



EPA's 33/50 Program Company Profile

HADCO Corporation



THE 33/50 PROGRAM

This Company Profile is part of a series of reports being developed by EPA to highlight the accomplishments of companies participating in the 33/50 Program. The 33/50 Program is an EPA voluntary pollution reduction initiative that promotes reductions in direct environmental releases and offsite transfers of 17 high-priority toxic chemicals. The program derives its name from its overall goals -- an interim goal of a 33% reduction by 1992 and an ultimate goal of a 50% reduction by 1995. The program uses 1988 Toxics Release Inventory (TRI) reporting as a baseline. In February, 1991, EPA began contacting the parent companies of TRI facilities that reported using 33/50 Program chemicals since 1988 to request their participation in the 33/50 Program. As of April, 1994, a total of 1,216 companies had elected to participate in the Program, pledging to reduce emissions of the 17 target chemicals by more than 355 million pounds by 1995. Companies are encouraged to set their own reduction targets, which may vary from the Program's national 33% and 50% reduction goals. Company commitments and reduction pledges continue to be received by EPA on a daily basis.

The 1992 TRI data revealed that releases and transfers of 33/50 Program chemicals declined by 40% between 1988 and 1992, surpassing the Program's 1992 interim reduction goal by more than 100 million pounds. This accomplishment, together with evidence from analysis of facilities' projected releases and transfers of the 17 priority chemicals, reported to TRI under the Pollution Prevention Act, offers strong encouragement that the 33/50 Program's ultimate goal of a 50% reduction by 1995 will be achieved.

EPA is committed to recognizing companies for their participation in the 33/50 Program and for the emissions reductions they achieve. The Program issues periodic Progress Reports, in which participating companies are listed and highlighted. In addition, Company Profiles, such as this one, are being prepared to provide more detailed information about companies that have written to EPA describing significant emissions reduction initiatives. Information presented in these profiles is drawn primarily from the company's written 33/50 Program communications and the annual TRI reports submitted by their facilities (including Pollution Prevention Act data reported to TRI in Section 8 of Form R). All company communications to EPA regarding the 33/50 Program are available to the public upon request.

EPA does not endorse the performance, worker safety, or environmental acceptability of any of the technical options discussed in this Profile. Mention of any product or procedure in this document is for informational purposes only, and does not constitute a recommendation of any such product or procedure, either express or implied, by EPA.

17 PRIORITY CHEMICALS TARGETED BY THE 33/50 PROGRAM

BENZENE
CADMIUM & COMPOUNDS
CARBON TETRACHLORIDE
CHLOROFORM
CHROMIUM & COMPOUNDS
CYANIDES
DICHLOROMETHANE*
LEAD & COMPOUNDS
MERCURY & COMPOUNDS
METHYL ETHYL KETONE
METHYL ISOBUTYL KETONE
NICKEL & COMPOUNDS
TETRACHLOROETHYLENE
TOLUENE
1,1,1-TRICHLOROETHANE
TRICHLOROETHYLENE
XYLENES

* Also referred to as methylene chloride

For information on the 33/50 Program, contact the TSCA Hotline at (202) 554-1404 or contact 33/50 Program staff directly by phone at (202) 260-6907 or by mail at Mail Code 7408, Office of Pollution Prevention and Toxics, U.S. EPA, 401 M Street, SW, Washington, D.C. 20460.

HADCO Corporation

HADCO achieved a 95% reduction company-wide in releases and transfers of 33/50 Program chemicals from 1988 to 1992. This reduction represents nearly 2.2 million pounds of toxic chemicals. In addition, according to company officials, further reductions have been achieved since the 1992 TRI filing, and overall reductions for HADCO now stand at 99.5% as of the end of 1993. The company is working to completely eliminate all releases and transfers of 33/50 Program chemicals.

I. CORPORATE BACKGROUND

HADCO Corporation is a manufacturer of custom printed circuit boards and backplanes for use in electronic components. Approximately 60% of the boards produced are used in computers, and an additional 30% are used in telecommunications equipment. The remaining 10% find end uses in various types of instrumentation, principally in medical devices and the automotive industry. HADCO is headquartered in Salem, New Hampshire, and operates six facilities. All these facilities report releases and transfers of TRI chemicals, but only Derry, NH and Owego, NY reported 33/50 chemical releases.

The company reported using four 33/50 Program chemicals during the years 1988 to 1992: dichloromethane, lead, methyl ethyl ketone, and 1,1,1-trichloroethane. Table I at the end of this profile summarizes the company's TRI releases and transfers for 1988 through 1992, while Table II presents these data for selected facilities.

HADCO committed to a 98% reduction in releases and transfers of 33/50 Program chemicals between 1988 and 1995.

Printed circuit boards are manufactured in a complex, multi-step process. Circuit board cores, containing up to 14 layers of "innerlayers," are produced using a dry film process described below, and then laminated together. Next, holes are drilled in the copper-coated plastic substrate board or the inner layer core. The holes are then lined with copper using a chemical plating process.

The circuit board pattern is applied to the surface of each layer of the board by a technique

Releases and Transfers of TRI Chemicals Reported by HADCO Corporation (1000 lbs)

	1988	1992
<i>33/50 Chemicals</i>		
Dichloromethane	1,977	60
Lead*	0	0
Methyl ethyl ketone	19	0
1,1,1-Trichloroethane	283	51
<i>33/50 Subtotal</i>	2,279	111
<i>Other TRI Chemicals</i>	545	516
<i>Total**</i>	2,823	627

* Lead is used in amounts usually below the reporting threshold.

** Columns do not sum to totals due to rounding.

called "Dry Film Processing." The boards are first cleaned with a mineral acid solution prior to application of the circuit board pattern. The clean copper surface is then coated with a light-sensitive polymer. When the circuit pattern is projected onto the polymer-coated board, the polymer is cured onto the areas where the copper will remain. The areas of polymer not subjected to light are washed away (previously with 1,1,1-trichloroethane). The bare copper is then etched away, and the circuit pattern is cleaned of residual polymer (previously using dichloromethane).

An automated plating line is used to plate additional copper thickness onto the outer layer circuit pattern, by reversing the circuit pattern exposure in the dry film process. The exposed non-circuit film is then stripped off the board. On some products, an electroplating process is used to deposit gold connectors from a cyanide solution. Finally, tin-lead solder is applied to component attachment points on most boards.

II. 33/50 PROGRAM GOALS

HADCO is focusing its reduction efforts at its two largest facilities -- Derry, NH and Owego, NY -- which account for all of the company's total releases and transfers of 33/50 program chemicals.

In May, 1991, HADCO announced its participation in the 33/50 Program and reported that the Derry, NH facility had already achieved reductions in releases of 33/50 Program chemicals greater than the national goals for the program.

HADCO has installed a recovery system to minimize air emissions of 33/50 program solvents. This recovery system and process chemistry substitution has reduced air emissions by more than 270,000 pounds over the State of New Hampshire requirements.

In September of the same year, the company expanded its participation to include goals for the Owego, NY facility. The company committed to reduce releases and transfers of 33/50 Program chemicals at this facility by 141,400 pounds by 1995, an 87% percent reduction from the 1988 TRI baseline.

Incorporating HADCO's reductions at its Derry facility, as well as the projected reductions at the Owego facility, the company's 33/50 Program goal is calculated to be a 98% reduction from 1988 levels by 1995.

III. FACILITY AND PROCESS LEVEL POLLUTION REDUCTION ACTIVITIES

HADCO's reduction efforts and 33/50 Program goals were achieved using substitution with less hazardous or non-hazardous chemicals and, where necessary, emissions control.

From July, 1989 through August, 1990 the company implemented a \$1.7 million process conversion and emission control project at its Derry facility. The project's goals were to eliminate use or minimize air emissions of chemicals used in the facility's manufacturing operations.

The cornerstone of the project was implementation of new aqueous-based chemicals in the cleaning and dry film processes. The dry film process was modified to include carbonate based developers instead of 1,1,1-trichloroethane, and hydroxide solutions instead of dichloromethane. A screen cleaning

use of dichloromethane was also replaced with an aqueous cleaning solution at the Owego, NH facility.

HADCO's conversion project has resulted in the following source reduction of 33/50 Program chemicals:

- Significant reduction in dichloromethane through conversion of six of the eight dry film and cleaning processes to water based chemistry;
- Elimination of 1,1,1-trichloroethane through conversion of the cleaning and dry film processes to water based chemistry; and,
- Elimination of methyl ethyl ketone as an additive to dichloromethane in cleaning (its only use at the facility).

Certain circuit board processes could not be replaced with this new water-based technology, however, because of user specifications, and still required 33/50 Program solvents. To reduce emissions of these chemicals, HADCO also installed a dual-bed activated carbon adsorption recovery system at its Derry, NH facility, which reduced remaining emissions of the three 33/50 Program solvents by over 99%.

HADCO achieved a 99.5% reduction in releases and transfers of 33/50 Program chemicals between 1988 and 1993. The company is now working toward a 100% reduction.

As an alternative to a recovery system, HADCO replaced both 1,1,1-trichloroethane and dichloromethane with a terpene solvent at its Owego, NH facility.

The recovery system was installed to further reduce air emissions. However, HADCO's process conversion and emission control program achieved significantly greater reductions than required by New Hampshire Air Toxics Regulations (adopted April, 1990). HADCO's state permit for dichloromethane allows emissions of no more than one pound per hour; however, the company estimates that its emissions level has been reduced to 0.3 pounds per hour. In addition, the State law did not require control of methyl ethyl ketone or 1,1,1-trichloroethane at the

Derry site. Thus, HADCO has reduced air emissions by more than 270,000 pounds over the state requirements.

The company has recently implemented similar conversions and emission control at its Owego facility. The facility eliminated the use of methyl ethyl ketone in 1991; 1,1,1-trichloroethane in December, 1992; and dichloromethane in March, 1994.

IV. PROGRESS TOWARD 33/50 REDUCTION GOALS

HADCO's efforts in pollution prevention and solvent recovery allowed the company to achieve its 33/50 Program goals two years ahead of schedule. Company-wide releases and transfers of 33/50 Program chemicals decreased 95% between 1988 and 1992, reflecting a reduction of almost 2.2 million pounds. In addition, according to company officials, the company achieved additional reductions in 1993 that have brought its total reductions to 99.5%. The following achievements have been recorded:

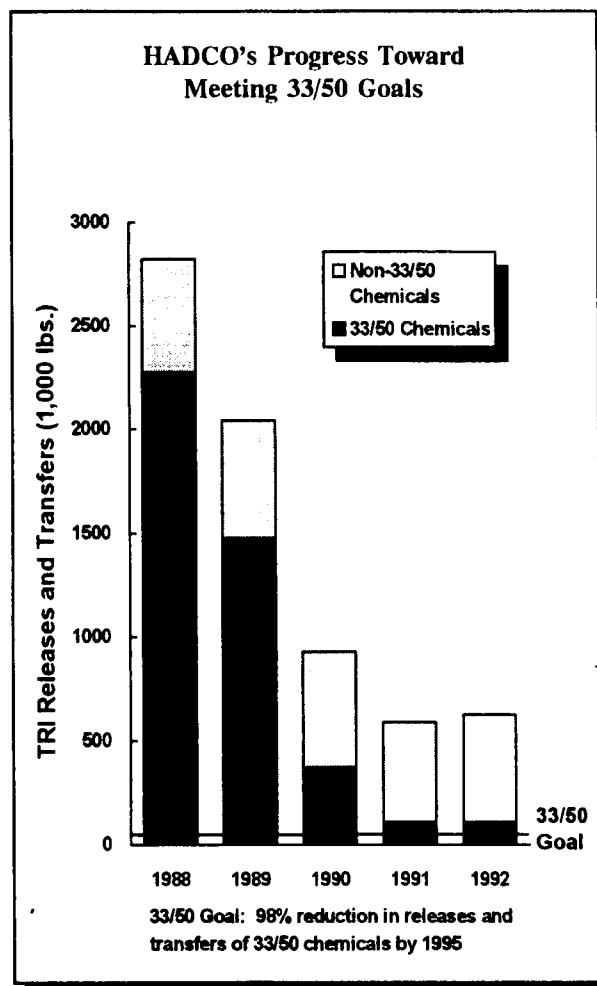
At the Derry, NH facility -

Total releases and transfers of 33/50 Program chemicals have been reduced by more than 99% from 1988 to 1992. Since 1990, the facility has reported no releases and transfers of 1,1,1-trichloroethane to TRI. The largest decrease in releases and transfers, however, has been for dichloromethane, a reduction of over 1.8 million pounds between 1988 and 1992. Moreover, these reductions were achieved during a period of increasing production at the facility.

The overwhelming majority of the decrease in dichloromethane was due to source reduction in the form of substitution with aqueous-based chemicals. In 1992, the Derry facility recovered over 300,000 pounds of dichloromethane in the adsorption recovery system, of which only 1,800 pounds were sent off-site for recycling (see Table III). The remainder of the reductions are attributable to substitution.

At the Owego, NY facility -

Total releases and transfers of 33/50 Program chemicals decreased 40% between 1988 and 1992. According to company officials however, releases and transfers of 33/50 Program chemicals were completely eliminated from the Owego facility in March, 1994.



V. SUMMARY OF HADCO'S EXPERIENCE

HADCO's participation in the 33/50 Program has fit nicely with the company's policy of actively seeking to reduce the use and release of hazardous chemicals. Company-wide releases and transfers of 33/50 Program chemicals decreased by 95% between 1988 and 1992, and decreased by 99.5% by the end of 1993.

The company has replaced the majority of its 33/50 Program solvents with aqueous substitutes, and plans to continue the process to achieve a complete elimination of releases and transfers of 33/50 Program chemicals. In addition, HADCO has installed a solvent recovery system which goes beyond New Hampshire's air toxics regulations, and will continue to look for substitutes for its other hazardous chemicals.

Table I
HADCO Corporation
TRI Releases and Transfers, 1988-1992

Chemical	Year	Total Air Emissions (pounds)	Surface Water Discharges (pounds)	Transfers to POTWs (pounds)	Other Off-site Transfers (pounds)	Total Releases and Transfers (1) (pounds)	Percent Change
							Total Releases and Transfers 1988-1992
Dichloromethane	1988	1,946,750	0	252	29,805	1,976,807	
	1989	1,099,000	0	250	23,450	1,122,700	
	1990	285,000	0	250	7,505	292,755	
	1991	71,650	0	37	483	72,170	
	1992	58,950	0	38	1,100	60,088	-97%
Lead	1989	0	0	250	8,350	8,600	-100%
Methyl ethyl ketone	1988	19,000	0	0	0	19,000	
	1989	10,760	0	0	0	10,760	
	1990	0	0	0	0	0	
	1991	0	0	0	0	0	
	1992	0	0	0	0	0	-100%
1,1,1-Trichloroethane	1988	282,600	2	0	0	282,602	
	1989	336,000	0	0	230	336,230	
	1990	81,000	5	0	73	81,078	
	1991	35,800	0	0	96	35,896	
	1992	50,500	0	0	500	51,000	-82%
<u>33/50 Program Chemicals</u>	1988	2,248,350	2	252	29,805	2,278,409	
	1989	1,445,760	0	500	32,030	1,478,290	
	1990	366,000	5	250	7,578	373,833	
	1991	107,450	0	37	579	108,066	
	1992	109,450	0	38	1,600	111,088	-95%
Non 33/50 Program Chemicals	1988	347,979	18,920	39,724	138,222	544,845	
	1989	312,112	13,002	98,838	139,702	563,654	
	1990	223,878	13,960	180,479	137,323	555,640	
	1991	186,380	11,670	159,468	127,895	485,413	
	1992	198,756	13,640	171,134	132,775	516,305	-5%
All TRI Chemicals	1988	2,596,329	18,922	39,976	168,027	2,823,254	
	1989	1,757,872	13,002	99,338	171,732	2,041,944	
	1990	589,878	13,965	180,729	144,901	929,473	
	1991	293,830	11,670	159,505	128,474	593,479	
	1992	308,206	13,640	171,172	134,375	627,393	-78%
<u>Percent Change, 1988-1992</u>							
33/50 Program Chemicals		-95%	-100%	-85%	-95%	-95%	
Non-33/50 Program Chemicals		-43%	-28%	331%	-4%	-5%	
All TRI Chemicals		-88%	-28%	328%	-20%	-78%	

Notes: (1) 1991 and 1992 Total Releases and Transfers do not include on- or off-site recycling or energy recovery.

Table II
HADCO Corporation
TRI Releases and Transfers at Selected Facilities, 1988-1992

Chemical	Year	Total Air Emissions (pounds)	Surface Water Discharges (pounds)	Transfers to POTWs (pounds)	Other Off-site Transfers (pounds)	Total Releases and Transfers (1) (pounds)	Percent Change Total Releases And Transfers 1988-1992
<u>Derry, NH Facility</u>							
Dichloromethane	1988	1,860,000	0	250	7,805	1,868,055	
	1989	1,011,000	0	250	3,200	1,014,450	
	1990	221,000	0	250	0	221,250	
	1991	18,750	0	37	303	19,090	
	1992	14,750	0	38	350	15,138	-99%
Lead	1989	0	0	250	8,350	8,600	-100%
Methyl ethyl ketone	1988	19,000	0	0	0	19,000	
	1989	10,760	0	0	0	10,760	-100%
1,1,1-Trichloroethane	1988	231,000	0	0	0	231,000	
	1989	297,000	0	0	230	297,230	
	1990	41,000	0	0	55	41,055	-100%
<u>33/50 Program Chemicals</u>							
	1988	2,110,000	0	250	7,805	2,118,055	
	1989	1,318,760	0	500	11,780	1,331,040	
	1990	262,000	0	250	55	262,305	
	1991	18,750	0	37	303	19,090	
	1992	14,750	0	38	350	15,138	-99%
Non-33/50 Program Chemicals	1988	208,379	0	14,500	74,250	297,129	
	1989	143,762	0	36,500	63,863	244,125	
	1990	105,950	0	138,770	73,755	318,475	
	1991	72,645	0	139,020	69,624	281,289	
	1992	70,584	0	147,690	52,887	271,161	-9%
All TRI Chemicals	1988	2,318,379	0	14,750	82,055	2,415,184	
	1989	1,462,522	0	37,000	75,643	1,575,165	
	1990	367,950	0	139,020	73,810	580,780	
	1991	91,395	0	139,057	69,927	300,379	
	1992	85,334	0	147,728	53,237	286,299	-88%
<u>Owego, NY Facility</u>							
Dichloromethane	1988	86,750	0	2	22,000	108,752	
	1989	88,000	0	0	20,250	108,250	
	1990	64,000	0	0	7,505	71,505	
	1991	52,900	0	0	180	53,080	
	1992	44,200	0	0	750	44,950	-59%

Table II
HADCO Corporation
TRI Releases and Transfers at Selected Facilities, 1988-1992

Chemical	Year	Total Air Emissions (pounds)	Surface Water Discharges (pounds)	Transfers to POTWs (pounds)	Other Off-site Transfers (pounds)	Total Releases and Transfers (1) (pounds)	Percent Change
							Total Releases And Transfers 1988-1992
1,1,1-Trichloroethane	1988	51,600	2	0	0	51,602	
	1989	39,000	0	0	0	39,000	
	1990	40,000	5	0	18	40,023	
	1991	35,800	0	0	96	35,896	
	1992	50,500	0	0	500	51,000	-1%
<u>33/50 Program Chemicals</u>	1988	138,350	2	2	22,000	160,354	
	1989	127,000	0	0	20,250	147,250	
	1990	104,000	5	0	7,523	111,528	
	1991	88,700	0	0	276	88,976	
	1992	94,700	0	0	1,250	95,950	-40%
Non-33/50 Program Chemicals	1988	120,200	18,920	1,014	33,792	173,926	
	1989	154,310	13,000	758	57,293	225,361	
	1990	109,420	13,960	509	47,969	171,858	
	1991	102,970	11,670	273	43,264	158,177	
	1992	113,150	13,640	274	65,575	192,639	11%
All TRI Chemicals	1988	258,550	18,922	1,016	55,792	334,280	
	1989	281,310	13,000	758	77,543	372,611	
	1990	213,420	13,965	509	55,492	283,386	
	1991	191,670	11,670	273	43,540	247,153	
	1992	308,120	13,965	509	56,742	379,336	13%

Notes: (1) 1991 and 1992 Total Releases and Transfers do not include on- or off-site recycling or energy recovery.

Table III
HADCO Corporation
Pollution Prevention Act Reporting at Selected Facilities (1)

Chemical	Year	Recycled On-site (pounds) (2)	Recycled Off-site (pounds)	Energy Recovery Off-site (pounds)	Treated On-Site (pounds)	Treated Off-Site (pounds)	Quantity Released (pounds)	Total Production Related Wastes (pounds)
<u>Derry, NH Facility</u>								
<u>Dichloromethane (only 33/50 Program chemical)</u>	1991	0	31,000	300	0	62	18,000	49,362
	1992	0	4,800	0	0	390	15,000	20,190
	1994	0	9,600	0	0	350	8,800	18,750
Non-33/50 Program Chemicals	1991	0	590,000	0	403,000	34,450	242,950	1,270,400
	1992	0	367,400	0	469,000	22,751	248,050	1,107,201
	1994	0	704,000	0	470,000	31,900	246,050	1,451,950
All TRI Chemicals	1991	0	621,000	300	403,000	34,512	260,950	1,319,762
	1992	0	372,200	0	469,000	23,141	263,050	1,127,391
	1994	0	713,600	0	470,000	32,250	254,850	1,470,700

Notes: (1) Actual data for 1991-1992; projections for 1994.

(2) Does not include recovered vapors reused in the process.