

# OPERATION OZONE SHIELD:

## The Pentagon's War on the Stratosphere

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### Reported U.S. 1989 CFC-113 Emissions by Sector

Sector	Share of Emissions
Military Plants	26.5%
Energy Department Nuclear Weapons Plants	3.0%
Top 100 Military Contractors — Non-Military Plants	29.0%
Du Pont CFC-113 Production Plants	6.8%
Non-Military Plants	34.6%

*The U.S. military, through its procurement standards, is responsible for a substantial share of the ozone-depleting emissions of American industry. The above chart is based upon the 100 Plants reporting the greatest amount of CFC-113 air releases to the EPA in 1989. (See the Appendix for details.)*

[The Center for Public Environmental Oversight has reconstructed and republished this 34-year-old report because fluorinated refrigerants are again an environmental concern, particularly for cooling at semiconductor plants and data centers. — Lenny Siegel, April, 2026]

## Summary

Scientists, U.S. policy-makers, and international law now agree: The long-term depletion of the stratospheric ozone layer poses a serious hazard to human health and the global environment. Emissions of chlorofluorocarbons (CFCs) and other forms of chlorine are catalyzing chemical reactions in the upper atmosphere, breaking down the Earth’s shield of ozone and allowing an increased level of solar ultraviolet radiation to reach the Earth’s surface. Increased ultraviolet exposure threatens crop yields and the viability of aquatic ecosystems. The United Nations Environmental Programme (UNEP) projects that ozone depletion over the United States and comparable latitudes could reach ten percent by the end of the century.

Many people within the U.S. government are working hard to limit that danger, but the Federal procurement bureaucracy, centered within the Department of Defense (DOD), still requires that government contractors use ozone-depleting substances, such as CFC-113 (Freon), in their work. Military specifications (“mil-specs”) set the standard, not only for weapons production and maintenance, but for the rest of industry. As a result, emissions of ozone-depleting chemicals continue, despite international agreements to phase out such substances.

In 1989, the 100 U.S. industrial plants reporting the largest quantities of CFC-113 emissions included 26 major Defense contractor plants and 3 nuclear weapons plants. Those military plants were responsible for 7.35 million pounds of CFC-113 releases, equal to 29.5% of the top 100 releasers’ emissions.

The Pentagon itself reports using over 5.75 million pounds more of CFC-113 in 1989, primarily as a solvent for cleaning electronics equipment and metal parts. DOD is scheduled to provide new summary data to Congress, but its individual facilities are not required to report releases of ozone-depleting chemicals. We estimate that the armed services and weapons plants are responsible for about 37% of America’s reported CFC-113 emissions.

The non-military plants of the top 100 military contractors released an additional 7.24 million pounds of CFC-113, or 29.0% of the top 100 releasers’ emissions. Though not required to follow military specifications, many of these facilities rely upon military standards. Thus, this value serves as a rough indicator of the influence that military specifications have over the aerospace, weapons, and electronics industries.

Over the last few years, the Department of Defense has issued a series of reports and directives designed to reduce the military sector’s use and release of ozone-depleting compounds. For example, a recent report to Congress recommended that DOD identify an individual office to coordinate the campaign against ozone-depleting chemicals. Though it’s moving in the right direction, the effort is slow and bureaucratic. In particular, DOD’s schedule for eliminating the release, procurement, and use of ozone-depleting compounds includes no timetable for revising military specifications.

Both the Air Force Titan 4 expendable launch vehicle and NASA’s Space Shuttle, often used for military missions, directly deliver vast amounts of ozone-depleting chlorine to the upper atmosphere. Each launch does as much to deplete the ozone layer as the annual release of CFC-113 from most individual industrial plants. Recurring problems with the Titan Solid Rocket Motor

Upgrade (SRMU)—including accidents at both ground tests—provide an opportunity to develop a more environmentally sensitive booster.

We applaud the progress DOD has made. We thank the many individuals within the U.S. military who are working to solve the problem. We recognize that eliminating all ozone-depleting releases may be complex, difficult, and costly. Nevertheless, we think that the Department of Defense, as an agency devoted to protecting the American people, should intensify and accelerate its program to stop destroying the ozone shield. We recommend the following:

1. All specifications requiring the use of CFC-113 should be withdrawn or overridden by January 1, 1993. The Pentagon should establish a timetable for eliminating requirements for other ozone-depleting compounds from Federal standardization documents, technical data packages, and engineering drawings.
2. Instead of a coordinating office, the Pentagon should establish a “CFC Command,” with sufficient funding, personnel, and authority to launch a high priority campaign to protect, not destroy, the ozone layer: an “Operation Ozone Shield.”
3. Each military base should report its releases of ozone-depleting substances through the Environmental Protection Agency’s Toxics Release Inventory.
4. The Air Force should choose an environmentally sound technology for Titan 4 boosters and subsequent launch systems.

### **Everybody’s Shield**

Few environmental issues have caught the attention of the American people—from eight-year-olds to astronauts—as the degradation of the ozone shield. The ozone layer, actually a concentration of triatomic oxygen (O<sub>3</sub>) in the stratosphere, from about 15 to 50 kilometers above the Earth, absorbs harmful ultraviolet radiation from the Sun. Throughout history and before, natural processes have continually created and broken down stratospheric ozone molecules.

Starting about two decades ago, however, humans started releasing large quantities of chlorine-containing pollutants into the upper atmosphere. As a consequence, ozone concentrations are declining measurably, creating at times the “ozone hole” over Antarctica, an actual gap in the ozone layer. In April 1991, the Environmental Protection Agency announced that the ozone shield directly above the continental United States—and other countries at the same latitude—has degraded as much as five percent over the last decade, twice the depletion that scientists had anticipated.

Ultraviolet radiation at the upper end of the ultraviolet spectrum (UV-B) poses a threat to all living organisms because it can damage DNA, the substance containing the genetic code of all living cells. Increased exposure to UV-B can damage aquatic ecosystems, crops and trees, and the immune systems of humans and other animals. It can cause cataracts and cancer. EPA projects that without controls, ozone depletion will reach fifty percent by the year 2075, causing nearly 200 million additional cases of skin cancer and nearly 4 million deaths in the United States alone.

As indicated by the unexpectedly high level of ozone depletion over the U.S., scientists do not yet fully understand the chemical processes that destroy atmospheric ozone. It is generally

agreed, however, that each ion of chlorine and bromine in the upper atmosphere triggers a series of chemical reactions in which hundreds of ozone molecules are broken down. Chlorofluorocarbon (CFC) gases such as CFC-113, sold by Du Pont under the trade name Freon, are released at the Earth’s surface and move through the atmosphere for years. Eventually they reach the stratosphere, break down, and catalyze ozone depletion.

In the U.S., CFCs are used in aerosol propellants, in the manufacture of plastic foam and insulation, in refrigeration and air conditioning equipment, and in the sterilization of medical instruments. Halons, similar compounds that also include bromine, are used in fire extinguishing equipment in areas containing sensitive electronic devices. CFC-113 is used to clean metal and electronic components and assemblies.

Americans have been aware of the threat of ozone depletion since the late 1970s, when warnings about releases of CFC—then known merely as fluorocarbons—from aerosol cans led to consumer boycotts and the prohibition of that use and the development of more ozone-friendly substitutes. Today thousands, perhaps millions of people avoid buying foam cups, CFC-based insulation, and car air conditioners, doing their part to protect the ozone shield.

### **Part of the Problem**

Meanwhile, the U.S. Department of Defense (DOD), an agency charged with responsibility for protecting Americans against external threats, remains a key part of the problem. Though DOD officially recognized its role in ozone depletion more than three years ago, its efforts to shape up have been woefully inadequate.

Following the ban of CFC aerosol sprays, the Reagan Administration abandoned plans to further regulate CFCs, and Du Pont sought new markets for the compounds. The electronics and aerospace industries, in the process of phasing down their use of cancer-causing solvents such as trichloroethylene, adopted CFC-113 as an effective alternative. By 1985, CFC-113 accounted for 12 percent of CFCs used in the US, and its use was growing 1.5 times as fast as other major CFCs.

The Department of Defense adopted CFC-113 as well, writing it into its procurement specifications, or “milspecs.” Today there are approximately 500 military and Federal specifications that directly require chlorinated solvents, CFCs, and halons. Additionally, approximately 9,000 milspecs have been identified that do not directly require these substances but cannot be met without the use of ozone-depleting compounds.

In 1986, according to DOD itself, the “Armed Forces and companies supplying equipment to them accounted for nearly half” the nation’s CFC-113 use. We believe that figure may understate the Pentagon’s role in the current CFC-113 market. The National Toxics Campaign Fund (NTCF) estimates that direct consumption by the military and military plants accounts for 37% of the CFCs emitted in the U.S. each year, and that military specifications account for as much as 31% more.

Earlier studies have shown that military contractors are among the top releasers of CFC-113 in California and Florida. To determine the military role nationally, NTCF has identified military plants among the top 100 releasers of CFC-113 in 1989, as reported to the EPA’s Toxics Release Inventory (TRI). Those top 100, accounting for nearly 40% of releases by all reporting firms, provide a good representation of the entire CFC-113 market.

In 1989, military and nuclear weapons plants released 29.5% of the top 100 total. Since the releases of Du Pont’s CFC-113 production plants—which sell to the military sector—are properly allocated between military and non-military CFC-113 users, we find that military factories are responsible for 31.6% of the CFC-113 emissions by the top 100 CFC-113 reporting facilities in the U.S.

**1989 Top 100 Reporting Air Releasers of CFC-113 in the United States**

Sector	# Plants	Releases (lbs)	% Releases	% Users’ Releases
Military Plants	26	6,601,765	26.5%	28.4%
Dept. of Energy Nuclear Weapons Plants	3	750,816	3.0%	3.2%
Top 100 Military Contractors – Non-Military Plants	27	7,236,317	29.0%	31.2%
Non-Military Plants	39	8,621,538	34.6%	37.1%
Total, Plants Using CFC-113	95	23,210,436		100.0%
Du Pont CFC-113 Production Plants	5	1,705,256	6.8%	
<b>TOTAL: Top 100 Releasers</b>	100	24,915,692	100.0%	

Furthermore, the military itself is responsible for an enormous volume of ozone-depleting emissions. In 1989 it used 1,212 metric tons (2,672,000 pounds) of halons and 4,255 metric tons (9,381,000 pounds) of CFCs, including 2,620 tons (5,776,000 pounds) of CFC-113. If that use is roughly equivalent to CFC releases by the armed services, then the military sector’s direct share of reported U.S. CFC-113 releases rises to 37%.

We have no accurate way of measuring, let alone analyzing, the armed forces’ direct release of ozone-depleting compounds, because the military is not currently required to report such emissions under the Toxics Release Inventory. Though Pentagon officials have promised to cooperate with the TRI, military-operated facilities squeeze through the loophole that exempts non-manufacturing facilities. Accurate, detailed, by-facility toxics releases reporting by the Pentagon is important not only for ozone-depleting substances, but for pollutants that cause more localized damage. For this reason, the General Accounting Office recommends that the Environmental Protection Agency (EPA) expand the TRI reporting base by including nonmanufacturers and other exempt facilities, and that Congress enact legislation requiring Federal agencies to take part in the TRI program. We agree: Each military base should report its release of ozone-depleting substances through the EPA’s Toxics Release Inventory.

Department of Defense responsibility for the use and release of ozone-depleting substances does not stop with military plants and bases. Many non-military plants use CFC-113 either because they supply products indirectly to the military, or merely because military standards have been adopted in some non-military sectors.

In 1988, William Parker, at that time the Pentagon’s top administrator for environmental affairs, explained the far-reaching impact of the Pentagon’s requirements for the use of CFC-113:

A shift away from CFC-113 is difficult, especially for the production of military equipment, because U.S. military specifications for soldering and cleaning as written discourage the use of alternative non-ozone depleting materials. These specifications have become the de facto world standard for electronic equipment manufacture for a variety of reasons: the military is a large customer and defense pacts with our allies internationalize standards; companies often produce their entire product line to qualify for possible military purchase; companies produce commercial electronics to these standards because they are assumed to be a mark of quality; and foreign standards cite military specifications even for civilian applications.

A more recent DOD study agreed: “the commercial manufacturing sector generally considers DOD standards to be ‘state of the art’ technology, and a great deal of commercial manufacturing is done to military specifications, particularly where product reliability is an issue.” In 1991, a Bell Labs scientist estimated that fifty percent of all electronics products are made per military spec because many companies do not have quality specifications of their own.

To serve as a rough indicator of wider DOD responsibility, we have included in our analysis a breakdown of the top 100 CFC-113 releasing plants that are owned by the nation’s 100 largest military contractors, but which we did not identify as military plants. These military-influenced facilities account for 29% of the emissions of the top 100 releasers and 31.2% of the releases of the 95 CFC-using plants in the top 100 TRI list.

### **Part of the Solution?**

In 1987, the international community officially recognized the environmental threat of CFC releases with the signing of the “Montreal Protocol on Substances that Deplete the Ozone Layer.” The Montreal agreement originally called for a fifty percent cut in CFC use by 1998. Strengthened in 1990, it now bans CFC production by the year 2000. The U.S. Clean Air Act Amendments of 1990 translated the Montreal goals into U.S. law, in cases setting more stringent intermediate standards.

While the Montreal Protocol and Clean Air Act represent a big step forward, they temper their protection of human health, accepting claims by industry that a more rapid phase-out of ozone-depleting compounds is technically infeasible or merely too expensive. Environmentalists believe that ozone depletion is a global disaster that will continue for years even if action is taken now to protect it, so we must act as quickly as we can. The use of CFC-113 as an industrial solvent, introduced within the last decade, can and should be eliminated by the mid-1990s.

To further that goal, U.S. environmental groups have been using the Toxics Release Inventory to identify and pressure major users of CFC-113. In 1987, three IBM plants, topped by the company’s San Jose, California complex with nearly 1.5 million pounds, led the national list of CFC-113 emitters. Environmentalists, organized by the Silicon Valley Toxics Coalition, staged an Earth Day 1989 rally at the IBM facility, demanding a reduction in CFC use.

Facing immediate pressure and the recognition that they would eventually need to stop using CFCs, major commercially oriented electronics companies responded. By 1989, IBM San

Jose had reduced its annual CFC-113 emissions to just 230,000 pounds, using technologies such as a water-based system for cleaning disk drive parts. Others, such as Digital Equipment, Northern Telecom, AT&T, and Apple, announced plans to eliminate CFC use as well.

TRI participants reported CFC-113 air emissions totaling 63,232,772 pounds in 1989, the most recent year for which data is available. Many smaller companies have not yet taken action, for lack of money or interest. Military contractors have not moved as fast as commercial computer and telephone companies, saying that regulations gave them less freedom to alter their production processes.

Prodded by Congress, the public, and Defense Department insiders, the Pentagon now has a comprehensive program designed to phase out the use and release of ozone-depleting compounds and to identify, test, and use environmentally responsible substitutes. Despite a series of directives and studies, the Pentagon effort remains slow and bureaucratic.

DOD has established what it considers an “aggressive schedule” for eliminating the use of such compounds, staged to deal with “non-essential uses,” “essential uses,” and “mission-critical uses.” For chlorofluorocarbons, including CFC-113, it sets the following schedule:

Action	Non-Essential	Essential	Mission-Critical	
Institute plans to reduce unnecessary releases during operation, maintenance, and training	October 1990	October 1990	October 1990	
Institute plans to eliminate procurement and use	January 1992	January 1993	January 1994	
Stop use in new procurements	January 1993	January 1994	January 1995	
Phase-out of current applications to 50% of 1986 levels	January 1993	January 1995	January 1998	
Reduce use in all applications to zero (except for recycled materials)	January 1994	January 1996	January 2000	
Percent of current DOD use of CFCs	21%	50%	29%	

This schedule may enable DOD to meet the goals of the Clean Air Act and the Montreal Protocol, but it fails to treat ozone depletion as an environmental crisis. Non-essential uses, the category slated for the most rapid response, only account for 21% of the DOD use of CFCs. The definition of non-essential uses only mentions “comfort cooling in family housing and installation support activities” as examples. Mission-critical uses are combat-related. While it may be difficult to replace fire-fighting halons in jet fighters, there are already proven substitutes for CFC-113 in many, if not most, solvent uses.

More important, this schedule for phasing out DOD CFC use makes no direct reference to military specifications, the set of DOD policies which have the greatest impact on ozone depletion. These standards, which guide the chemical choices of a major portion of U.S. industry, influence much more than the environmental practices of armed services. Yet the Pentagon has announced no timetable for phasing out such milspecs. This is the greatest gap in the DOD strategy.

To its credit, the Department of Defense has begun to examine the thousands of milspecs that call for the use of ozone-depleting substances. This process has the support, at least on paper, of top policy-makers, and many Pentagon researchers and managers are taking the task seriously. Compared to major commercial firms, however, the Pentagon’s progress is extremely slow.

In fact, the Pentagon appears to be resisting pressure from its contractors: “Despite a mandate last May from the Assistant Secretary of Defense for Production and Logistics calling for switching to CFC alternatives, some in DOD are resisting. Others are reworking their specifications, but mainly to please nervous suppliers who expect to run out of CFC cleaning agents.” One specification official noted: “I’ve not gotten a lot of direction from DOD in terms of this issue—at least not me.”

To overcome inertia within the Department, high-level DOD officials must set a timetable for eliminating requirements for ozone-depleting compounds from Federal standardization documents, technical data packages, and engineering drawings. They should withdraw or override all milspecs requiring CFC-113 solvents by January 1, 1993. DOD’s CFC Advisory Committee, comprised of five members each from DOD, EPA, and industry, recommends that DOD identify an individual office to coordinate the effort to eliminate requirements for CFCs and other ozone-depleting compounds. That’s a good idea, but it doesn’t go nearly far enough. DOD should create a “CFC Command” with the budget, personnel, and authority to force recalcitrant bureaucrats to move quickly. It should be headed by someone with sufficient rank to ensure cooperation from all military components.

Though the U.S. military has a well-deserved reputation for bureaucratic inefficiency, last year it proved its ability to respond to a crisis, moving hundreds of thousands of men and women and vast quantities of materiel to the Middle East. Ozone degradation poses a clear and immediate threat to the environmental security of the United States, and our Defense Department must shift from a destroyer of the ozone layer to a protector. We need an Operation Ozone Shield!

### **Rockets Attack the Ozone Layer, Too**

Together, industrial and military users of CFCs represent the largest threat to the ozone layer, but Air Force and NASA space launches are among the largest individual sources of ozone-depleting chemicals. Large solid-fueled rocket boosters, used by the Air Force on the Titan 4 expendable launcher and by NASA on the Space Shuttle, generate hundreds of thousands of pounds of toxic exhaust every time they burn.

A major portion of that exhaust is hydrogen chloride. When released near the Earth’s surface, hydrogen chloride combines with water in the atmosphere to form hydrochloric acid, creating acid rain or acid fog. When emitted in the stratosphere, hydrogen chloride quickly breaks

down into chlorine and hydrogen. The chlorine, identical to chlorine from CFCs, triggers ozone-depletion reactions.

Each Shuttle launch, reports NASA, directly deposits 68,000 kilograms (150,000 pounds) of chlorine into the upper atmosphere. This is equivalent to the amount of chlorine in 263,000 pounds of CFC-113. In all of 1989, only one industrial plant in the United States—Du Pont’s West Virginia facility—released as much CFC-113 as to equal the ozone destruction caused by three shuttle launches, and NASA now fires several Shuttles each year. Only four other plants compared to two launches.

With each launch, the Titan 4’s solid-fueled boosters emit nearly half the hydrogen chloride as the current Shuttle boosters. The larger Titan’s Solid Rocket Motor Upgrade (SRMU), now in development, is supposed to release nearly sixty percent the exhaust of the Shuttle. With three to eight launches planned each year, the Titan program ranks just behind the Shuttle on the list of the largest annual ozone depleters.

NASA argues that solid rocket launches represent a small part of the overall problem, but that is no reason to ignore them. If our government does nothing to eliminate sources of that size, then it will accomplish virtually nothing. In fact, it can set back the entire ozone-protection effort by example: Why should releasers of minuscule amounts of ozone-depleting chemicals—such as small businesses and individual consumers—make sacrifices to help maintain the ozone layer when well-funded Federal agencies such as NASA and the Air Force ignore the largest sources?

We do not call for an immediate end to space-launch activities. Rather we call for a halt in the development of new solid rocket boosters—the Shuttle’s Advanced Solid Rocket Motor and the Titan SRMU—before they are produced. Future launch programs, such as the National Launch System, should also use environmentally sound technologies.

There are several possible alternatives to solid boosters, each of which must be evaluated for cost, safety, thrust, and pollution. Among the candidates that appear to pose a lesser environmental threat are liquid hydrogen-oxygen engines, like the Shuttle’s main engine; hybrid engines, which use a rubberized solid fuel in combination with liquid oxygen; and solid fuels with magnesium added to combine with chlorine products.

An Air Force environmental official told the Los Angeles Times: “The EPA has yet to develop precisely what their regulations will be, but we know it’s coming.” We think it should come sooner, rather than later, and the Titan SRMU may be the place to start. The SRMU project is already in trouble, suffering a lethal accident in September 1990 and a failed test-firing in April 1991. It is at least a year behind schedule and five percent above budget. As a result, the Air Force is seeking new booster options, including at least one proposal for a liquid-fueled booster. The Air Force should choose an environmentally sound technology for Titan 4 boosters.

## Appendix: Top 100 CFC-113 Air Releasers by Sector, 1989

### **Military Plants — Total: 6,601,765 lbs (26.5%)**

**Air Force Plant No. 4 (General Dynamics)** — Fort Worth, Texas: 500,000 lbs (2.0%)  
**IBM** — Endicott, New York: 484,200 lbs (1.9%)  
**General Dynamics** — East Camden, Arkansas: 417,422 lbs (1.7%)  
**Mississippi Army Ammo. Plant (Mason & Hanger)** — Stennis Space Center, MS: 408,400 lbs (1.6%)  
**Honeywell** — Clearwater, Florida: 378,000 lbs (1.5%)  
**Eastman Kodak** — Rochester, New York: 377,000 lbs (1.5%)  
**United Technologies / Hamilton Standard** — Windsor Locks, Connecticut: 321,000 lbs (1.3%)  
**Allied-Signal / AiResearch** — Torrance, California: 300,000 lbs (1.2%)  
**Honeywell** — Albuquerque, New Mexico: 293,537 lbs (1.2%)  
**Moog** — East Aurora, New York: 275,275 lbs (1.1%)  
**General Dynamics** — Pomona, California: 253,780 lbs (1.0%)  
**Air Force Plant No. 44 (Hughes Aircraft / GM)** — Tucson, Arizona: 232,905 lbs (0.9%)  
**General Electric** — Lynn, Massachusetts: 231,334 lbs (0.9%)  
**Bulova / Hamilton Technology** — Lancaster, Pennsylvania: 225,000 lbs (0.9%)  
**Allied-Signal / Garrett Engine** — Phoenix, Arizona: 185,600 lbs (0.7%)  
**Raytheon** — Lowell, Massachusetts: 179,300 lbs (0.7%)  
**United Technologies / Pratt & Whitney** — North Haven, Connecticut: 170,000 lbs (0.7%)  
**Pneumo Abex / NWL Control Systems** — Kalamazoo, Michigan: 168,895 lbs (0.7%)  
**General Motors / Hughes Aircraft** — Fullerton, California: 161,510 lbs (0.6%)  
**Unisys** — Roseville, Minnesota: 160,000 lbs (0.6%)  
**Rockwell International** — Richardson, Texas: 157,608 lbs (0.6%)  
**Honeywell** — Minneapolis, Minnesota: 157,600 lbs (0.6%)  
**SCI Systems** — Huntsville, Alabama: 149,380 lbs (0.6%)  
**Motorola** — Scottsdale, Arizona: 140,100 lbs (0.6%)  
**Sequa / Atlantic Research** — East Camden, Arkansas: 138,519 lbs (0.6%)  
**Boeing** — Renton, Washington: 135,400 lbs (0.5%)

### **Dept. of Energy Nuclear Weapons Plants — Total: 750,816 lbs (3.0%)**

**Savannah River Plant (Du Pont/Westinghouse)** — Aiken, South Carolina: 400,000 lbs (1.6%)  
**Bendix Plant (Allied-Signal)** — Kansas City, Missouri: 176,300 lbs (0.7%)  
**Y-12 Plant (Martin Marietta)** — Oak Ridge, Tennessee: 174,516 lbs (0.7%)

**Non-Military Plants of Top 100 Military Contractors —  
Total: 7,236,317 lbs (29.0%)**

**General Motors / Harrison Radiator** — Lockport, New York: 660,250 lbs (2.6%)  
**IBM** — Rochester, Minnesota: 624,000 lbs (2.5%)  
**General Motors / Delco Electronics** — Oak Creek, Wisconsin: 540,100 lbs (2.2%)  
**AT&T** — Lee’s Summit, Missouri: 505,000 lbs (2.0%)  
**Boeing** — Everett, Washington: 460,160 lbs (1.8%)  
**Motorola** — Arlington Heights, Illinois: 350,000 lbs (1.4%)  
**General Motors** — Coopersville, Michigan: 300,000 lbs (1.2%)  
**AT&T** — North Andover, Massachusetts: 295,010 lbs (1.2%)  
**Ford Motor / Ford Electronics** — Lansdale, Pennsylvania: 279,000 lbs (1.1%)  
**Hewlett-Packard** — Boise, Idaho: 260,000 lbs (1.0%)  
**Acustar (Chrysler)** — Dayton, Ohio: 259,000 lbs (1.0%)  
**Allied-Signal** — Baton Rouge, Louisiana: 235,290 lbs (0.9%)  
**IBM** — San Jose, California: 230,000 lbs (0.9%)  
**General Electric** — Louisville, Kentucky: 227,000 lbs (0.9%)  
**Motorola** — Seguin, Texas: 190,000 lbs (0.8%)  
**General Motors / Delco Electronics** — Kokomo, Indiana: 178,029 lbs (0.7%)  
**GTE / AG Communications** — Northlake, Illinois: 173,000 lbs (0.7%)  
**General Electric** — Morrison, Illinois: 166,100 lbs (0.7%)  
**AT&T** — Oklahoma City, Oklahoma: 160,700 lbs (0.6%)  
**Motorola** — Plantation, Florida: 155,000 lbs (0.6%)  
**Motorola** — Phoenix, Arizona: 154,000 lbs (0.6%)  
**Unisys** — Clear Lake, Iowa: 150,000 lbs (0.6%)  
**IBM** — Austin, Texas: 150,000 lbs (0.6%)  
**AT&T** — Little Rock, Arkansas: 143,000 lbs (0.6%)  
**Rockwell International** — Downers Grove, Illinois: 135,868 lbs (0.5%)  
**TRW / Technar** — Irwindale, California: 128,310 lbs (0.5%)  
**AT&T** — Allentown, Pennsylvania: 127,500 lbs (0.5%)

**Non-Military Plants — Total: 8,621,538 lbs (34.6%)**

**SCI Systems** — Rapid City, South Dakota: 534,556 lbs (2.1%)  
**Robert Bosch** — Charleston, South Carolina: 510,000 lbs (2.0%)  
**Baxter HealthCare** — Mountain Home, Arkansas: 450,000 lbs (1.8%)  
**Seagate Technology / Imprimis Technology** — Omaha, Nebraska: 323,000 lbs (1.3%)  
**Crain Industries** — Elkhart, Indiana: 309,000 lbs (1.2%)  
**Nashua Corporation** — Merrimack, New Hampshire: 298,000 lbs (1.2%)  
**Baxter HealthCare** — Anasco, Puerto Rico: 273,375 lbs (1.1%)  
**Compaq Computer** — Houston, Texas: 270,000 lbs (1.1%)  
**Northern Telecom** — Chapel Hill, North Carolina: 264,500 lbs (1.1%)  
**Lennox International** — Fort Worth, Texas: 264,068 lbs (1.1%)  
**WCI Holdings / Collins & Aikman** — Farmville, North Carolina: 262,805 lbs (1.1%)  
**Storage Technology** — Louisville, Colorado: 251,545 lbs (1.0%)

**Inter-City Products / Heil-Quaker** — Lewisburg, Tennessee: 244,000 lbs (1.0%)  
**Wacker Siltronic** — Portland, Oregon: 240,000 lbs (1.0%)  
**Timken / MPB** — Keene, New Hampshire: 231,000 lbs (0.9%)  
**Millipore** — Cidra, Puerto Rico: 200,000 lbs (0.8%)  
**Sony Magnetic Products** — Dothan, Alabama: 198,246 lbs (0.8%)  
**MEMC Electronic Materials** — Moore, South Carolina: 190,000 lbs (0.8%)  
**Meramec Group / Fashion Shoe** — Sullivan, Missouri: 189,000 lbs (0.8%)  
**Bristol-Myers Squibb / Zimmer** — Warsaw, Indiana: 188,862 lbs (0.8%)  
**Becton-Dickinson** — Columbus, Nebraska: 188,630 lbs (0.8%)  
**Gentex** — Simpson, Pennsylvania: 187,655 lbs (0.8%)  
**Siemens-Bendix Automotive** — Newport News, Virginia: 182,746 lbs (0.7%)  
**Pilkington Holdings / Sola Barnes Hind** — San Diego, California: 181,800 lbs (0.7%)  
**C. R. Bard / Bard Cardiopulmonary** — Las Piedras, Puerto Rico: 160,000 lbs (0.6%)  
**Bausch & Lomb** — Rochester, New York: 160,000 lbs (0.6%)  
**Calsonic Manufacturing** — Shelbyville, Tennessee: 160,000 lbs (0.6%)  
**Matsushita Electric** — Franklin Park, Illinois: 160,000 lbs (0.6%)  
**Schering-Plough / Wesley-Jessen Corp.** — Chicago, Illinois: 159,920 lbs (0.6%)  
**McDermott / Babcock & Wilcox** — Lynchburg, Virginia: 151,500 lbs (0.6%)  
**Becton Dickinson / Vacutainer** — Sumter, South Carolina: 150,000 lbs (0.6%)  
**Jepson Corp. / Signet Armorlite** — San Marcos, California: 148,165 lbs (0.6%)  
**Stanley Electric** — London, Ohio: 140,000 lbs (0.6%)  
**Becton Dickinson / Deseret Medical** — Sandy, Utah: 138,108 lbs (0.6%)  
**NMB / New Hampshire Ball Bearings** — Peterborough, New Hampshire: 136,979 lbs (0.5%)  
**Evcon Industries** — Wichita, Kansas: 135,240 lbs (0.5%)  
**Electromedics** — Englewood, Colorado: 132,184 lbs (0.5%)  
**CIMCO** — Costa Mesa, California: 129,000 lbs (0.5%)  
**NMB / New Hampshire Ball Bearings** — Chatsworth, California: 127,654 lbs (0.5%)

**CFC-113 Production Plants — Total: 1,705,256 lbs (6.8%)**

**Du Pont** — Washington, West Virginia: 800,000 lbs (3.2%)  
**Du Pont** — Clearfield, Pennsylvania: 279,480 lbs (1.1%)  
**Du Pont / Chambers Works** — Deepwater, New Jersey: 229,623 lbs (0.9%)  
**Du Pont / Corpus Christi Plant** — Ingleside, Texas: 211,553 lbs (0.8%)  
**Du Pont** — Antioch, California: 184,600 lbs (0.7%)

**TOTAL (including CFC-113 Production Plants): 24,915,692 lbs (100.0%)**