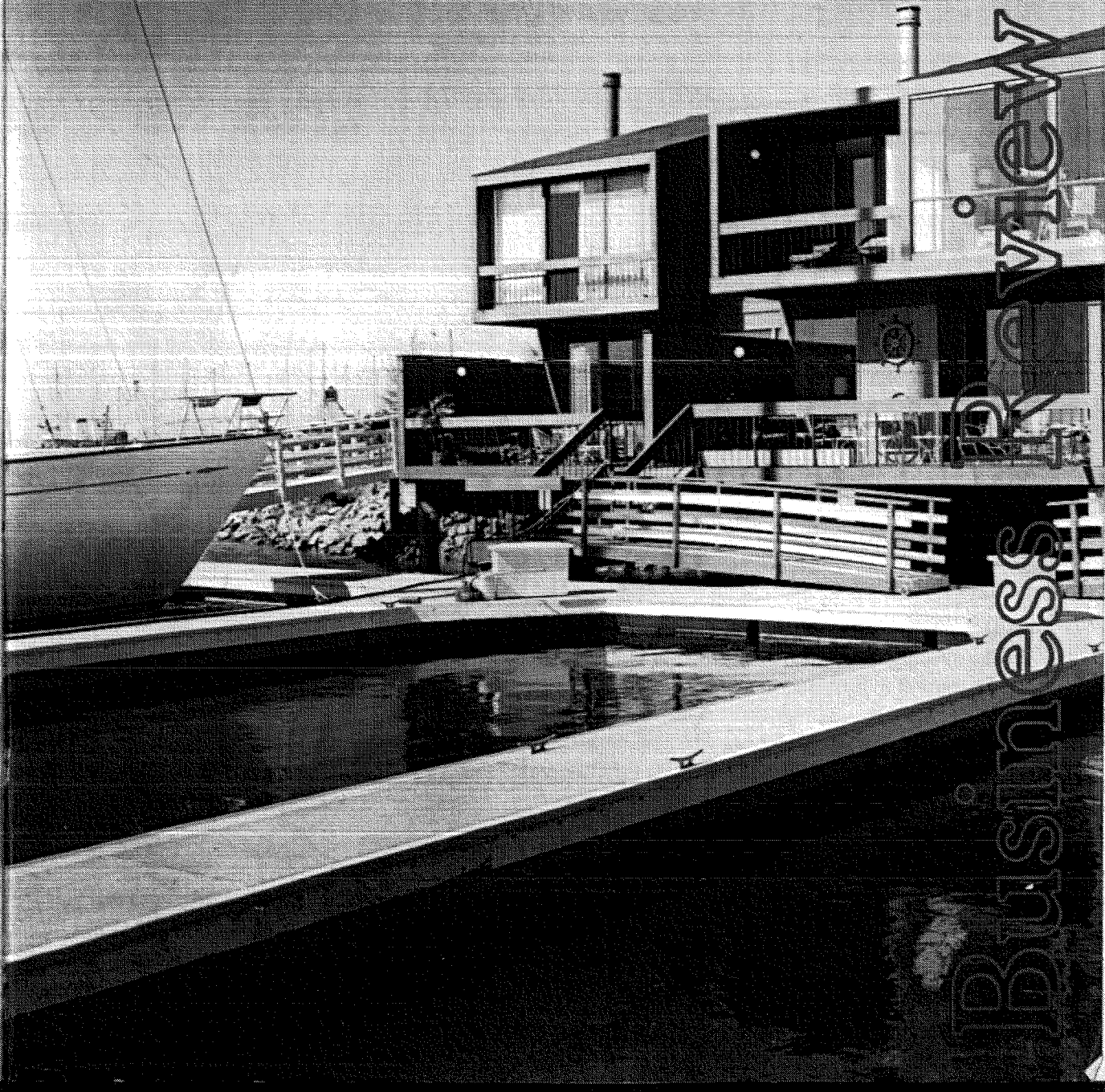


Federal Reserve Bank of San Francisco

January/February, 1973



Business

### **Housing: On the Way Down?**

After six years of sustained albeit uneven expansion, the Western housing industry appears due for a decline this year.

### **Where the Money Came From**

Major Western banks expanded their sources of funds strongly during 1972, and allocated those funds almost entirely to loans.

### **Pollution Control: Two Industries**

The copper and forest-products industries face heavy costs in cleaning up the air and water pollution they cause.

**Business Review** is edited by William Burke, with the assistance of Karen Rusk (editorial) and Janis Wilson (graphics). Copies of this and other Federal Reserve publications are available from the Administrative Services Department, Federal Reserve Bank of San Francisco, P.O. Box 7702, San Francisco, California 94120.

# Pollution Control: Two Industries

Some perspective on the continuing controversy over the cost of cleaning up the nation's air and water can be obtained from a perusal of a 1972 report prepared jointly by the Council on Environmental Quality, the Environmental Protection Agency, and the U.S. Department of Commerce. According to this study, installation of pollution-control equipment would not impose "severe costs" on major national and regional industries, meaning that it would not seriously threaten the long-run economic viability of the industrial activities examined. The study did find, however, that damage could result to individual plants or communities affected by specific environmental measures.

Matched against this latter factor, of course, would be the investment's dividends in improving the quality of life. These returns will take the form of decreased medical bills, increased recreational opportunities, diminished damage to buildings and materials and, most important, the maintenance of the ecological balance necessary for human survival.

The report concluded that perhaps two percent of the 12,000 plants in the surveyed industries

would be forced to close by 1976 because of pollution-control requirements, but most of the affected plants are old and marginal, and would soon have been phased out anyway. Roughly the same percentage of the workforce in affected industries would be laid off, amounting to 50,000 to 125,000 jobs overall. (Some new environment-related jobs would help offset these losses, although not necessarily in the same communities.) Plant closings are likely to occur in 50 to 100 small communities dominated by affected industries, and in each of these cases, the impact would be substantial.

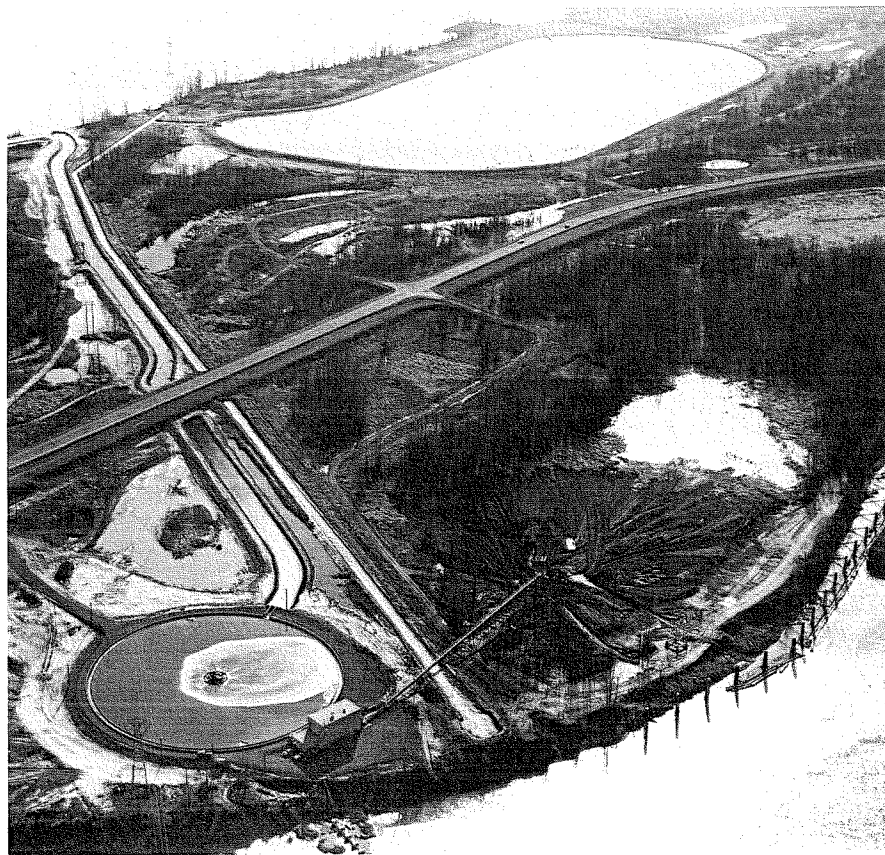
The report suggested that the inflation in consumer and capital goods resulting from environmental measures could reduce the growth of real GNP during the 1972-80 period by 0.1 percentage points annually, or from an average annual rate of 4.8 percent to 4.7 percent. Concurrently, the unemployment rate would rise by a comparable small amount. The economic effects would be greatest during the present half-decade, as investment is accelerated to meet the requirements of the new antipollution standards, and somewhat less during the 1977-80 period after the bulk of the investment has been made.

At the same time, higher prices in this country could increase the attractiveness of foreign imports and make U.S. goods less competitive in foreign markets, adversely affecting our net trade balance by close to \$1 billion a year. The recent devaluation of the dollar would offset this factor to some extent, although not completely.

On the other hand, other industrial nations may themselves be forced to adopt expensive anti-pollution measures so that prices for their goods may rise. Technological advances meanwhile might lower cleanup costs considerably in this country, through increased attention to recycling wastes, recovering valuable materials, and changing manufacturing processes.

### **Cost of clean copper**

The Federal report provides estimates of the probable cost of antipollution equipment for several major industries which are centered in the West. According to these estimates, the nation's copper industry will have to spend somewhere between \$300 million and \$690 million for antipollution equipment through 1976, depending upon the emission standards finally promulgated. (One major firm expects to pay as



**A forest-products mill in Washington has spent close to \$20 million on installations such as this to improve water quality control.**

much for pollution abatement in the current half-decade as it did during the entire last quarter-century.) These expenditures could raise copper prices from as little as zero to 8 percent, depending upon the extent of foreign competition and the ability of producers to pass on the increase in production costs.

Despite the possibility of higher prices, two smelters were identified as being possible candidates for closing because of inability to pay for required pollution controls, and employment growth in the industry generally was expected to slow down.

Copper producers face a major problem in reducing the amount of sulphur dioxide and other pollutants emitted by smelters treating sulphide ores and concentrates. In accordance with the Clean Air Act of 1970, the Environmental Protection Agency in 1971 established national ambient air quality (general atmospheric) standards for six of the most widespread air pollutants, including sulphur dioxide, the main pollutant from copper smelters. The primary standard, designed to protect public health, limits the maximum concentration of sulphur dioxide in the air to an annual average of 80 micrograms per cubic meter per day. The secondary standard, designed to protect not only against public-health hazards but also against dangers to property and vegetation, calls for a maximum concentration of 60 micrograms per cubic meter.

#### **What standards?**

Some states brought their regulations into line with the Federal standards, but certain major copper producing areas—namely, Arizona, Montana, Nevada and the Puget Sound area of Washington—went even further. In those areas, local regulations were established

calling for the copper companies to remove from the smelter smoke 90 percent of the sulphur content of the material charged into each smelter. Because these local plans apparently were more stringent than the toughest Federal regulations, the health authorities in most of these states later agreed to back away from the 90-percent requirement. Last May, for example, the Arizona State Board of Health agreed to replace the 90-percent emission control standard with a standard closer to the Federal requirement but without the Federal insistence on the use of positive controls, including actual sulphur-dioxide removal devices. The Environmental Protection Agency rejected these state plans, however, because they permitted the companies to monitor themselves through the use of the so-called "closed loop" system without legally established procedures for enforcement. In new regulations issued last spring, the EPA called for the copper companies to reduce sulphur-dioxide emissions by as much as 97 percent.

In Arizona, the proposed regulations would call for the removal of 90 to 97 percent of the sulphur-dioxide emissions at five

smelters, and for 70 and 81-percent removal from the state's other two smelters. The companies would be required to remove sulphur dioxide from converters and roasters by mid-1975, a procedure that would shut off an average of 70 percent of emissions. Producers would then have a two-year extension period in which to install the more sophisticated systems required to control the weaker sulphur-dioxide gas streams produced by the reverberatory furnace, technology which must still be developed.

The copper companies have challenged these requirements in the courts in an effort to prevent them from becoming final and thereby replacing the state plans. Last August, five companies sought to overturn the EPA decision that rejected Arizona's antipollution plan, on the basis that the state standards are more than adequate to meet Federal standards well ahead of the time proposed by EPA. The Arizona regulations call for compliance by the end of 1973, while the EPA regulations have to be met by mid-1975.

The firms argued, moreover, that the EPA action was not supported by existing technical data. The

state agency based its emission reduction requirements on annual-average air quality readings, while EPA based its reduction requirements on daily average readings. Industry and state officials questioned the validity of basing what could be a very expensive control program on what may be rare occurrences. The suit was dismissed, apparently on procedural grounds, but the companies are seeking another hearing, leaving the Arizona situation confusing at best.

The final outcome of this question will be of prime importance to Arizona, which produces about 40 percent of the nation's copper and contains 7 of the country's 15 smelters within its borders. Arizona's smelters are responsible for putting a million tons of sulphur dioxide into the air every year—but they also are responsible for a major part of the state's payrolls. The standards finally adopted not only will affect the future life of the smelters, but also will influence decisions regarding the opening of new mines, particularly those containing ores which cannot be processed by chemical methods.

### **Tax on sulphur dioxide?**

A proposed Federal tax on sulphur-dioxide emissions, originally considered quite restrictive by copper producers, could be less worrisome to them if it is passed in accordance with the President's proposal of February 1972. According to that proposal, the tax would not be applicable in areas of the country where the ambient air is cleaner than existing Federal standards require. Western copper smelters altogether are responsible for 4 million tons a year of sulphur-dioxide pollution, as compared with 25 million tons from 800 power plants throughout the country. Yet overall air contamination in these uncrowded states is still far below the maximum pollution levels set by Federal standards.

The air in the Southwest is estimated to have about .002 parts per million as the maximum level, well below the maximum level permissible under the strictest Federal standards. Thus, under the Administration's tax proposal, the air in Arizona could get considerably dirtier before the copper companies would be hit by the Federal tax.

Despite the confusion over state and Federal standards, the copper

companies are moving forward with their programs to remove pollutants. Most companies are installing sulphuric-acid plants to capture as much of the sulphur dioxide as possible, since that is the only proven technology for removing sulphur oxides from smelter gases. However, acid production in the conventional copper smelter is practical only with a converter-gas process, which at best removes only 50 to 70 percent of the oxides.

To achieve as much as 90-percent removal of sulphur dioxide, innovative technology for handling the normally dilute gases generated in the typical reverberatory furnace will have to be devised. One process due to be tested at an El Paso (Texas) pilot plant will produce elemental sulphur from gas containing 14 percent or more sulphur dioxide; this approach will provide a product which, unlike sulphuric acid, can be easily stored, shipped and sold. Another possible process involves a limestone-scrubbing system to absorb sulphur oxides from the weak gases given off by the furnace and acid plant. As a last resort, the reverberatory furnace may have to be replaced by flash smelters or electric furnaces to provide stronger gases for conversion to sulphuric acid.

### **Case studies (copper)**

A good example of the kind of measures now being taken to meet changing environmental standards is provided by the smelter at Ray, Arizona, which is relatively new by the standards of the industry (1957). Original air-pollution control equipment included waste-heat boilers and converter hoods on the reverberatory furnace, large balloon flues for gravity settlement of dust from smelter gases, and a large electrostatic precipitator to clean gases before discharge. Then, in 1969, the producer completed a concentrate-roasting system and a sulphuric-acid plant that recovers about 55 percent of the sulphur in the smelter feed.

When Arizona established a 90-percent sulphur-emission standard, new antipollution measures were adopted for the Ray smelter. Waste-heat boilers were installed behind each converter. Presently, water-cooled hoods and tightly sealed ducts and flues are being installed to conduct converter gases to the acid plant, which is being expanded from 750 to 900 tons per day. And as technology develops, the plant will install a limestone-scrubbing process to eliminate acid-plant flue gases.

Different firms have recorded varied reactions to the Federal and state emission standards. One firm, in the midst of an expansion program at its San Manuel (Arizona) plant, decided to scale down its expansion plans, install pollution-control equipment at those facilities, and shut down a smaller smelter at Superior (Arizona) rather than modernize the latter's facilities. This firm will treat converter gases from its San Manuel smelter at a \$30-million sulphuric-acid plant capable of producing 500,000 tons of acid a year, and will also install a monitoring system. If these measures still do not meet ambient standards, the company will apply limestone-scrubbing to reverberatory furnace gases.

The sulphuric acid produced at San Manuel will be sold to another company for a new \$59-million plant at Twin Buttes (Arizona), which will use the acid to extract copper from ore through electrolysis. This transaction not only will provide an outlet for acid produced in pollution-control operations, but will permit the utilization of 20 million tons of surface oxide ore hitherto left stored at the mine site.

One firm at Miami (Arizona) is rebuilding its entire smelter, installing a 500 ton/day electric furnace and five new converters, and constructing a new acid plant. Still another firm, faced with the cost of installing new equipment at its Tacoma (Washington) smelter, has considered closing that plant and building a new smelter on the Gulf Coast, which not only lies between the Arizona mines and the Eastern markets but also provides a better market for sulphuric acid. To date, however, the decisions to limit expansion at San Manuel and to shut down Superior represent the only identifiable loss of smelter capacity traceable to the enactment of emission controls.

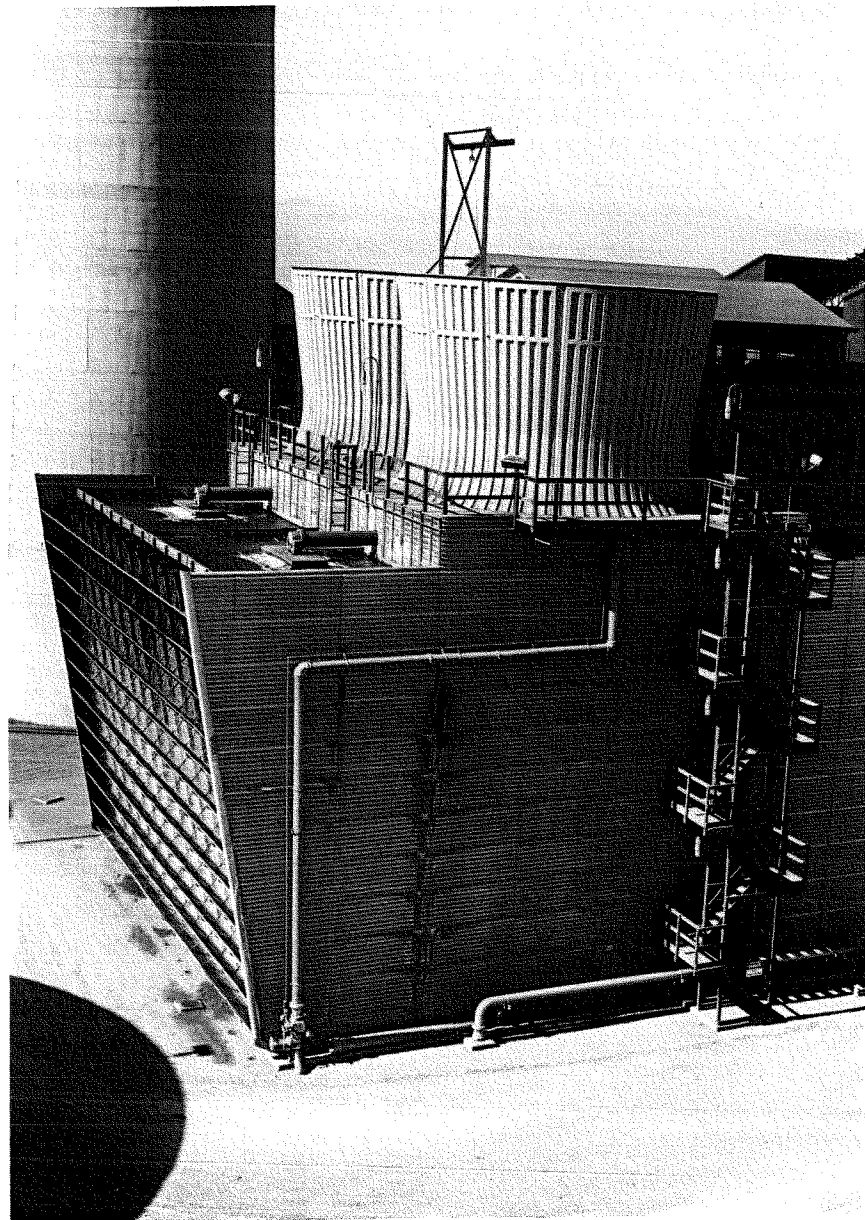
### **Cost of clean forests**

The Pacific Northwest's forest-products industry is faced with massive expenses to bring its operations into compliance with existing air- and water-pollution regulations. In the nation as a whole, according to the 1972 Federal report, pulp and paper mills alone will need capital expenditures of \$3.3 billion in 1972-76, with annual costs per ton of product ranging from perhaps \$5.50 to \$12.50. Price increases of anywhere between 3.5 and 10.0 percent are expected to result from these

increased expenditures. However, perhaps one-fifth of the 329 mills considered marginal to the industry still would be forced to close, eliminating 16,000 jobs by 1976 and in some cases causing "significant community impact" in rural areas.

The Northwest's forest-products industry over the years has made some progress in pollution control by creating more and more products from its own waste materials. Today, about 70 percent of the input into pulp and paper mills consists of residues salvaged after the production of lumber and plywood. The sawdust, shavings and trimmings generated by sawmills—most of which otherwise would be burned or emptied into waterways—are instead recycled to produce paper, particle-board, hardboard, roofing materials, soil conditioners, chemicals, and a wide range of other products.

Most firms are making greater use of "thinnings" or scrub trees that formerly would have been neglected because of the poor-quality timber they produce. For example, a Klamath Falls (Oregon) mill has recently installed a new log merchandiser, designed to process logs which heretofore would



**A copper company in Arizona recently has installed this acid-plant cooling tower.**



have been burned or left in the woods because of excessive defects.

Yet progress has been much slower in the use of wood bark, 14 to 16 million tons of which are produced every year by the nation's lumber, plywood and paper mills. About one-third is used as fuel for generating steam, perhaps another one-tenth is used as mulch or soil conditioner, but most bark simply represents a solid-waste disposal problem, especially for small non-integrated producers. To handle this waste material, more and more sawmills are installing smokeless incinerators and burners, in accordance with state standards requiring burners to become smokeless within three minutes of startup.

**Pulp: solids, chemicals, smells**

Pulping processes involve major pollution problems, whether for the kraft process (used in producing packing cartons and grocery sacks) or for the sulphite process (used in producing printing papers, tissues, or other specialty products). Both processes borrow enormous quantities of water from streams or ground waters, and in spite of multiple reuse, create vast amounts of contaminated ef-

## Pollution Control Bonds

Much of the heavy cost of installing pollution-control equipment is being met through tax-exempt industrial-development revenue bonds, which are sold through public agencies rather than directly by the firms buying the equipment. Firms utilizing this procedure can finance their equipment at lower costs than they would incur if they relied upon bank borrowing or other such conventional-financing sources. Moreover, companies can tap new sources of financing, such as some banks and insurance companies, that ordinarily would not invest in most corporate securities but are traditionally heavy purchasers of tax exempts. Altogether, sales of pollution-control bonds amounted to only \$65 million in 1971, but the total reached \$500 million in 1972 and is expected to rise steeply in coming years.

This development promises a resurgence of industrial revenue-bond financing, which burgeoned during the late 1960's but was then stymied when Congress placed a limit on the amount of tax-exempt bonds that could be sold for such purposes. The limit on manufacturing-plant issues

is \$1 million (\$5 million in certain cases), but pollution-control bonds are specifically excluded from this ceiling.

A local or state authority, created by the state legislature, issues pollution-control bonds on behalf of a specific company. The proceeds pay for pollution-control equipment and facilities, which the company leases by paying a yearly rental fee until the bonds mature, at which time the company can buy the equipment at a depreciated price. The interest yielded on these bonds is exempt from income taxes, and the interest savings for the companies can amount to one or two percentage points less than regular commercial financing.

In some cases, companies don't have to pay any sales tax on the pollution-control equipment bought with bond proceeds. Firms can also get 100-percent financing from these bonds, and do not have to put up any equity of their own, as they might under other financing arrangements. Also, they can obtain long-term (10-25 years) financing with these bonds, as contrasted with shorter-term commercial-bank financing.

fluents. One problem involves the neutralization of dissolved chemicals found in mill discharges, and a second involves the elimination of suspended and settleable wastes such as fibers, sand, bark, and dirt. The former is quite difficult, but the latter is a relatively simple (albeit costly) matter.

In handling solid wastes, paper-machine discharges first go to a "save-all"—a screening device which not only helps to cleanse the discharge stream but also recovers reusable wood fibers for return to the manufacturing process. The discharge then goes through a "clarifier" where it is retained until the remaining solids have settled to the bottom as sludge, after which the sludge is further thickened and used for landfill or incinerated.

Chemical discharges create difficulties by providing nutrients for bacteria, which with their excessive biological activity rapidly deplete river water's dissolved oxygen content and thereby destroy normal fish life. To overcome this problem, the effluent is subjected to a secondary treatment process and then released into ponds where motor-driven aerators build up its oxygen content. This action speeds up the rate at which

bacteria consume the dissolved solids in the effluent, so that it can then be released with minimum demands on the oxygen in the receiving stream.

As for air pollution, problems develop with both the sulphite and kraft processes, principally the latter. Sulphite plants give off sulphur dioxide, but this chemical can successfully be reintroduced into sulphite-pulp manufacture. Used for this purpose are such devices as condensers, venturi scrubbers, and "packed towers," which clean the gases released from the plant.

In the more complicated cleanup procedures involved in the kraft process, chemicals are routinely retrieved from spent cooking liquors, evaporated to a proper consistency, and then burned in recovery furnaces. This procedure reduces the amount of waste material released into the waterways yet creates serious atmospheric difficulties. Emissions of dust and kraft-mill chemicals can be minimized through the use of electrostatic precipitators installed in plant stacks to collect chemical dust in the flue gas; indeed, the newest such installations are rated 99-percent efficient. But these precipitators cannot remove the various sulphur

compounds which are given off by the kraft process, and which provide extremely unpleasant odors in very low concentrations.

The most common attack on this problem involves an oxidation process. The black liquor left over from the pulp-cooking process is first mixed with air, and the sulphurous compounds are then stabilized, greatly reducing the odor before the various gases are vented into the atmosphere from the recovery furnace. The furnace meanwhile burns the organic material in the black liquor and returns the recoverable chemicals to the pulping system.

#### **Case studies (forest products)**

Pulp and paper mills in the West already have made substantial progress in controlling air and water pollution. In fact, the Council on Economic Priorities, a sharp critic of the paper industry's previous pollution-control record, reported in its latest survey that the industry will have achieved adequate pollution control at most of its mills by 1975. The industry's water-pollution control effort started much earlier than air-pollution control, since the states were required to submit water-pollution control programs to the Federal Water Quality Administration in 1967.

Virtually every paper and pulp company in the Northwest is presently engaged in environmental programs to meet air- and water-quality standards. For example, a \$31-million project is well underway at a Camas (Washington) plant, primarily through the replacement of an old sulphite pulp mill with a recently completed "magnetite" pulping facility. This new facility is capable of recovering used chemicals in high-energy furnaces so as to reduce the oxygen-depleting qualities of the mill's discharge by at least 70 percent. Secondary-treatment facilities and completion of a water-use reduction program are scheduled for 1973.

A \$15-million project at a Port Townsend (Washington) mill, involving new facilities for both air- and water-pollution control, has brought the mill into conformity with antipollution standards well ahead of the deadline. Dust and odor emissions have been brought under control, through the installation of a recovery furnace with sophisticated controls, a high-efficiency electrostatic precipitator to remove dust from furnace gases, and a boiler for burning gases from the digestors. Also, water

purification has been improved through facilities to remove bark from woodmill effluents and fiber from pulpmill effluents.

A program underway at a Lewiston (Idaho) kraft mill should eliminate local pollution problems by 1975. Secondary treatment facilities will be installed at the plant, at a cost of \$11-million, by the end of 1974. An air-pollution control program begun in the mid-60's will be completed with the addition of a \$10-million low-odor recovery furnace and scrubbers.

The nation's forest-products industry on the whole still faces a mammoth cleanup task, in view of the \$3.3-billion bill for pollution control estimated in the recent Federal report. Only the electric-power industry (and perhaps steel) can expect a higher cleanup bill. As noted above, some mills undoubtedly will close rather than install costly antipollution equipment; a sulphite-pulp mill at Everett (Washington) may shut down because of this factor. But over the long run, the new facilities in this and other regional industries can be counted on to produce in both a more efficient and much cleaner atmosphere.

**Yvonne Levy**