

POLLUTION PREVENTION PAYS (3P). 3M'S RESPONSE TO INDUSTRIAL WASTE CONTROL

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INTRODUCTION

3M has a corporate policy to keep its facilities in conformance with all environmental requirements, to solve its own pollution problems and to develop products that have a minimum adverse effect on the environment. However, the environmental legislation and regulations of the early 1970s, which specified increasingly sophisticated treatment technologies as control measures, stimulated a desire at 3M to look for a better way. That "better way" at 3M took the form of the "Pollution Prevention Pays" or 3P Program. Rather than apply end-of-pipe add-on control technology which is very expensive, resource and energy consumptive, and residue generating, emphasis has been placed upon prevention of generation of pollution at the source through: product reformulation, process modification, equipment redesign, waste recycle or reuse.

In the nine years since the 3P Program was formalized, over 1,000 programs have been developed preventing the annual generation of 90,000 tons of air pollutants, 950 million gallons of wastewater, 10,000 tons of water pollutants and 138,000 tons of sludge and solid waste. In addition, energy savings equivalent to 254,000 barrels of fuel oil are achieved annually.

During the last two decades, the U.S. has passed a number of strong environmental regulations in response to the demand of the public to protect the environment. Unfortunately, much of this legislation emphasized the specifics of pollution control technology. Not only was a reduction in emission specified but also the acceptable method to accomplish this.

Futhermore, this legislation did not consider the environment as a whole. For instance, water pollution control laws and regulations were enacted without considering the impact on air pollution, and vice versa, or the impact of air and water pollution controls on solid waste disposal was not appreciated.

To meet the requirements of these regulations, the immediate response by U.S. industry was to clean up pollution that already has been created. This generally was accomplished by providing a costly pollution removal facility at the end of a production line.

Natural resources, energy, manpower, and money were consumed to operate the pollution control device throughout its life span. At its very best, in line with the Law of Conservation which states pollutants cannot be destroyed, only changed in form, this approach can only contain the pollution temporarily and not ultimately eliminate the problem.

Furthermore, these types of controls work only with pollution created during the manufacturing process in the factories and which can be called "First Generation" pollution. They do not and cannot cope with "Second Generation" or "Third Generation" pollution.

"Second Generation" pollution is product-use pollution, which is the environmental impact of products after they leave the factory. The user's pollution problem cannot be solved by controls in the producer's factory.

"Third Generation" pollution is that which is created when a product, or the residue from a product, is disposed of in a landfill or by other means.

Therefore, conventional methods of pollution control only deal with the symptoms of "First Generation" pollution; they are ineffective against "Second Generation" and "Third Generation" pollution.

POLLUTION PREVENTION PAYS PROGRAM

In late 1974, 3M established a special program to encourage its scientists, engineers, and other concerned employees to develop low or nonpollution technologies to resolve its environmental problems.

We call this "Pollution Prevention Pays" or the "3P" Program, for short. This effort has been in effect since 1975 and centers around four areas of activities which are: product reformulation, process modification, equipment redesign, and recovery of waste materials for reuse. By eliminating pollution at the source, end-of-pipe treatment is unnecessary and valuable materials can be recovered. Thus, pollution prevention can pay for itself.

The 3P Program was established to achieve an improved environment; reduced capital and operating costs for pollution control facilities; reduced material and energy costs; increased sales of products with reduced pollution potential; and spin-off technologies, perhaps leading to commercial development of new products.

This effort deals with all three generations of pollution: "First," development and production; "Second," product use; and "Third," product disposal.

From 1975 through 1983, the program has generated a total savings of \$191 million. This includes \$155 million from U.S. operations and \$36 million from 20 international operations. The program has produced more than 1,000 projects since its initiation. The program also has produced significant reductions in the amount of pollution generated by 3M manufacturing facilities worldwide. Pollution prevented is shown in Table I.

Table I. Annual Pollution Prevented by 3P Program

Type of Pollutants	U.S.	International
Air pollutants, tons	83,000	8,000
Water pollutants, tons	10,000	400
Wastewater, million gallons	550	400
Sludge/Solid Waste, tons	135,000	3,000

EXAMPLES OF 3P PROJECTS

Product Formulation

A change in the formulation of pressure-sensitive tape eliminated solvents which were replaced with solventless raw materials. In one factory, 1,100 tons of solvent emissions were reduced with associated savings of \$1.5 million per year.

Process Modification

An inert condensation type solvent recovery system was installed on a tape making line. This installation recovers about 2.5 million pounds of solvent previously emitted to the atmosphere and saves \$750,000 per year in solvent, production, and energy costs.

Equipment Redesign

A plant boiler was modified to burn hydrocarbon-laden exhaust from a maker, which eliminated add-on pollution control that would have cost \$1 million. Energy recovered will reduce fuel costs by \$270,000 per year.

Recycling and Reuse

Ammonium sulfate, produced in reactors during the formulation of iron oxide, was previously discharged through a wastewater treatment plant into a river. It is now concentrated in a vapor compression evaporator and sold as a liquid fertilizer, producing revenues of \$271,000 a year. The need for pollution control equipment was eliminated, thus saving \$1 million in equipment costs.

OPERATIONAL EXPERIENCE

As in the past, future successes to this program are linked to two factors: (1) the active and aggressive support of our board chairman, Mr. Lewis W. Lehr, and other top-level managers; and (2) a constant effort to encourage low and nonpollution technology among our scientists, engineers, and technicians.

The 3P Program has full support of 3M's top management. This is reflected in 3M's corporate environmental policy statement. The policy states that 3M will prevent pollution at its source wherever and whenever possible, and that 3M will conserve natural resources through the use of conservation and other appropriate methods. Top management involvement and support is essential both to set priorities for all levels of management and to encourage widespread participation in the program. This is especially important when risks must be taken to get a project implemented.

It is the responsibility of 3M's Environmental Engineering and Pollution Control (EE & PC) staff to coordinate the program throughout the company. This is done through contact with 3M's technical staff to familiarize them with regulations, costs, and problems affecting pollution control.

As is often the case, how to dispose of waste is the last concern during process development. However, it is at the early stages that solutions may be easiest to find, though not intuitively obvious. Building awareness of current waste disposal costs is especially important for processes developed years ago when these costs were lower, particularly for hazardous wastes.

A project must meet several criteria to be considered as a 3P project. It must eliminate or reduce existing or potential pollution. It must have a monetary saving to 3M, although there is no minimum dollar savings requirement. Also, a 3P project must involve a degree of technical accomplishment and personal involvement on the part of the person submitting it for approval.

To receive recognition as a 3P project, an employee submits a one-page form to the 3P Coordinating Committee. This form contains information on the process and any modifications, pollutants eliminated, money saved, technical accomplishment, and stage of implementation. The Committee consists of representatives of 3M's manufacturing, laboratory, engineering, and EE & PC staff. It considers the merits of each project and then decides whether to accept a project for recognition. Accepted projects are reviewed with division management to confirm that recognition is deserved.

The staff who submit accepted 3P projects receive a certificate signed by Mr. Lewis Lehr, Chairman and Chief Executive Officer of 3M, Dr. Robert Bringer, Executive Director of EE & PC, and the appropriate division vice president or general manager with congratulations to the employee for his or her contribution to the 3P Program. Often the certificate is presented at a special lunch or dinner by top division management. 3P recognition goes beyond this symbolic gesture because persons submitting projects are recognized as being among the most innovative in the company. 3P recognition can also be a factor in career advancement opportunities for individuals.

We also have had a few problems implementing the program, but these have been minor. Internal problems relate to assurance of superior quality of products reformulated to remove a pollutant, expenditure of capital, and a reluctance to change. External problems have included government and customer approval of reformulated products and attitudes of regulatory and legislative bodies.

Because 3M is a new products-oriented company, products and processes are always being invented or modified. As a result, it has been comparatively easy to incorporate the pollution prevention concept into the technical activity of the company.

It should be recognized that in some industries, however, the processes cannot be changed, or at least not easily, without disrupting production. Changeover may be too costly, or there may be no low and nonpollution technology to eliminate the pollution sources. Therefore, safe and economical disposal alternatives will continue to be needed even with greater use of source control programs by U.S. industry.

It was originally thought that 3P results would decrease after several years because most of the potential for results would have been achieved. However, it was found that new technologies or replacement technologies are providing a continuous flow of opportunities. Additional gains are expected to occur in the years ahead.