluoromethane	NI at 10	0.7	-
Chlorodibromomethane	NI at 10	-	-
Hexachlorobutadiene	NI at 10	-	-
Hexachlorocyclopentadiene	NI at 10	-	-
Chromium (Tot.)	0.1-20	1.5-50	0.25-1
Chromium (Hex.)	1	50	-
Copper	0.1-1	0.5-100	0.05-0.5
Iodine	10	-	-
Iron	5-500	5	-
Isophorone	NI at 15.4	-	-
Lead	0.1-10	50-250	0.5-1.7
Manganese	10	-	-
Magnesium	-	1000	50
Mercury	0.1-5	1400	2-12.5
Napthalene	500	-	-
Nickel	1-5	2-200	0.25-5
Nitrobenzene	500	-	-
2-nitrophenol	NI at 10	-	-

Table 5 (continued)

POLLUTANT	ACTIVATED SLUDGE	ANAEROBIC DIGESTION	NITRIFICATION
4-nitrophenol	NI at 10	-	-
2,4-dinitrophenol	1	-	-
N-nitrosodiphenylamine	NI at 10	-	-
N-nitroso-di-N-propylamine	NI at 10	-	-
Pentachlorophenol	0.95	0.2	-
Phenol	200	-	4
Bis-(2-ethyl hexyl)phthalate	NI at 10	-	-
Butyl benzyl phthalate	NI at 10	-	-
Di-n-butyl phthalate	NI at 10	-	-
Di-N-octyl phthalate	NI at 16.3	-	-
Diethyl phthalate	NI at 10	-	-
Dimethyl phthalate	NI at 10	-	-
Chrysene	NI at 5	-	-
Acenaphthylene	NI at 10	-	-
Anthracene	500	-	-
Fluorene	NI at 10	-	-
Phenanthrene	500	-	-
Pyrene	NI at 5	-	-
Tetrachloroethylene	NI at 10	20	-
Toluene	NI at 35	-	-
Trichloroethylene	NI at 10	20	-
Aroclor-1242	NI at 1	-	-
Aroclor-1254	NI at 1	-	-
Aroclor-1221	NI at 1	-	-
Aroclor-1232	NI at 10	-	-
Aroclor-1016	NI at 1	-	-
Silver	0.03-5	-	0.25
Sodium	-	3500	-
Sulphide	50	50-100	-
Tin	-	9	-
Vanadium	20	-	-
Zinc	0.3-20	1-10	0.01-1

From:
Russell L.L., Cain C.B. and Jenkins D.I. "Impacts of Priority Pollutants on Publically Owned Treatment Works Processes. A Literature Review" Proceedings of the 37th Industrial Waste Conference. Ann Arbor . Mich. USA 1982

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Table 6

TYPICAL TREATMENT PLANT REMOVAL RATES FOR HEAVY METALS

HEAVY METAL	PERCENT REMOVAL BY PRIMARY TREATMENT		PERCENT REMOVAL PRIMARY PLUS SECONDARY	
	Range	Typical	Range	Typical
Cadmium	7 - 50	35	50 - 70	60
Chromium	16 - 56	50	33 - 93	80
Copper	16 - 53	50	82 - 92	85
Lead	20 - 71	65	57 - 97	90
Mercury	22 - 67	65	51 - 73	65
Nickel	6 - 50	35	32 - 72	60
Zinc	26 - 51	50	76 - 82	80

NOTE: A number of factors affect removal efficiencies including heavy metal concentration, the form in which it is present and the nature of the treatment processes. Therefore, the above table should be used as a guide only and actual site data is preferable and recommended.

Table 7

TYPICAL BACKGROUND CONCENTRATIONS OF HEAVY METALS IN DOMESTIC WASTEWATER

HEAVY METALS	CONCENTRATIONS (µg/L)				
	Adelaide	Brisbane	Melbourne	Perth	Sydney
Arsenic	-	< 2	3	< 2	3
Cadmium	2	< 10	< 1	< 10	1
Chromium	4	< 10	4	< 20	3 - 6
Copper	110	90	160	90-200	140 -180
Lead	12	< 50	10	< 40	15
Mercury	0.8	< 1	< 0.5	< 1	1
Nickel	13	< 15	14	< 50	5
Selenium	-	< 2	< 10	-	2
Zinc	145	280	162	150-300	50 - 90

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