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A tanker discharges liquid waste into a garbage-filled trench at Castlereagh.

What to do about

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liquid trade wastes?

One of the problems created by the growth of our industrial cities is finding ways of disposing of ever-greater amounts of waste. More people with their rising standard of living create more garbage, and industry produces more solid and liquid wastes.

Unpleasant and often corrosive or poisonous industrial liquids like paint solvents, insecticides, or grease-trap wastes often create a particularly difficult problem, since they cannot be accepted into city sewer systems and have to be disposed of elsewhere. A common expedient has been to dump these liquids along with solid wastes at local authority land-fill depots, but as the city population grows and becomes more dense, the number of suitable sites becomes less and less. Inevitably, sooner or later, a crisis results.

Such a crisis developed in Sydney at the end of 1969. Already most of the local council tips were nearing the ends of their lives, and the shortage of suitable new sites had become acute. Then in December of that year most of the local councils were told for health reasons to close their depots to liquid wastes. Industry had to find other ways of getting rid of them. Considerable amounts were illegally discharged into the sewer system. Some contractors even resorted to such methods as dumping in the bush at night and, worse still, in water-courses.

Doing something about this problem was made particularly difficult by the fact that nobody knew how much waste—either solid or liquid—was being produced in the Sydney area. As a first step, the State government therefore commissioned Mr A. E. Barton, a member of the British government's Committee on Toxic Waste Disposal, to report on and to recommend ways of overcoming the problem. The Barton report, which was published in May 1970, gave for the first time some idea of the size of the problem, and just how dangerous the situation was becoming.

Mr Barton recommended that a single authority be set up. It should be responsible within the Sydney region for co-ordinating the disposal of all household garbage, and all solid industrial wastes. It should also be responsible for disposing of all industrial liquid wastes that may not be discharged into the city's sewer system. The Metropolitan Waste Disposal Authority came into being a year later, in June 1971, with these aims.

Collection and transportation of the wastes still remains the job of local councils or industry—the Authority helps provide the means of getting rid of them. At present some local councils still do dispose of all the wastes within their areas, but gradually, as their depots become exhausted, the Authority will take over these functions.

Liquids surveyed

Before the newly created Metropolitan Waste Disposal Authority could set about solving the problem of how to dispose of Sydney's liquid trade wastes, it needed to find out exactly what quantities were produced, and what they were. Armed with this information it would then be able to know how much of this waste it would have to deal with, and how much would be accepted by the Metropolitan Water, Sewerage, and Drainage Board—the body that operates the city's sewer system.

Disposing of the wastes at a centrally located liquid treatment plant seemed the most likely answer, but without detailed knowledge about the wastes it would be impossible to design the right sort of plant. The Authority commissioned Crooks, Michell, Peacock, and Stewart Pty Ltd to act as consultants, and carry out a detailed survey into the problem with the aim of recommending the best method and site for disposing of the liquids.

Survey results indicated that Sydney's factories produce more than 6800 million litres of liquid waste each year. Nearly 97% of this is suitable for discharging into sewers or the storm-water system. About 95 million litres of liquid trade wastes would have to be treated at a central treatment plant—a figure that would probably rise to 140 million litres by 1980.

About 50 million of the 95 million litres to be treated at the plant contained burnable organic materials, and the consultants recommended that these should be incinerated, probably in a fluidized-bed incinerator since this type of burner can burn lower-grade fuel than the conventional fixed-chamber type. However, research would be needed before a suitable furnace could be designed, and the Authority therefore approached the North Ryde laboratory of the CSIRO Division of Mineral Chemistry for help. The Division has considerable experience with operating this type of furnace.

Burning watery wastes

Some of the liquids recommended for burning contain a considerable proportion of water, so at first sight the idea of burning them seems a little surprising. However, at the Division of Mineral Chemistry an experimental fluidized-bed burner was operating that could burn slurries consisting of water and coal-mining wastes (see *Ecos* 1), and the Division thought that this burner could probably be modified to burn the liquid trade wastes. These would have to be mixed together in the right proportions to produce a fuel with the right burning characteristics.

During mid 1973 the Division and the Authority began a combined study into how this could be done. Dr R. Carlisle and Mr S. E. Teoh, from the Metropolitan Waste Disposal Authority, joined Dr Peter Waters, Mr George Szpindler, Mr Martin Young, and Mr Peter Mullins at North Ryde—the group who had developed the fluidized-bed incinerator for coal wastes. The aims of the program were to:

- study the feasibility of burning the liquids in a fluidized-bed incinerator
- analyse the wastes to find out what they were
- work out their burning behaviour
- discover what problems would be encountered when blending the wastes into suitable mixtures for burning

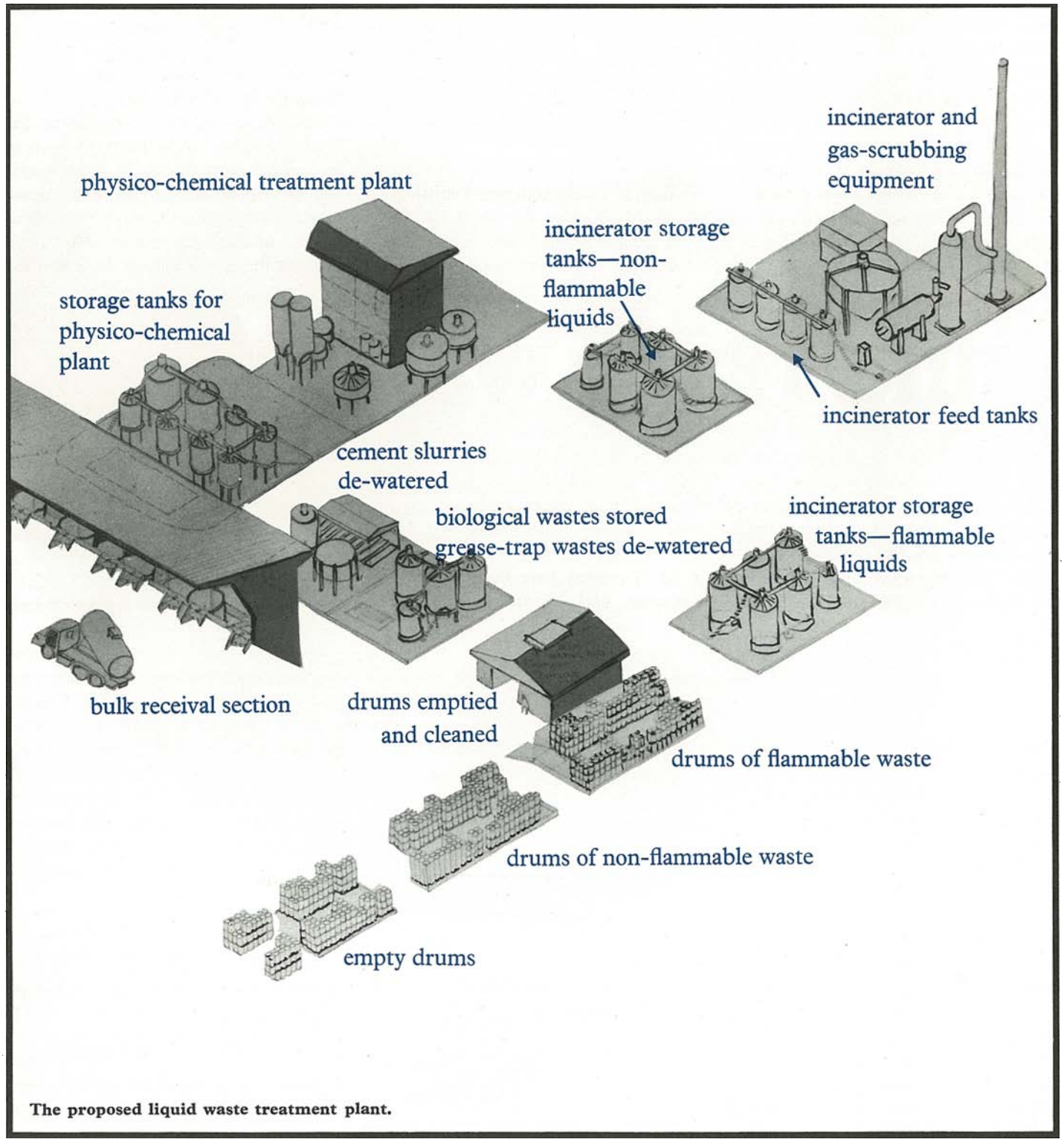
The research team was also able to advise on the likely long-term corrosion problems in a full-scale incinerator, and suggest what pollutants might be a problem and how to deal with these, even though it did not specifically study these aspects. In addition, it carried out development work on the design of the fluidized-bed incinerator to improve its performance when burning liquid wastes.

Briefly, in a fluidized-bed incinerator, a strong updraught of air agitates a layer, or bed, of solid unburnable particles so that they remain suspended. The whole bed therefore acts like a fluid. Any gritty, unburnable material such as sand can be used for the bed. The fuel is injected into the fluidized bed and burnt within it.

Fluidized-bed furnaces operate at about 900°C. If the fuel is too rich they have to be damped down. In furnaces that are burning solid materials, this damping down is done by spraying water into them. Dr Waters and his colleagues showed that it is indeed possible to control furnaces burning liquid wastes by deftly blending highly flammable wastes with the ones that contain a large proportion of water. Hence even the organic matter in the very watery wastes is burnt, and at the same time the temperature of the furnace is kept under control.

Typical samples

The research team obtained 27 different samples in 44-gallon drums from 19 producers of liquid waste in the Sydney region. These samples represented most of the types of waste that might be suitable for burning. The researchers did not, however, include chlorinated hydrocarbons, or animal and vegetable oils and



The proposed liquid waste treatment plant.

Sydney's factories produce more than 6800 million litres of liquid waste each year.

fats. The team excluded chlorinated hydrocarbons because the furnace lacked the equipment to adequately trap the gases likely to be given off, and the animal and vegetable oils and fats because these would go rancid during storage.

Test burns showed that, although it was possible to burn the liquids, some care was needed in mixing them so that the wastes didn't precipitate out or flocculate, thus clogging the feed-lines to the furnace. For example, one sample of an enamel-type paint proved especially tricky, since, when mixed with many of the other organic liquids, it produced a fibrous precipitate that matted together into a solid mass within a few seconds.

The research group also arranged for Supervise-Sheen Laboratories Pty Ltd to determine the concentrations of 20 elements in the wastes likely to cause environmental pollution and problems within an incinerator. It turned out that about six of the 27 samples contained relatively large amounts of such contaminants as sulphur, chlorine, mercury, lead, and zinc. However, the team found that judicious blending with other wastes could reduce the concentrations of these pollutants to what it considered to be insignificant levels. A full-scale waste incinerator would, of course, have to comply with the very stringent regulations laid down in the New South Wales *Clean Air Act*.

The Metropolitan Waste Disposal Authority is now calling for tenders for the construction of a central liquid waste disposal plant. The plant will comprise, to begin with, a section for chemically neutralizing liquids such as acids and alkalis and an incinerator. The incinerator will not necessarily be a fluidized-bed unit—this will depend on the tenders received. The information gained from the cooperative study with CSIRO was used in designing the specifications for the incinerator. The plant will be designed so that it can be expanded as the need arises.

Land-fill method

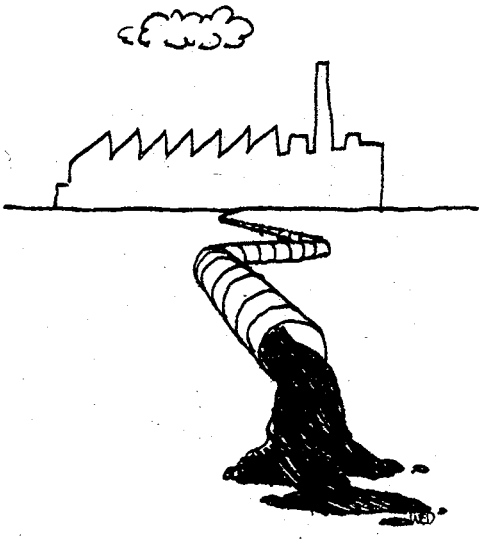
The plant will not be operating until 1977. In the meantime, the Authority has been disposing of liquid trade wastes in a land-fill operation some 50 km from Sydney, at Castlereagh near Penrith. The Authority investigated about 60 brick pits around Sydney, and even disused coal mines as far away as Lithgow and Cessnock, before deciding to use the Castlereagh site.

This consists of a borrow pit that had previously been used by the Department of Main Roads as a source of gravel. It is lined with impervious clay. The liquid wastes are now poured into specially dug trenches, which are first filled with absorbent solid waste—such as household garbage and the upholstery from used cars —so that the liquids remain and do not seep into surrounding areas. So far some 8 ha of ground have been used in the operation, and this area will increase to about 40 ha before the depot is closed down. Areas already used are covered with topsoil, and the whole 40 ha will be planted with trees.

Liquid wastes generated in Sydney

	million litres
paints, inks, solvents	157
oils	117
latex–water emulsions	1
organic wastes (food)	5040
organic wastes (chemical)	256
acids	45
alkalis	544
neutral salts and neutralized acids	327
other organic wastes	342
	6829

The liquids that will be disposed of at Sydney's central liquid waste treatment plant represent only the most toxic fraction of all the industrial wastes produced.



Some companies are now processing their wastes on site.

On average, it costs the producers of liquid trade wastes more than 3 cents per litre (15 cents per gallon) to dispose of them at Castlereagh. The Authority charges 1·5 cents per litre (7 cents per gallon) at the gate, and the rest is made up by the high cost of transport from the industrial areas of Sydney.

Bush despoiled

Unfortunately, less-scrupulous contractors do still occasionally discharge their tanker loads of waste liquids in the bush. The Barton report recommended that the Authority have the power to license all factories or other sources of liquid waste, and all disposal contractors. The Authority expects to be endowed with these powers under regulations shortly to be brought in. It will then be in a position to stamp out any illicit dumping. Maximum penalties will range from $1000 to $5000, and daily penalties for continuing breaches could be as high as $2000.

It now appears that the difficulty and high cost of disposing of liquid trade wastes over the past few years have had a marked effect on the quantities actually produced—in fact they seem to have gone down substantially. A second more recent survey by the Authority has shown that many companies have found other ways of disposing of their wastes, or are finding other uses for them. Some are now processing their wastes on site, so that they can then be legally discharged into the sewer network.

The original 1972 survey suggested that the incinerator should be designed to deal initially with some 50 million litres per year. It now seems that a unit capable of dealing with only about half this figure will be adequate in the early years.

More about the topic

Development of the Sydney Region Waste Management Plan. R. Conolly. *Technical papers for the 1974 Australian Waste Management and Control Conference*, 1974, 1–7.

The liquid waste survey in the metropolitan Sydney area. A. G. Forrester. *Technical papers for the 1974 Australian Waste Management and Control Conference*, 1974, 57–63.