

## Reducing Toxins: Where to Look and How to Do It

*Data on 2,158 manufacturing plants in the chemicals and allied products industry show two important findings: first, that some manufacturers excel at minimizing toxic waste from industrial activity. Other manufacturers (who make the same products) literally need to “know how” these successes are achieved.*

*Second, the study also finds that — with respect to certain products, many manufacturers appear to have reached a “ceiling” in their ability to reduce toxic waste. For these classes of products, R&D is needed for technological breakthroughs to achieve further reductions.*

*The research — conducted at the U.S. Census Bureau’s Center for Economic Studies and sponsored by the U.S. Department of Energy — uses 1987 data from the Census Bureau’s Longitudinal Research Database, 1988 data from the Bureau’s Pollution Abatement Cost and Expenditures Survey, and data from the Environmental Protection Agency’s 1987 Toxics Release Inventory.*



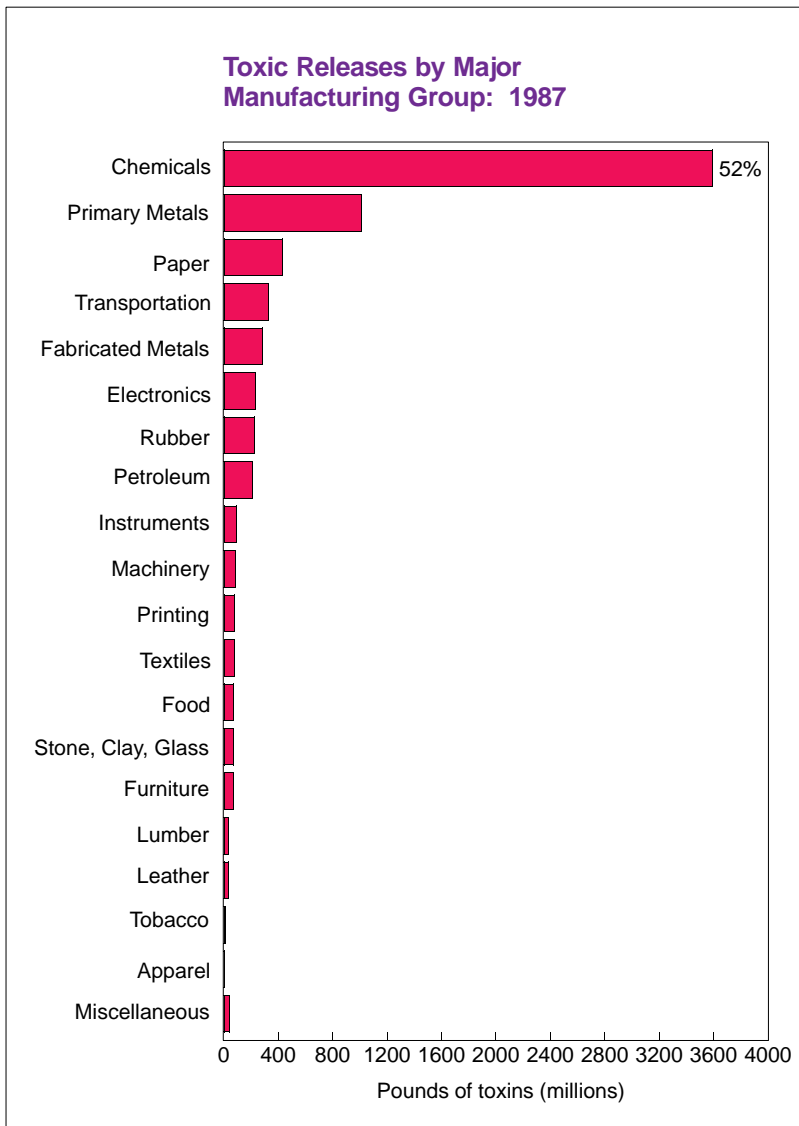
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### Chemical Industry Has High Toxic Releases

In 1987, the chemical and allied products industry accounted for 52 percent of toxic releases by all manufacturers. Technology trans-

fers or R&D breakthroughs for this sector would be particularly fruitful for environmental protection. For such transfers and breakthroughs to occur, however, the use of uniform, industry-wide regulation (otherwise



known as “Command and Control”) needs reconsideration. For, even in the highly “toxic” chemical and allied products industry, *certain plants distinguish themselves by their ability to keep their toxic releases below the industry average* for those manufacturing the same product line.

### Traditional Approach to Reducing Wastes: “Command and Control”

As noted by the President’s Council on Environmental Quality, “[E]arly federal policies to protect the environment generally relied on a command-and-control approach that typically specified an environmental goal, a method to achieve that goal, a deadline, and penalties for failure to comply.” Smokestacks, baghouses, filters, and the like have been the grist of “command-and-control” from 1964 onward.

While this approach has reduced environmental pollutants, it does not take account of the differences in characteristics among manufacturing plants. Therefore, uniform regulations impact individual manufacturers unevenly — creating at least two practical drawbacks:

- Pollution reductions are not achieved in the least costly way.
- Opportunities for even greater reductions are lost in an emphasis on prescribed technology (by which pollutants must be reduced), rather than in focusing on flexible combinations of know-how and technology that have worked successfully for some manufacturers with cost-saving implications for others manufacturing the same products.

### Performance is Measured in Pounds Per \$1000 of Shipments

In this study, environmental performance is measured by toxic intensity, that is, pounds of toxic waste released (into the environment or captured and transferred to

another site) per \$1,000 of shipments at a manufacturing plant.

Each manufacturing plant is classified by its primary product line. In the chemical and allied products industry, examples of product lines include (but are not limited to) softwood distillation products, household detergents, nitric acid, natural base glues, paints, perfumes, polyester, synthetic medicinal chemicals, and pharmaceutical preparations acting on the skin.

- “Successful” plants are defined as those releasing fewer pounds of toxins per \$1000 of shipments than the average of other plants manufacturing the same product line.

### Certain Plants Are Doing Something Right

The data show that — in the chemical and allied products industry — there are “intra-firm spillover effects,” suggesting that manufacturing plants belonging to the same firm learn by sharing experience.

- Specifically, 8.3 percent of the manufacturing plants — owned by 1.5 percent of the firms — had significantly lower intensities of toxic releases in relationship to all other plants studied.

This finding was obtained after important factors were held equal — such as the product being manufactured, and expenditures for machinery, labor and energy. In this way, plants could clearly be compared with one another on one issue: intensity of toxic releases.

There are at least three potential explanations for the achievement of the “successful” plants. Namely, there may be differences in:

- The production technology and processes used by these manufacturers relative to others whose plants are producing the same primary product but pro-

ducing higher intensities of toxins.

- Management ability and actions.
- H The secondary products manufactured at these plants.

One conclusion that might be drawn from this is that technology transfer and transfer of managerial know-how would enable the less successful manufacturers (making the same products) to similarly reduce toxic waste.

### “The Class Ceiling” Calls for a Breakthrough

By contrast, plants manufacturing certain other classes of products — for example, explosives, synthetic resins, and herbicides — are generating approximately the same intensities of toxic wastes. In these cases, a technological breakthrough is needed to elevate production technologies to a higher level of environmental efficiency.

### When to Transfer and When to Innovate

The appropriateness of either transferring existing technology and know-how or of developing new technology through R&D is contingent upon — respectively:

- H *Wide variability* in the toxic release rate among plants making the same primary product lines.

Examples of product lines in which some manufacturers are producing low intensities, and others are producing high intensities, of toxic wastes are synthetic nitric acid and ammonia, synthetic rubber, and special finishes.

- *Narrow variability* (i.e., the reaching of a “ceiling”) within product lines.

Examples of product lines in which all manufacturers are producing about the same intensities of toxic wastes are synthetic resins, thermoplastic resins, and herbicidal preparations.

**When No Action Is the Economical Choice**

However, variability is not the only factor to be considered in deciding which policy action would be appropriate — or whether to take action at all. Other important factors are:

- Level (high or low) of toxic intensity.
- Total quantity of toxic waste released.

- Number of plants manufacturing the product line.

For example, if the manufacture of a product line is limited to a few plants and generates small quantities and low intensities of toxic releases, then the variability among manufacturers makes essentially no difference for purposes either of technology transfer or innovation through R&D.

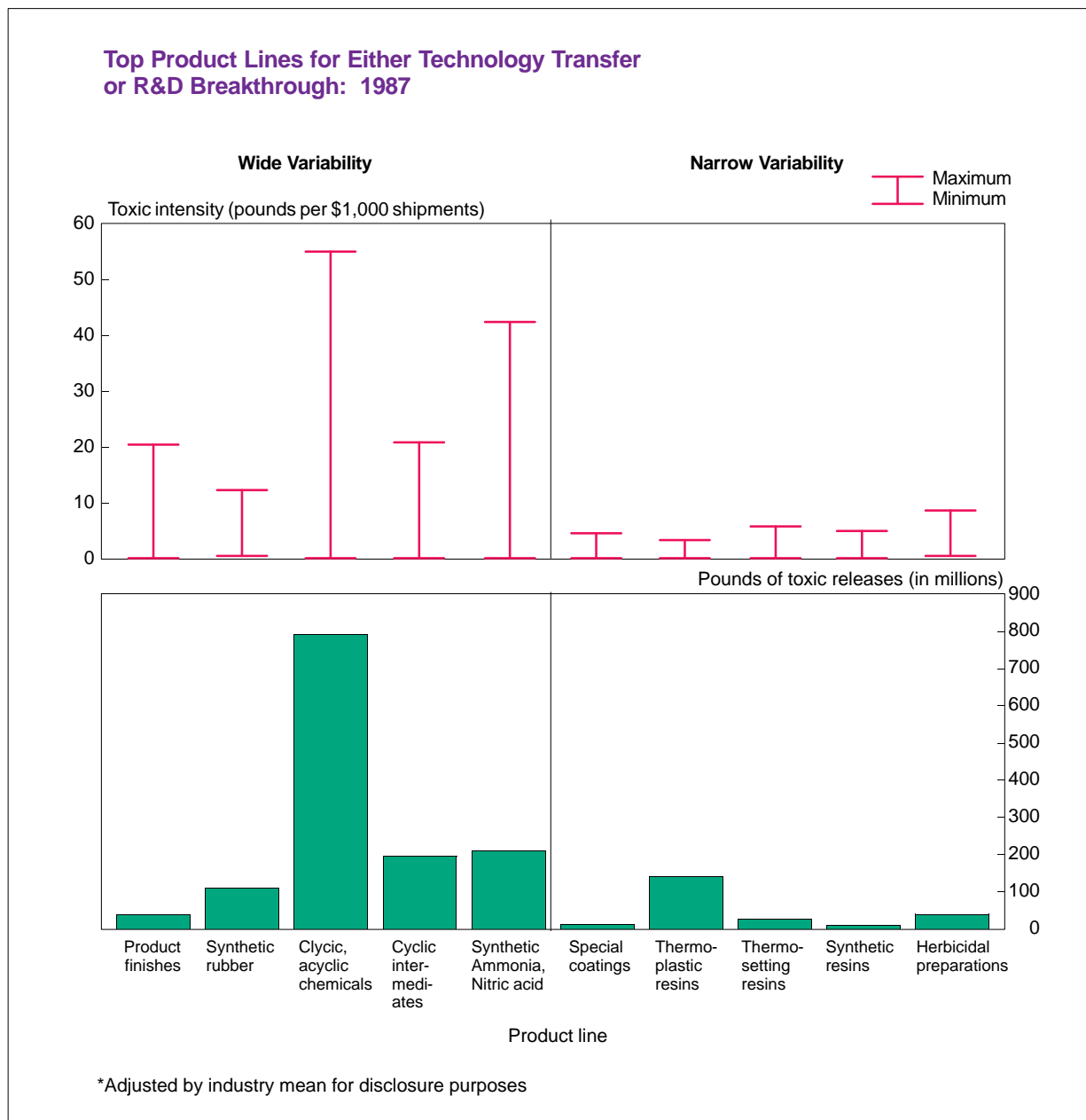
Examples of product lines whose manufacture falls into this combina

tion of categories include nitrogen, lithographic and offset ink, mixed fertilizers, and evaporated salt.

**Product Lines Are Key to Determining R&D Allocations**

There are four potential means to protect the environment from industrial wastes:

- 1) Stop manufacturing the product (that results in industrial waste).
- 2) Alter the production process to minimize the waste.



**Recommended Courses of Action  
Variability Among Manufacturers'  
Intensity of Toxic Releases\***

		High	Low
<b>Level of Intensity of Toxic Releases i.e., Releases per \$1000 of Shipments</b>	High	Transfer of Technology or "Know-How"	Search for R&D Breakthrough
	Low	No Action Necessary	No Action Necessary

\* Holding equal product line, ownership, and expenditures for machinery, labor and energy

- 3) Capture and store the waste.
- 4) Recycle or neutralize it.

Environmental policy has traditionally chosen option #3, but is shifting its focus toward options #2 and #4. For example, the Department of Energy is now promoting the development of new technology to achieve these objectives. However, since toxic wastes are difficult to neutralize, minimization is the preferred goal.

This study has demonstrated that manufacturing plants differ greatly in their environmental performance, as measured by intensity of toxic

releases. These differences are not apparent at the *industry* level — that is, in aggregate statistics. *Aggregate statistics encompass both high and low intensity product lines, obscuring the differences (variability) among manufacturers.* Without knowledge of these differences, there can be no understanding of why some manufacturers are more successful than others in controlling toxic releases.

It is for this reason that policymakers must look at the *detailed product lines* of plants. Therefore, this research provides a powerful, new quantitative tool which — in conjunction with other information —

can assist policymakers in allocating environmental R&D resources.

*The larger research project upon which these findings are based is described in "Toxic Waste Intensity in the U.S. Chemical Industries" (1994) by Mary L. Streitwieser. The document — which contains complete descriptions of the databases, the statistical methods used, and data limitations — can be obtained through the Center for Economic Studies (CES) at the U.S. Census Bureau.*

*This Brief is one of a series that presents information of current interest based upon research conducted at the CES. The CES houses highly specialized longitudinal microdata files, undertakes research on important economic issues, and — with confidentiality protection — provides researcher access to the files. For further information, contact Robert H. McGuckin, (301) 457-1848.*

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