CONTROL OF INDUSTRIAL WASTEWATER DISCHARGES IN THE NORTH WEST OF ENGLAND

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ABSTRACT

North West Water (NWW) manage a scheme to ensure the efficient control of industrial effluent discharges to protect the environment, the Company's assets, assist in meeting short and long-term Water Quality objectives, whilst highlighting present and future problems.

Guidelines have been developed based on a policy of encouraging the treatment of industrial effluent in admixture with domestic sewage, provided that this can be satisfactorily achieved. Discharges of industrial effluent can be made only with the consent of the controlling Company and an extensive service for the reception and treatment of industrial effluent is offered.

The legal framework necessary to facilitate control, evolved over many years, has continued to develop and expand to encompass U.K. and European legislation. Aspects relevant to industrial effluent control and regulation are outlined and discussed.

Charging for the reception, conveyance and treatment of industrial effluent forms an important part of the control mechanism and ensures that industry pays a fair price for the service provided.

Increasing pressure to reduce inputs to the environment of dangerous substances has resulted in legislation, both national and international, which has a major impact on the business of waste water treatment. A description of the U.K. approach to the incorporation of European Community and North Sea conference requirements into its own legislative framework is included.

KEYWORDS

Objectives; U.K. and European Legislation; North Sea Conference; Dangerous Substances; Consent; Control; Charging;

INTRODUCTION

The north west of England, birthplace of the industrial revolution of the mid-nineteenth century, was one of the first in the world to recognise that it had a trade effluent discharge problem. The need for control was occasioned initially by the requirement of industry to have a wholesome supply of river water for its processes. Discharges of highly polluting trade effluents direct to river were therefore unacceptable. Prior to 1974 industrial effluent control was the responsibility of the local municipal authority, acting under the appropriate U.K. legislation, mainly the Public Health Acts of 1936, 1937 and 1961. Trade effluent
control practice was highly variable, ranging from no control in some areas to well organised schemes in others.

In 1974, ten water authorities were formed, covering the whole of England and Wales and these bodies inherited the responsibility for water supply and sewage treatment. Immediate steps were taken through the auspices of the National Water Council and the Confederation of British Industry to derive a trade effluent control and charging scheme which would form the framework of control for all the water authorities. These 'Recommended Guidelines' were finally published in February 1976 and have recently been developed to form an extensive document for use by NWW staff in controlling industrial discharges.

In 1989 the UK Government introduced a Water Act transferring ownership of the ten regional water authorities from public to private sector and control of discharges to watercourses (including sewage treatment works outfalls) became the responsibility of the newly formed National Rivers Authority (NRA). The Act also established the need for a national regulator to oversee the activities of the new water companies and introduced a mechanism for control of the input of listed dangerous substances to the aquatic environment. The function of regulator is carried out by the Director General of Water Services (DG) and control of dangerous substances is the responsibility of Her Majesty's Inspector of Pollution (HMIP). The right to discharge industrial effluent to the public sewer was provided by the Public Health (Drainage of Trade Premises) Act 1937. However, the discharge is not lawful unless it is made with the formal consent of the water company or is the subject of an agreement under the same Act. The failure of a water company to give a consent may result in an appeal by the trader to the DG, as is also the case where a trader feels that the conditions imposed in a consent are too restrictive or unfair. NWW operates a policy of encouraging the treatment of industrial effluent in admixture with domestic sewage, provided that this can be satisfactorily achieved. An extensive service for the reception and treatment of industrial effluent is offered and will be developed further in the future. Since 1974 NWW has sought to provide, wherever possible, a service to industry for the disposal of effluent and industry has been encouraged to divert their effluent from rivers to sewers. It has been generally accepted that for most types of effluent, treatment at sewage works is the most acceptable means of disposal in view of the dilution available and the economics of scale.

OBJECTIVES

The main objective of control is to prevent industrial effluent discharges to public sewers causing:

- breach of North West Water's legal obligations
- damage or harm to the sewerage system and the personnel employed therein
- interference with the effective and economic treatment of the mixed sewage in processes employed at the sewage works
- unacceptable effects on water resources or the environment generally
- unacceptable storm sewage discharges to watercourses

Other objectives include:

- the collection of data for use in the design of future sewerage and sewage treatment works and to ensure the proper management of water resources.
- to ensure that the trader pays a fair charge for the services rendered for the reception, conveyance, treatment and disposal of his effluent.

HISTORY

The first mention of industrial effluent in British Statute appeared in the Rivers Prevention of Pollution Act 1876 which contained a statement that local authorities should give facilities to enable manufacturers to discharge factory effluents into the public sewers, but the authority was not compelled to accept any effluent which would prejudicially affect the sewers or treatment processes. From such crude beginnings subsequent legislation developed a comprehensive system for the control of trade effluents discharged to sewer which has proved effective in the fight
against pollution. Five main Acts have been introduced which enabled this control to be exercised.
• Public Health Act 1936
• Public Health (Drainage of Trade Premises) Act 1937
• Public Health Act 1961
• Control of Pollution Act 1974
• The Water Act 1989

**Definition of trade effluent** The Public Health (Drainage of Trade Premises) Act, 1937 states - 'trade effluent means any liquid, either with or without particles of matter in suspension therein, which is wholly or in part produced in the course of any trade or industry carried on at trade premises and in relation to any trade premises, means any such liquid as aforesaid which is so produced in the course of any trade or industry carried on at those premises, but does not include domestic sewage'. This definition was amended by Section 63(1) of the Public Health Act 1961 to include land or premises used or intended to be used for agricultural or horticultural purposes or for scientific research or experiment. Laundry effluent is now included and effluent from fish farming was included under the Water Act 1989.

**LEGISLATIVE PROCEDURES**

Industrial effluent can only be discharged to the public sewerage system with the consent of the water company. In certain cases, where prescribed substances or the effluent from prescribed processes may be present, it is also necessary to obtain the permission of the Department of the Environment (DoE).

The consent may be in the form of an agreement between the water company and the discharger or more normally through the consent document. In either case the conditions on which the discharge can be made are stipulated and the volume, nature and composition of the effluent is limited. It is possible for conditions in the consent to be varied by the Company serving a Direction Notice on the discharger. The trader then has the right of appeal to the Director General of Water Services against changes or new conditions imposed.

**Obligations of the sewerage undertaker**
• receive the effluent in accordance with the terms of the consent.
• monitor the quality of effluent and review consent conditions.
• ensure that the discharge does not result in the breach of a sewerage undertakers own control limitations for sludge or sewage works final effluent disposal.
• keep available for public inspection copies of consents, agreements and directions.
• have regard for safety of the public employees.
• ensure the trader pays a fair charge for the reception, conveyance, treatment and disposal of the waste;
• protect the environment.

**Obligations of the industrialist**
• obtain a consent or agreement to discharge to a public sewer;
• comply in every respect with the conditions of the consent or agreement;
• have regard to health and safety;
• pay the full charge on demand;
• protect the environment.

Discharges to public sewers are controlled through monitoring procedures involving random sampling and spot-checks by the sewerage undertaker for compliance control and composite samples taken for charging purposes. It is an offence to discharge industrial effluent without a consent or in breach of the conditions of a consent. If a discharge is found to be exceeding consent limits then action is taken. Serious incidents causing damage or harm or causing treatment problems are considered for prosecution and in exceptional cases the sewerage undertaker may seek an injunction to prevent continuous breaches of a consent. In general, NW have adopted an encouraging and co-operative approach to assist industry solve the often difficult problem of effluent treatment and disposal, but wherever such co-operation is lacking, prosecution in the courts is used.
With the increasing regulation imposed on the water companies, other bodies can be involved in controlling industrial discharges. DoE, HMIP, the NRA and the Ministry of Agriculture, Fisheries and Food (MAFF) are all involved when controlling potentially toxic elements or prescribed substances and processes.

**EC DIRECTIVES**

The European Community has influenced pollution control in the member states in recent years. Previously, water companies could determine consent conditions to protect their own installations and having regard to safety and acceptable levels of contamination of the environment. The only external influence was that of MAFF through its licence conditions for the disposal of sludge to land and sea. In future, the requirements stipulated in EC Directives will have an increasing effect on water company control standards and directives already in force are beginning to cause NWW to reconsider its control strategies. In respect of discharges to sewer, the directive having the greatest impact is the so-called 'Dangerous Substances Directive' 76/464/EEC. This directive contains two lists of substances or groups of substances grouped into a 'black list' (List I) and a 'grey list' (List II) on the basis of their toxicity, persistence and bio-accumulation in the environment. The 'parent' directive was ratified by the Council of Ministers on 4 May 1976 and under the provisions of the directive, further 'daughter' directives can be issued to stipulate limit values and river quality standards for any of the substances in List I and substances currently in List II can be elevated into List I.

**THE RED LIST**

In November 1987 the Second International Conference on the Protection of the North Sea was held in London. Government Ministers of the eight North Sea States represented at the conference agreed upon actions to protect and enhance the North Sea environment. The British Government is strongly committed to the North Sea Declaration of Intent and has drawn up a list, the 'Red List', of dangerous substances for which priority attention is required. The list was prepared using similar environmental considerations to those used in the Directive 76/464/EEC, and in fact contains all the Black List plus additional substances (see table 1).

<table>
<thead>
<tr>
<th>Mercury and its compounds</th>
<th>1, 2 - Dichloroethane</th>
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<tr>
<td>Cadmium and its compounds</td>
<td>Trichlorobenzene</td>
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<td>Gamma-Hexachlorocyclohexane</td>
<td>Atrazine</td>
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<td>DDT</td>
<td>Simazine</td>
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<tr>
<td>Pentachlorophenol</td>
<td>Tributyltin compounds</td>
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<td>Hexachlorobenzene</td>
<td>Triphenyltin compounds</td>
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<td>Azinphos-methyl</td>
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<tr>
<td>Polychlorinated biphenyls</td>
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<td>Dichlorvos</td>
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*Table 1 January 1990*

The Red List initially applied only to the North Sea but has since been extended to cover all coastal waters around the UK and water companies were asked to prepare and develop action plans aimed at making substantial reductions in the amounts of Red-List substances discharged to those waters.

**PRESCRIBED SUBSTANCES AND PROCESSES**

Control of Red List substances and the obligation to comply with EC Directives required new legislation and the Water Act 1989 has given a mechanism in the form of Trade Effluents (Prescribed Processes and Substances) Regulations.
The Red List was incorporated into a list of prescribed substances and certain processes were classified as prescribed processes. Any application for a consent (or an agreement) to discharge from a prescribed process or to discharge a prescribed substance (or any direction of a consent containing such substances or from such processes) must be referred to HMIP.

The Company must not issue a consent or enter into an agreement to which these substances or processes relate until the Secretary of State has determined the limits to be applied. The Secretary of State can prohibit such substances or processes and has the power to review existing consents involving them.

**CHARGING**

The policy of NWW is to impose a standard method of charging for the reception and treatment of industrial effluent.

The cost per cubic metre of effluent received and treated is determined in accordance with the formula:

\[
C = R + V + M + \frac{Ot \cdot B + St \cdot S}{Os \cdot Ss}
\]

where:

- \(C\) = Total charge in pence per cubic metre of trade effluent.
- \(R\) = Reception and conveyance cost per cubic metre of sewage.
- \(V\) = Volumetric and primary treatment cost per cubic metre of sewage.
- \(M\) = Cost of providing and operating sea outfalls per cubic metre of sewage.
- \(Ot\) = The COD (mg/l) of the trade effluent after one hour quiescent settlement at pH 7.0.
- \(Os\) = The COD (mg/l) of average strength settled sewage.
- \(B\) = Biological oxidation cost per cubic metre of settled sewage, (including the cost of secondary sludge disposal).
- \(St\) = The total weight of suspended solids (mg/l) of the trade effluent at pH 7.
- \(Ss\) = The total weight of suspended solids (mg/l) of average strength crude sewage.
- \(S\) = Treatment and disposal cost of primary sludges per cubic metre of sewage.

Charges are designed to have regard to the services provided in the disposal of any particular industrial effluent. Only those factors applicable are used.

Following the privatisation of the water industry in 1989, the charges levied by each new water company are subject to regulation by the DG. The increase in charges is restricted to a tariff basket containing five charges: measured sewerage, unmeasured sewerage, measured water, unmeasured water and trade effluent. The increase allowed is Retail Price Index (RPI) + a factor 'K' where 'K' has been set for NWW at 5% for 10 years, reviewable after 5 years.

**CONTROL**

In order to achieve the stated objectives a scheme of control is operated for all industrial discharges entering the sewerage network. Discharges of industrial effluent are subject to limitation in respect of volume, nature and composition.

Standards are set on the basis of local, national or international requirements. In the case of Prescribed Processes and Substances, reference is made to HMIP before consent limits are set.

NWW has produced guidelines suggesting standard conditions for the more commonly occurring contaminants. However, each case is considered individually to achieve the degree of treatment necessary and protect the treatment and disposal system.

**Control Procedures** In order to properly control industrial discharges it is necessary to establish a set of procedures by which that control can be effected.
These will necessarily include systems for gathering information both analytical and volumetric and systems by which this information can be translated into control action or financial data for billing. It is therefore necessary to set up a sampling scheme on a scientific and statistical base and also to carry out regular inspections of all sites discharging industrial effluent. When determining the number of samples for charging purposes it is necessary to understand the relationship between the precision of the charge and the number of samples obtained. (See Fig. 1)

**FIG. 1. VARIATION OF PRECISION OF THE CHARGE WITH NUMBER OF EFFLUENT SAMPLES OBTAINED**

These control procedures are well established within NWW. It is however worth mentioning at this point a number of issues which are emerging as potential problems.

**Volatile Liquids.** In recent years the control of volatile organic liquids has been addressed. Matthews (1975) focused attention on this aspect of control and described a rational approach to the derivation of procedures for the calculation of discharge limits for various volatile materials. Toogood and Hobson (1980) published an extended list of volatile materials, together with information on volatility and aqueous concentrations in equilibrium with threshold limit values. This work has been invaluable to trade effluent control but it has also highlighted major problems some industrialists could have in meeting proposed limits.

**Colour.** The presence of colour in industrial discharges must also be considered where there is a possibility of it having an adverse effect on the receiving watercourse. It is necessary wherever possible to take steps to reduce coloured discharges.
Although the colour of an industrial discharge is not in itself considered to be a pollutant, it can constitute a nuisance. Where a number of sources of colour exist within a given catchment area then all need to be considered equally.

**Nutrients** A consequence of the North Sea Conference was the requirement to reduce nutrient inputs to coastal waters. This will involve reduction in nitrogen and phosphate levels being discharged, requiring considerable capital expenditure. A means of recovering this cost is currently being considered.

**Treatability** Increasingly, industrialists are installing on-site effluent treatment plants in order to treat their own effluent to a higher standard. This can often result in the removal of the more easily biodegradable fraction, leaving the intractable portion of the effluent for treatment at the municipal sewage treatment works. Whilst this has the effect of reducing income to the water company, costly sewage treatment plant may still need to be installed in order to meet the effluent discharge standards required. It could therefore be necessary to include a 'treatability' factor within the charging formula whereby wastes which are difficult to treat attract a premium charge.

**CONCLUSION**

It has been demonstrated that water companies and manufacturing industries can work together to improve the environment. As pressures increase to make yet further improvements, both will have to increase standards to achieve acceptable water quality. Compliance with stricter effluent discharge standards will be necessary and there will be a requirement to move into new areas of control not currently being addressed.

The experience and knowledge gained over many years by North West Water will be invaluable in ensuring that we are at the forefront in providing expertise to assist our trade effluent dischargers in the North West and to make this expertise available to the rest of the world.

**REFERENCES**
