NOES QUESTIONNAIRE ITEM NO. 35
Methods of Fume and Gas Monitoring

Intent

The intent of this question was to generally categorize the methods used in monitoring fumes, gases, mists, dusts, or vapors.

This item was displayed on the questionnaire as:

35. How is this monitoring conducted?

1 Sample collection with laboratory analysis (Skip to Question 37)
2 Direct reading instruments
3 Both

Notes

This question was asked only if the interviewee had indicated the existence of a regular monitoring program within the facility, and the response had met the conditions specified in the discussion of question 34.

Analysis

One analysis of the responses to question 35 is presented.

Responses 35.1, 35.2, or 35.3 - Fume monitoring methods

The estimates of the plants which utilize sample collection with laboratory analysis, or direct reading instruments, or both methods in their monitoring of environmental levels of chemical materials, and workers in those plants (by number and proportion of the total) are displayed in Figure IV-32 and Tables IV-31 and IV-32.

Figure IV-32	Fume monitoring methods by plants and workers in plants
Table IV-31	Number and percent of plants and employees in plants which monitor fumes, gases, mists, dusts and vapors by method (by major industrial group)
Table IV-32	Number and percent of plants and employees in plants which monitor fumes, gases, mists, dusts and vapors by method (by 2-digit SIC)

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-31

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH MONITOR FUMES WITH LABORATORY ANALYSIS

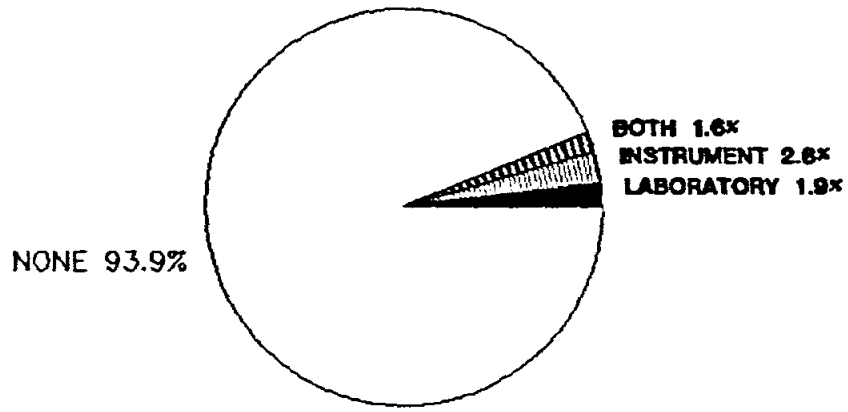
MAJOR GROUP	PLANTS			EMPLOYEES		
	COLLECTION	INSTRUMENTS	BOTH	COLLECTION	INSTRUMENTS	BOTH
07	...	...	...	...	...	...
13	208* (193) 2.2%	425* (175) 4.4%	197* (156) 2.0%	2914* (2707) .7%	66805* (31100) 16.1%	19112* (11903) 4.6%
15-17	98* (113) .1%	990* (470) 1.0%	394* (236) .4%	9792* (11291) .3%	113240* (42046) 3.7%	50336* (27961) 1.6%
20-39	6888 (759) 3.6%	4459 (758) 2.3%	5191 (579) 2.7%	2216908 (269495) 11.5%	1056854 (169371) 5.5%	4394450 (305937) 22.8%
40-49	821* (411) 1.4%	3407* (1193) 5.7%	1345* (761) 2.3%	180843* (88319) 5.7%	245756* (74885) 7.8%	123924* (34726) 3.9%
50-59	541* (419) .9%	319* (271) .5%	124* (141) .2%	31930* (16225) 2.1%	10494* (10691) .7%	37100* (42248) 2.4%
70-79	283* (193) .4%	2901* (1212) 3.8%	488* (310) .6%	67875* (21220) 3.1%	118049* (42591) 5.4%	164952* (81546) 7.5%
80	842* (322) 11.9%	655 (118) 9.3%	454* (147) 6.4%	601223* (209825) 16.4%	807959 (147691) 22.1%	451348* (125802) 12.3%
ALL	9682 (1054) 1.9%	13157 (1951) 2.6%	8193 (1064) 1.6%	3111486 (353981) 9.3%	2419157 (246516) 7.2%	5241222 (346392) 15.7%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

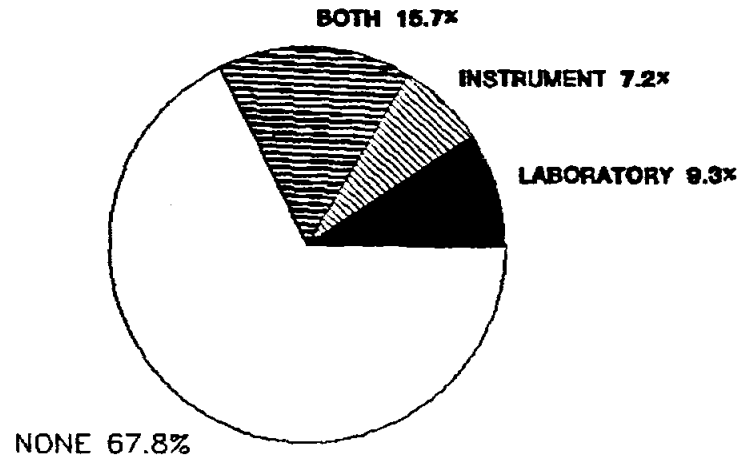
FIGURE IV - 32

FUME MONITORING METHODS BY PLANTS AND WORKERS IN PLANTS

(NOES 1981-1983)



PLANTS



WORKERS

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-32

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH MONITOR FUMES WITH LABORATORY ANALYSIS

SIC CODE	PLANTS			EMPLOYEES		
	COLLECTION	INSTRUMENTS	BOTH	COLLECTION	INSTRUMENTS	BOTH
07	...	...	...	...	...	...
13	208* (193) 2.2%	425* (175) 4.4%	197* (156) 2.0%	2914* (2707) .7%	66805* (31100) 16.1%	19112* (11903) 4.6%
15	...	26* (17) .1%	253* (216) 1.0%	...	27204* (17594) 3.0%	30708* (23271) 3.4%
16	98* (113) .8%	640* (306) 5.1%	133* (90) 1.1%	9792* (11291) 1.7%	82147* (38197) 13.9%	19071* (12961) 3.2%
17	...	324* (324) .5%	8* (10) .0%	...	3889* (3892) .2%	557* (729) .0%
20	227* (88) 1.5%	707* (216) 4.7%	212* (98) 1.4%	26453* (24390) 1.7%	257553* (75704) 16.6%	118156* (56225) 7.6%
21	26* (42) 23.8%	...	15* (8) 13.8%	1608* (2605) 1.4%	...	42021* (35930) 36.9%
22	539 (102) 11.2%	88* (52) 1.8%	41* (24) .9%	227349* (56959) 31.6%	29214* (21008) 4.1%	65034* (45716) 9.1%
23	115* (72) .7%	...	...	54285* (42381) 4.4%	...	...
24	202* (190) 1.7%	110* (101) .9%	149* (91) 1.2%	18795* (13467) 3.2%	12859* (11839) 2.2%	53106* (23947) 9.2%
25	117* (92) 2.2%	74* (70) 1.4%	...	46596* (29489) 9.0%	77760* (59575) 15.0%	...
26	385* (160) 6.5%	130* (105) 2.2%	134* (72) 2.3%	55043* (18097) 8.8%	57030* (39971) 9.1%	134273* (59277) 21.4%
27	115* (68) .6%	324* (228) 1.6%	205* (125) 1.0%	36577* (20860) 3.1%	27218* (19249) 2.3%	116584* (51771) 9.8%
28	594* (262) 7.7%	607* (252) 7.9%	1426* (428) 18.5%	209631* (61497) 22.8%	43022* (14261) 4.7%	443300 (78160) 48.3%
29	83* (120) 5.9%	350* (204) 24.9%	182* (54) 12.9%	9614* (13951) 4.3%	46678* (23003) 21.0%	139202* (70583) 62.8%
30	386* (132) 4.6%	106* (91) 1.3%	336* (155) 4.0%	96708* (40269) 12.8%	21120* (16642) 2.8%	154208* (80294) 20.5%
31	33* (35) 2.1%	35* (37) 2.3%	32* (38) 2.1%	9755* (10480) 5.5%	4706* (4963) 2.7%	10482* (12234) 6.0%
32	677* (232) 6.8%	32* (37) .3%	370* (138) 3.7%	170468* (53409) 29.6%	5451* (12015) .9%	92300* (37209) 16.0%
33	806* (271) 13.6%	144* (93) 2.4%	492* (168) 8.3%	227499* (107586) 21.2%	64539* (34651) 6.0%	445142* (107788) 41.6%

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-32 (CONTINUED)

SIC CODE	PLANTS			EMPLOYEES		
	COLLECTION	INSTRUMENTS	BOTH	COLLECTION	INSTRUMENTS	BOTH
34	890* (315) 4.0%	720* (343) 3.3%	283* (143) 1.3%	182915* (49302) 12.2%	82198* (32488) 5.5%	68683* (53827) 4.6%
35	408* (145) 1.5%	220* (105) .8%	274* (90) 1.0%	271180* (81826) 11.4%	57997* (27480) 2.4%	492779 (98600) 20.7%
36	541* (192) 5.1%	202* (88) 1.9%	400* (107) 3.8%	185970* (57936) 9.5%	156657* (55121) 8.0%	693551 (160590) 35.3%
37	374* (130) 6.7%	286* (160) 5.1%	215* (63) 3.9%	227406 (53510) 12.1%	75394* (35545) 4.0%	1085651 (216454) 57.7%
38	144* (88) 3.6%	185* (160) 4.5%	205* (95) 5.1%	105681* (70747) 13.9%	29909* (29162) 3.9%	231759* (108315) 30.5%
39	225* (254) 2.9%	139* (156) 1.8%	220* (219) 2.9%	53377* (54281) 10.2%	7548* (15598) 1.4%	8219* (20655) 1.6%
41	...	...	...	...	...	...
42	509* (342) 2.4%	486* (375) 2.3%	81* (70) .4%	38459* (25575) 4.7%	31571* (24615) 3.8%	10023* (7348) 1.2%
45	3* (4) .1%	14* (16) .4%	12* (15) .3%	13752* (14653) 3.0%	52570* (57065) 11.7%	25630* (24078) 5.7%
48	...	5* (5) .0%	754* (722) 4.8%	...	1043* (945) .2%	29368* (18733) 4.4%
49	309* (158) 3.0%	1868* (787) 18.2%	497* (348) 4.9%	128631* (71481) 15.3%	109225* (52396) 13.0%	58902* (22189) 7.0%
50	468* (417) 1.5%	98* (135) .3%	124* (141) .4%	30034* (16381) 3.3%	7179* (9867) .8%	37100* (42248) 4.1%
51	73* (66) .8%	221* (223) 2.4%	...	1896* (1708) .9%	3316* (3348) 1.6%	...
55	...	...	...	...	...	...
72	...	1602* (830) 7.5%	206* (253) 1.0%	...	35200* (17561) 7.4%	4532* (5572) 1.0%
73	246* (196) 1.3%	1299* (668) 7.1%	282* (129) 1.5%	55203* (26173) 5.0%	82849* (39937) 7.5%	160420* (81000) 14.6%
75	...	...	...	...	...	...
76	36* (45) .4%	...	...	12672* (15755) 6.2%	...	...
80	842* (322) 13.6%	655 (118) 9.3%	454* (147) 6.4%	601223* (209825) 16.4%	807959 (147691) 22.1%	451348* (125802) 12.3%
All	9682 (870) 1.9%	12123 (1852) 2.4%	8193 (1028) 1.6%	3111486 (264090) 9.4%	2367811 (262021) 7.1%	5241222 (382328) 15.8%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NOES QUESTIONNAIRE ITEM NO. 36
Direct Reading Instruments Used in Fume Monitoring

Intent

The intent of this question was to categorize the direct reading instrumentation used in the monitoring of fumes, gases, mists, dusts or vapors.

This item was displayed on the questionnaire as:

36. Which types of direct reading instruments are used in the monitoring program? Circle "yes" or "no" for each type listed below:

	Yes	No
1. Direct mass measurement tests	1	2
2. Fibrous aerosol monitors	1	2
3. Detector tubes	1	2
4. Infrared (I.R.) gas monitors	1	2
5. Ultraviolet (U.V.) gas monitors	1	2
6. Gas chromatograph monitors	1	2
7. Electrochemical monitors	1	2
8. Other "wet" chemical methods	1	2

Notes

This question was asked only of those respondents indicating the existence of a regular program to monitor gases, fumes, dusts, mists or vapors and who also indicated the use of direct reading instruments in that monitoring program. More than one type of direct reading instrument may have been specified.

Analysis

Two analysis of the responses to question 36 are presented.

(1) Response 36, sub-items 1 to 8 - Types of direct reading instruments used in plants using direct reading instruments

The estimated proportions of direct reading instrument types used in plants using direct reading instruments for fume monitoring by plants and workers are displayed in Figure IV-33.

Figure IV-33 Types of instruments used in plants using direct reading instruments by plants and workers

(2) Response 36, sub-items 1 to 8 - Estimated plants and workers using different types of direct reading instruments

The estimates, by type of direct reading instrument used, of the plants which have regular programs to monitor the environmental levels of chemical fumes, etc., and which use direct reading instruments, and workers in those plants (by number and proportion of the total) are displayed in Tables IV-33, IV-34, IV-35 and IV-36.

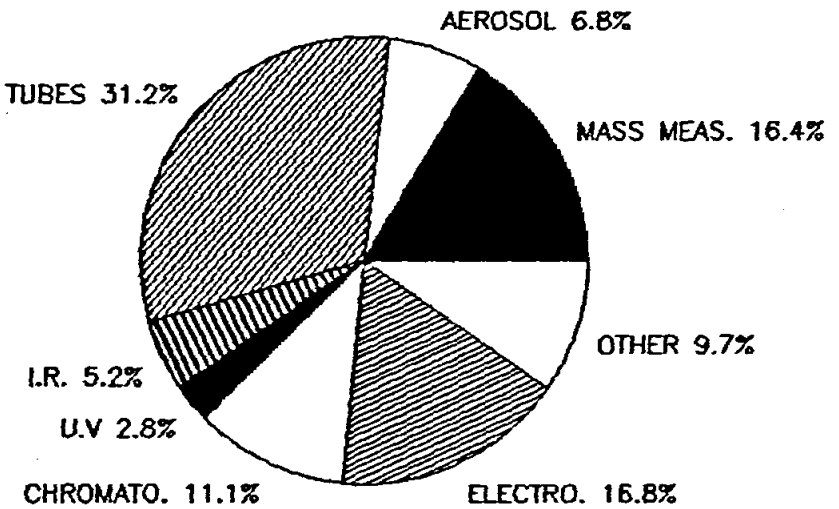
Table IV-33	Estimated number of plants by type of direct reading instrument used (by major industrial group)
Table IV-34	Estimated number of plants by type of direct reading instrument used (by 2-digit SIC)
Table IV-35	Estimated number of employees in plants by type of direct reading instrument used (by major industrial group)
Table IV-36	Estimated number of employees in plants by type of direct reading instrument used (by 2-digit SIC)

Note: These estimates of plants and workers in plants using specific types of direct measuring instruments are not mutually self-exclusive. No attempt should be made to total numbers across the eight columns of data provided.

As in Analysis 2, question 32, multiple responses to question 36 from one facility are possible. Therefore the effect of adding across columns is to multiply count a single original observation.

FIGURE IV – 33

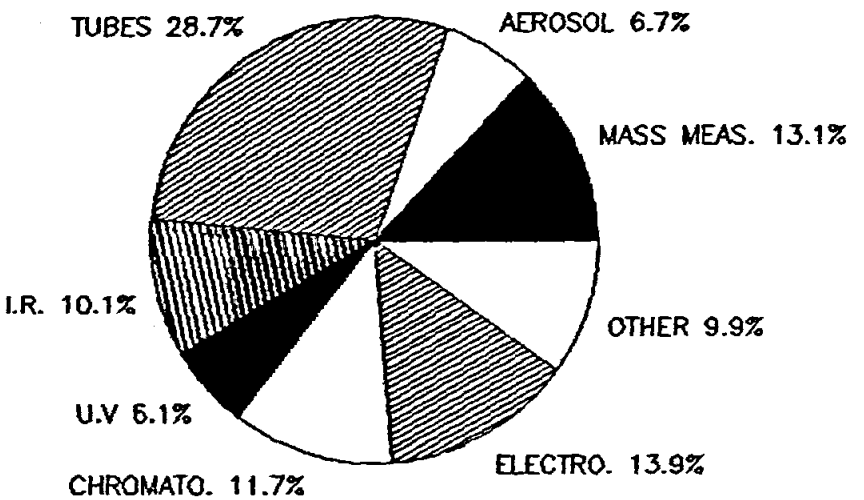
TYPES OF INSTRUMENTS USED IN PLANTS USING DIRECT READING INSTRUMENTS BY PLANTS AND WORKERS IN PLANTS (NOES 1981-1983)



PLANTS

LEGEND

MASS MEAS.	• direct mass measurement tests
AEROSOL	• fibrous aerosol monitors
TUBES	• detector tubes
I.R.	• infrared gas monitors
U.V.	• ultraviolet gas monitors
CHROMATO.	• gas chromatograph monitors
ELECTRO.	• electrochemical monitors
OTHER	• other "wet" chemical methods



WORKERS

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-33

ESTIMATED NUMBER OF PLANTS BY TYPE OF DIRECT READING INSTRUMENT USED

MAJOR GROUP	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
07	...	...	...	...	...	...	...	...
13	88* (62) .9%	...	346* (212) 3.6%	40* (31) .4%	...	40* (31) .4%	515* (257) 5.3%	...
15-17	166* (95) .2%	23* (16) .0%	804* (353) .8%	5* (5) .0%	...	177* (154) .2%	548* (278) .6%	341* (333) .3%
20-39	3112 (480) 1.6%	1044 (171) .5%	6545 (877) 3.4%	894 (220) .5%	376* (122) .2%	2181 (414) 1.1%	2031 (257) 1.1%	1635* (411) .9%
40-49	1837* (700) 3.1%	1325* (740) 2.2%	2609* (1054) 4.4%	561* (417) .9%	453* (396) .8%	1267* (681) 2.1%	1950* (752) 3.3%	966* (716) 1.6%
50-59	...	98* (135) .2%	222* (188) .4%	...	...	...	...	221* (223) .4%
70-79	960* (711) 1.3%	116* (72) .2%	1073* (530) 1.4%	92* (59) .1%	142* (70) .2%	378* (264) .5%	1328* (732) 1.8%	521* (300) .7%
80	152* (118) 2.2%	12* (13) .2%	407* (140) 5.8%	405* (116) 5.7%	102* (51) 1.4%	219* (103) 3.1%	90* (64) 1.3%	61* (29) .9%
ALL	6316 (1119) 1.2%	2619* (776) .5%	12007 (1544) 2.4%	1997 (490) .4%	1073* (424) .2%	4261 (860) .8%	6462 (1147) 1.3%	3745* (966) .7%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-34

ESTIMATED NUMBER OF PLANTS BY TYPE OF DIRECT READING INSTRUMENT USED

SIC CODE	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
07	...	...	...	...	...	...	...	...
13	88* (62) .9%	...	346* (212) 3.6%	40* (31) .4%	...	40* (31) .4%	515* (257) 5.3%	...
15	31* (22) .1%	16* (14) .1%	268* (217) 1.0%	5* (5) .0%	...	...	243* (214) .9%	5* (5) .0%
16	127* (91) 1.0%	...	528* (266) 4.2%	...	...	169* (150) 1.3%	305* (184) 2.4%	12* (27) .1%
17	8* (10) .0%	8* (10) .0%	8* (10) .0%	...	...	8* (10) .0%	...	324* (324) .5%
20	240* (119) 1.6%	...	577* (187) 3.8%	46* (31) .3%	44* (41) .3%	138* (65) .9%	213* (110) 1.4%	63* (60) .4%
21	15* (8) 13.8%	7* (11) 6.8%	12* (8) 10.8%	4* (6) 4.0%	...	12* (8) 10.8%	15* (8) 13.8%	12* (8) 10.8%
22	47* (31) 1.0%	39* (27) .8%	30* (22) .6%	...	...	8* (8) .2%	...	...
23	...	...	...	...	...	...	...	...
24	66* (63) .6%	76* (68) .6%	193* (120) 1.6%	...	...	186* (120) 1.6%	...	110* (101) .9%
25	3* (4) .1%	...	74* (70) 1.4%	...	...	3* (4) .1%	...	...
26	120* (133) 2.0%	66* (53) 1.1%	208* (148) 3.5%	...	21* (20) .4%	67* (55) 1.1%	87* (62) 1.5%	66* (50) 1.1%
27	253* (167) 1.2%	12* (20) .1%	517* (258) 2.5%	...	...	31* (32) .2%	21* (23) .1%	4* (4) .0%
28	365* (127) 4.7%	144* (66) 1.9%	1630* (456) 21.1%	45* (25) .6%	63* (31) .8%	881* (359) 11.4%	558* (146) 7.2%	487* (326) 6.3%
29	147* (47) 10.4%	51* (39) 3.6%	248* (88) 17.6%	122* (42) 8.7%	31* (31) 2.2%	189* (64) 13.5%	219* (111) 15.6%	282* (201) 20.0%
30	43* (31) .5%	108* (72) 1.3%	245* (114) 2.9%	...	62* (61) .7%	133* (86) 1.6%	106* (93) 1.2%	68* (62) .8%
31	...	...	67* (54) 4.4%	...	...	...	...	...
32	221* (133) 2.2%	28* (33) .3%	216* (92) 2.2%	...	...	59* (35) .6%	94* (82) .9%	36* (29) .4%
33	340* (125) 5.7%	98* (55) 1.7%	521* (169) 8.8%	16* (14) .3%	...	90* (88) 1.5%	103* (48) 1.7%	111* (69) 1.9%

SIC CODE	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
34	522* (282) 2.4%	150* (85) .7%	410* (155) 1.9%	199* (169) .9%	3* (8) .0%	67* (37) .3%	176* (95) .8%	70* (59) .3%
35	116* (53) .4%	88* (47) .3%	346* (99) 1.3%	58* (32) .2%	52* (29) .2%	38 (9) .1%	73* (29) .3%	71* (39) .3%
36	186* (75) 1.8%	95* (71) .9%	421 (104) 4.0%	130* (54) 1.2%	37* (22) .3%	123* (42) 1.2%	137* (80) 1.3%	68* (40) .6%
37	58* (21) 1.0%	71* (30) 1.3%	378* (157) 6.8%	137* (78) 2.4%	38* (16) .7%	73* (40) 1.3%	117* (47) 2.1%	71 (11) 1.3%
38	85* (76) 2.1%	...	315* (149) 7.8%	139* (100) 3.4%	25* (33) .6%	83* (80) 2.1%	86* (79) 2.1%	116* (81) 2.9%
39	284* (214) 3.7%	11* (34) .1%	138* (150) 1.8%	...	...	...	25* (104) .3%	...
41	...	...	...	...	...	...	...	...
42	98* (45) .5%	73* (71) .3%	73* (71) .3%	...	...	...	241* (223) 1.1%	301* (291) 1.4%
45	10* (15) .2%	10* (15) .2%	27* (20) .7%	...	...	...	3* (4) .1%	...
48	751* (722) 4.8%	751* (722) 4.8%	754* (722) 4.8%	...	...	...	5* (5) .0%	...
49	380* (316) 3.7%	492* (393) 4.8%	721* (422) 7.0%	329* (351) 3.2%	453* (396) 4.4%	668* (409) 6.5%	1102* (528) 10.8%	665* (460) 6.5%
50	...	98* (135) .3%	222* (188) .7%	...	...	...	...	...
51	...	...	...	...	...	...	...	221* (223) 2.4%
55	...	...	...	...	...	...	...	...
72	780* (620) 3.7%	...	426* (365) 2.0%	...	...	...	760* (607) 3.6%	48* (48) .2%
73	180* (110) 1.0%	116* (72) .6%	648* (353) 3.5%	92* (59) .5%	142* (70) .8%	378* (264) 2.1%	569* (433) 3.1%	473* (295) 2.6%
75	...	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...	...
80	152* (118) 2.2%	12* (13) .2%	407* (140) 5.8%	405* (116) 5.7%	102* (51) 1.4%	219* (103) 3.1%	90* (64) 1.3%	61* (29) .9%
ALL	5717 (951) 1.1%	2619* (776) .5%	10974 (1518) 2.2%	1765* (469) .3%	1073* (410) .2%	3663 (713) .7%	5864 (1230) 1.2%	3745* (1037) .7%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-35

ESTIMATED NUMBER OF EMPLOYEES IN PLANTS BY TYPE OF DIRECT READING INSTRUMENT USED

MAJOR GROUP	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
07	...	...	...	...	...	...	...	...
13	17700* (12000) 4.3%	...	68603* (42492) 16.6%	15189* (11898) 3.7%	...	15189* (11898) 3.7%	73757* (43173) 17.8%	...
15-17	58197* (30418) 1.9%	3663* (2760) .1%	112300* (50382) 3.7%	20157* (21701) .7%	...	47792* (39814) 1.6%	86317* (42860) 2.8%	32481* (30778) 1.1%
20-39	2285655 (274281) 11.9%	1174143 (228410) 6.1%	4662873 (311970) 24.2%	1432381 (179644) 7.4%	936682 (209183) 4.9%	1919790 (258231) 10.0%	2383938 (224008) 12.4%	1750953 (282360) 9.1%
40-49	94247* (30755) 3.0%	87341* (36270) 2.8%	238925* (65819) 7.6%	11412* (8781) .4%	36262* (31700) 1.1%	88475* (35488) 2.8%	148051* (38122) 4.7%	70638* (40145) 2.2%
50-59	...	7179* (9867) .5%	44279* (42683) 2.9%	...	...	...	...	3316* (3348) .2%
70-79	102264* (42701) 4.7%	56185* (30433) 2.6%	211032* (94211) 9.6%	95707* (63331) 4.4%	117484* (65484) 5.3%	123715* (61457) 5.6%	80735* (34170) 3.7%	72330* (29120) 3.3%
80	133088* (64039) 3.6%	45006* (36568) 1.2%	566623* (212360) 15.5%	501089 (114557) 13.7%	156156* (72187) 4.3%	209772* (74881) 5.7%	80573* (49555) 2.2%	115006* (56383) 3.1%
ALL	2691151 (288392) 8.1%	1373517 (236337) 4.1%	5904635 (402239) 17.7%	2075935 (223821) 6.2%	1246584 (232941) 3.7%	2404733 (281164) 7.2%	2853372 (242811) 8.5%	2044725 (293809) 6.1%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-36

ESTIMATED NUMBER OF EMPLOYEES IN PLANTS BY TYPE OF DIRECT READING INSTRUMENT USED

SIC CODE	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
07	...	...	...	...	...	...	...	...
13	17700* (12000) 4.3%	...	68603* (42492) 16.6%	15189* (11898) 3.7%	...	15189* (11898) 3.7%	73757* (43173) 17.8%	...
15	15203* (14185) 1.7%	3106* (2726) .3%	42805* (24563) 4.8%	20157* (21701) 2.2%	...	...	22552* (13168) 2.5%	20157* (21701) 2.2%
16	42437* (27586) 7.2%	...	68937* (42956) 11.6%	...	...	47235* (39394) 8.0%	63765* (40261) 10.8%	8435* (19241) 1.4%
17	557* (729) .0%	557* (729) .0%	557* (729) .0%	...	...	557* (729) .0%	...	3889* (3892) .2%
20	80225* (35371) 5.2%	...	272907* (79490) 17.6%	63050* (31016) 4.1%	9404* (8758) .6%	105832* (47948) 6.8%	117827* (54282) 7.6%	51310* (48988) 3.3%
21	42021* (35930) 36.9%	16019* (23625) 14.1%	16277* (23396) 14.3%	258* (345) .2%	...	16277* (23396) 14.3%	42021* (35930) 36.9%	16277* (23396) 14.3%
22	67170* (52134) 9.4%	20205* (13318) 2.8%	53087* (46469) 7.4%	...	...	46166* (45024) 6.5%	...	...
23	...	...	...	...	...	...	...	...
24	33214* (23258) 5.7%	11747* (10539) 2.0%	32752* (17396) 5.7%	...	...	24606* (15577) 4.2%	...	12859* (11839) 2.2%
25	20917* (22806) 4.0%	...	77760* (59575) 15.0%	...	...	20917* (22806) 4.0%	...	...
26	74094* (75530) 11.8%	93108* (64580) 14.9%	139876* (88867) 22.3%	...	12975* (12418) 2.1%	81466* (61087) 13.0%	106083* (68189) 16.9%	51886* (43062) 8.3%
27	82523* (36937) 7.0%	12676* (20866) 1.1%	137430* (52767) 11.6%	...	...	34991* (24532) 3.0%	13537* (15007) 1.1%	20626* (18958) 1.7%
28	206931 (38271) 22.5%	79275* (38364) 8.6%	449582 (80355) 49.0%	106528* (55645) 11.6%	71388* (46150) 7.8%	244792 (60820) 26.7%	235998* (68295) 25.7%	84748* (45981) 9.2%
29	84148* (33144) 37.9%	24714* (18325) 11.1%	157074* (74566) 70.8%	71476* (54853) 32.2%	34219* (54628) 15.4%	112706* (69198) 50.8%	126695* (72997) 57.1%	86681* (38123) 39.1%
30	36093* (19511) 4.8%	87397* (64429) 11.6%	142936* (69073) 19.0%	...	64484* (63269) 8.6%	99350* (68369) 13.2%	27014* (27030) 3.6%	69230* (63952) 9.2%
31	...	...	15188* (13315) 8.6%	...	...	...	...	...
32	23587* (13083) 4.1%	1844* (2167) .3%	73206* (33629) 12.7%	...	...	26224* (18065) 4.6%	18022* (17959) 3.1%	21956* (17692) 3.8%
33	276518* (96692) 25.8%	89278 (21670) 8.3%	471940 (101893) 44.1%	55683* (43000) 5.2%	...	68521* (54929) 6.4%	168528 (22152) 15.7%	190785* (78595) 17.8%

SIC CODE	MASS MEASUREMENT	AEROSOL	DETECTOR TUBES	INFRARED GAS	ULTRA-VIOLET GAS	GAS CHROMA-TOGRAPH	ELECTRO-CHEMICAL	OTHER WET CHEMICAL
34	54367* (28564) 3.6%	23288* (26101) 1.5%	108154* (62088) 7.2%	27148* (15667) 1.8%	3227* (8689) .2%	21044* (8773) 1.4%	20557* (12680) 1.4%	15554* (13107) 1.0%
35	166101* (64300) 7.0%	141829* (52315) 6.0%	489366 (101557) 20.6%	159989* (44230) 6.7%	143251* (40618) 6.0%	146158* (37044) 6.1%	256316* (98724) 10.8%	125599* (43657) 5.3%
36	371847* (164186) 18.9%	218113* (152154) 11.1%	682368 (157772) 34.7%	280058* (118084) 14.2%	145638* (108504) 7.4%	240593 (57723) 12.2%	344232* (144285) 17.5%	217263* (150213) 11.1%
37	506788* (254820) 27.0%	352453* (162022) 18.7%	1097019 (176472) 58.3%	543868* (277025) 28.9%	418786* (216160) 22.3%	478226* (310759) 25.4%	747621* (296434) 39.8%	621057* (196334) 33.0%
38	155451* (114926) 20.5%	...	237444* (106903) 31.3%	124324* (114318) 16.4%	33311* (46769) 4.4%	151921* (121509) 20.0%	156083* (118130) 20.6%	165121* (112000) 21.7%
39	3660* (2598) .7%	2198* (6852) .4%	8506* (17846) 1.6%	...	...	...	3403* (13914) .6%	...
41	...	...	...	...	...	...	...	...
42	27121* (14169) 3.3%	7010* (6805) .9%	7010* (6805) .9%	...	...	...	15248* (12141) 1.9%	6235* (4656) .8%
45	11401* (18177) 2.5%	11401* (18177) 2.5%	78200* (61379) 17.3%	...	...	...	14228* (18215) 3.2%	...
48	16143* (14712) 2.4%	16143* (14712) 2.4%	29368* (18733) 4.4%	...	...	...	1043* (945) .2%	...
49	30004* (21641) 3.6%	52788* (33287) 6.3%	73000* (24602) 8.7%	3287* (3514) .4%	36262* (31700) 4.3%	78897* (35621) 9.4%	107954* (40504) 12.8%	64403* (37683) 7.7%
50	...	7179* (9867) .8%	44279* (42683) 4.8%	...	...	...	...	...
51	...	...	...	...	...	...	...	3316* (3345) 1.6%
55	...	...	...	...	...	...	...	...
72	10274* (7884) 2.2%	...	10903* (9554) 2.3%	...	...	...	17084* (14302) 3.6%	6003* (6025) 1.3%
73	91990* (40545) 8.4%	56185* (30433) 5.1%	200129* (93654) 18.2%	95707* (63331) 8.7%	117484* (65484) 10.7%	123715* (61457) 11.2%	63651* (32238) 5.8%	66328* (28429) 6.0%
75	...	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...	...
80	133088* (64039) 3.6%	45006* (36568) 1.2%	566623* (212360) 15.5%	501089 (114557) 13.7%	156156* (72187) 4.3%	209772* (74881) 5.7%	80573* (49555) 2.2%	115006* (56383) 3.1%
ALL	2681573 (245559) 8.1%	1373517 (261706) 4.7%	5853289 (424585) 17.6%	2067810 (162135) 6.2%	1246584 (211924) 3.7%	2395155 (239695) 7.2%	2843794 (262815) 8.6%	2044725 (318807) 6.1%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NOES QUESTIONNAIRE ITEM NO. 37
Retention of Records From Fume Monitoring Programs

Intent

The intent of this question was to determine the length of time that facilities retain the records from programs to monitor fumes, gases, dusts, or mists in the workplace.

This item was displayed on the questionnaire as:

37. How long do you retain the records of the monitoring program?

__ Years (If "forever" code "99")
(If "unknown" code "UK")

Notes

This question was asked only of those respondents who indicated that a program to monitor fumes, gases, mists, or dusts was in existence in the facility.

Definitions, inclusions, and exclusions pertaining to fume monitoring are found in the Notes text of questionnaire item 36.

As discussed in the Notes text for question 33, three classes of responses to question 37 were possible. As before, responses of "unknown" duration were discarded, and the "forever" and "non-forever" values analyzed separately.

Analysis

Two analyses of the responses to question 37 are presented.

(1) Response 37 - "Non-forever" or average years of retention for the records from fume monitoring programs

The estimated average length of time that records from fume monitoring programs are retained are displayed in Figures IV-34 and IV-35, and Tables IV-37 and IV-38.

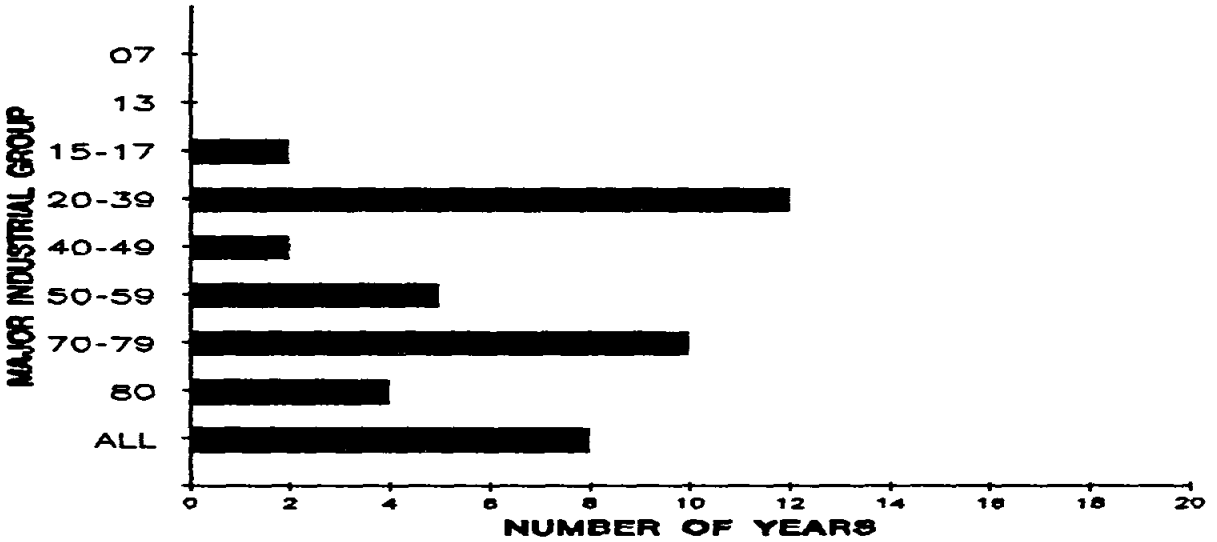
Figure IV-34	Average number of "non-forever" years plants keep fume monitoring records (by major industrial group)
Figure IV-35	Average number of "non-forever" years plants keep fume monitoring records (by 2-digit SIC)
Table IV-37	Average number of years facilities keep fume monitoring records among plants not reporting "forever" (by major industrial group)
Table IV-38	Average number of years facilities keep fume monitoring records among plants not reporting "forever" (by 2-digit SIC)

(2) Response 37 - Fume monitoring records kept "forever"

The estimates of the plants which keep fume monitoring records "forever", and workers in those plants (by number and proportion of the total) are displayed in Figures IV-36 and IV-37, and Tables IV-39 and IV-40.

Figure IV-36	Proportion of plants which keep fume monitoring records "forever" (by major industrial group)
Figure IV-37	Plants which keep fume monitoring records "forever" (by 2-digit SIC)
Table IV-39	Number and percent of plants and employees in plants which keep fume monitoring records "forever" (by major industrial group)
Table IV-40	Number and percent of plants and employees in plants which keep fume monitoring records "forever" (by 2-digit SIC)

FIGURE IV – 34
AVERAGE NUMBER OF "NON-FOREVER" YEARS PLANTS KEEP FUME MONITORING RECORDS
(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-37

AVERAGE NUMBER OF YEARS FACILITIES KEEP FUME MONITORING RECORDS AMONG PLANTS NOT REPORTING "FOREVER"

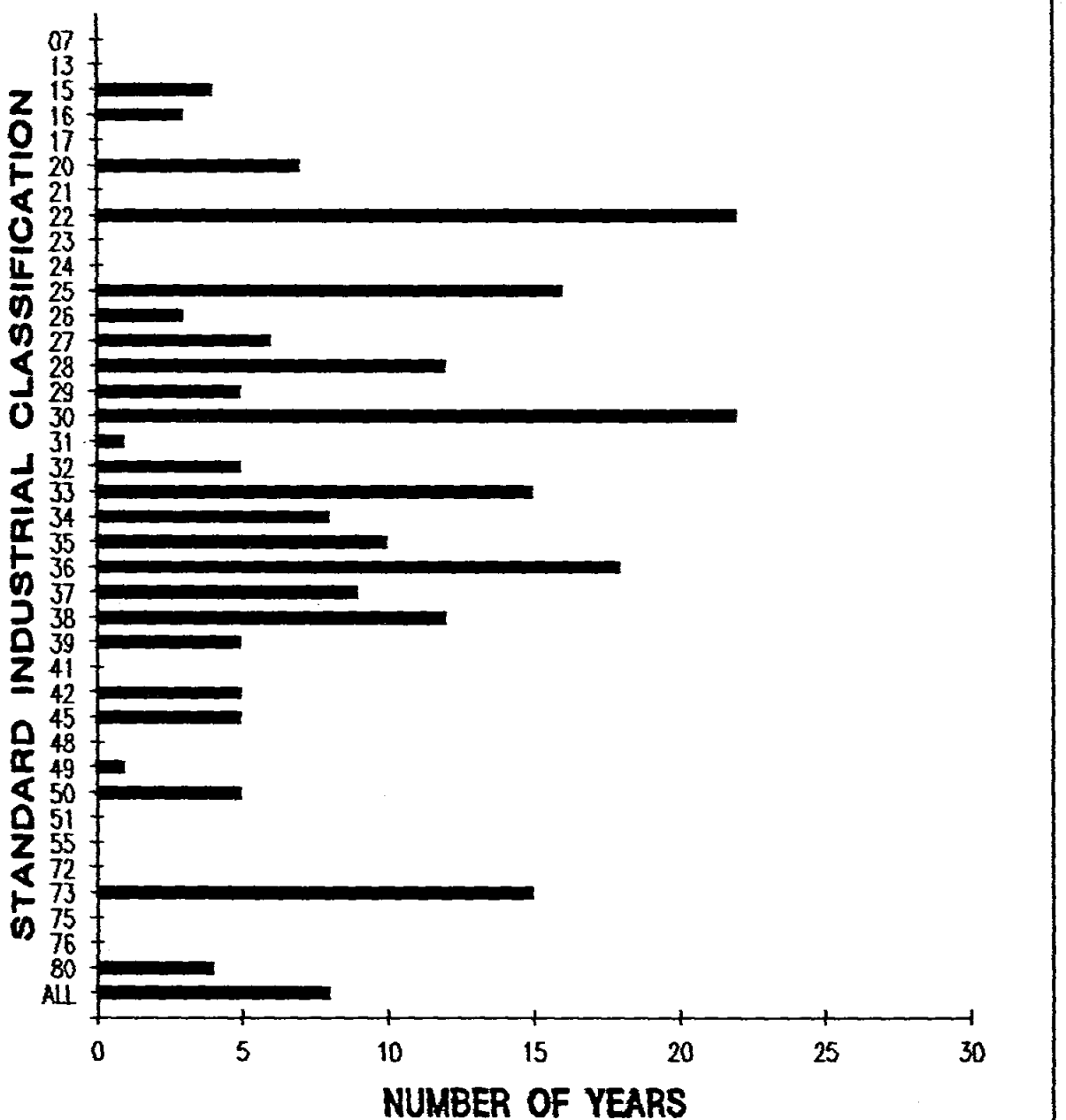
MAJOR GROUP	PLANT SIZE SMALL (8-99)	MEDIUM (100-499)	LARGE (≥500)	ALL
07	...	...	...	...
13	...	...	...	...
15-17	2* (2)	4* (2)	1* (1)	2* (2)
20-39	9* (4)	8 (2)	21 (3)	12 (2)
40-49	<1	19* (17)	21* (13)	2* (2)
50-59	...	5* (3)	...	5* (3)
70-79	7* (7)	75* (53)	...	10* (8)
80	...	4* (2)	8* (3)	4* (2)
ALL	5* (2)	11* (3)	17 (3)	8 (2)

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 35

AVERAGE NUMBER OF "NON-FOREVER" YEARS
PLANTS KEEP FUME MONITORING RECORDS

(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-38

AVERAGE NUMBER OF YEARS FACILITIES KEEP FUME MONITOR RECORDS AMONG PLANTS NOT REPORTING "FOREVER"

SIC CODE	PLANT SIZE SMALL (8-99)	MEDIUM (100-499)	LARGE (≥500)	ALL
07	...	...	...	...
13	...	...	...	...
15	...	5* (4)	2* (1)	4* (3)
16	3* (2)	4* (2)	...	3* (2)
17	...	...	...	...
20	...	6* (4)	17* (14)	7* (3)
21	...	...	...	...
22	...	11* (7)	30 (2)	22 (5)
23	...	...	...	...
24	...	...	...	...
25	...	30* (21)	5* (4)	16* (12)
26	...	3* (2)	...	3* (2)
27	...	5* (4)	8* (6)	6* (3)
28	4* (7)	6* (6)	41* (18)	12* (10)
29	...	...	30 (<.5)	5* (18)
30	...	16* (12)	26* (10)	22* (8)
31	...	1* (1)	...	1* (1)
32	...	7* (5)	3* (2)	5* (3)
33	16* (10)	10* (10)	9* (6)	15* (7)

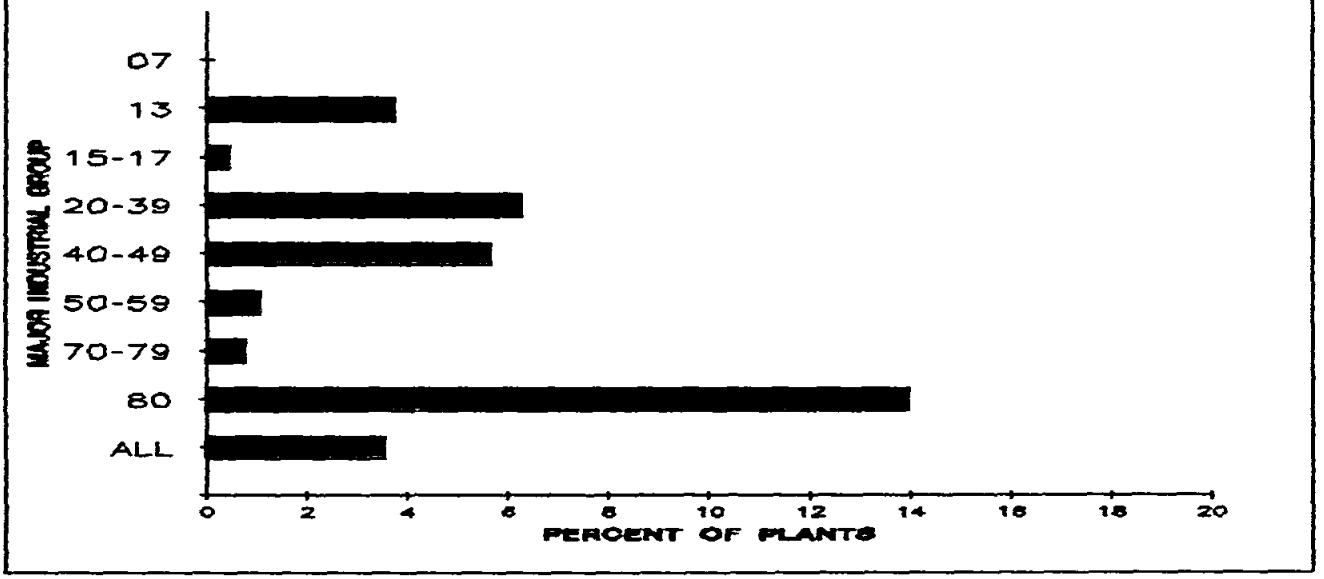
SIC CODE	PLANT SIZE SMALL (8-99)	MEDIUM (100-499)	LARGE (≥500)	ALL
34	...	9* (7)	5* (4)	8* (5)
35	...	1* (1)	19* (6)	10* (4)
36	40* (27)	5* (2)	18* (9)	18* (9)
37	4* (2)	...	25 (4)	9* (8)
38	...	29* (13)	7* (7)	12* (8)
39	2* (1)	5* (4)	30* (21)	5* (10)
41	...	...	...	...
42	...	25* (25)	...	5* (5)
45	...	...	5* (13)	5* (13)
48	...	...	...	...
49	<1	...	30* (21)	1* (1)
50	...	5* (3)	...	5* (3)
51	...	...	...	...
55	...	...	...	...
72	...	...	...	...
73	12* (8)	75* (53)	...	15* (13)
75	...	...	...	...
76	...	...	...	...
80	...	4* (2)	8* (3)	4* (2)
ALL	5* (2)	11* (3)	17 (3)	8 (2)

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 36

PROPORTION OF PLANTS WHICH KEEP FUME MONITORING RECORDS "FOREVER"

(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-39

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH KEEP FUME MONITORING RECORDS "FOREVER"

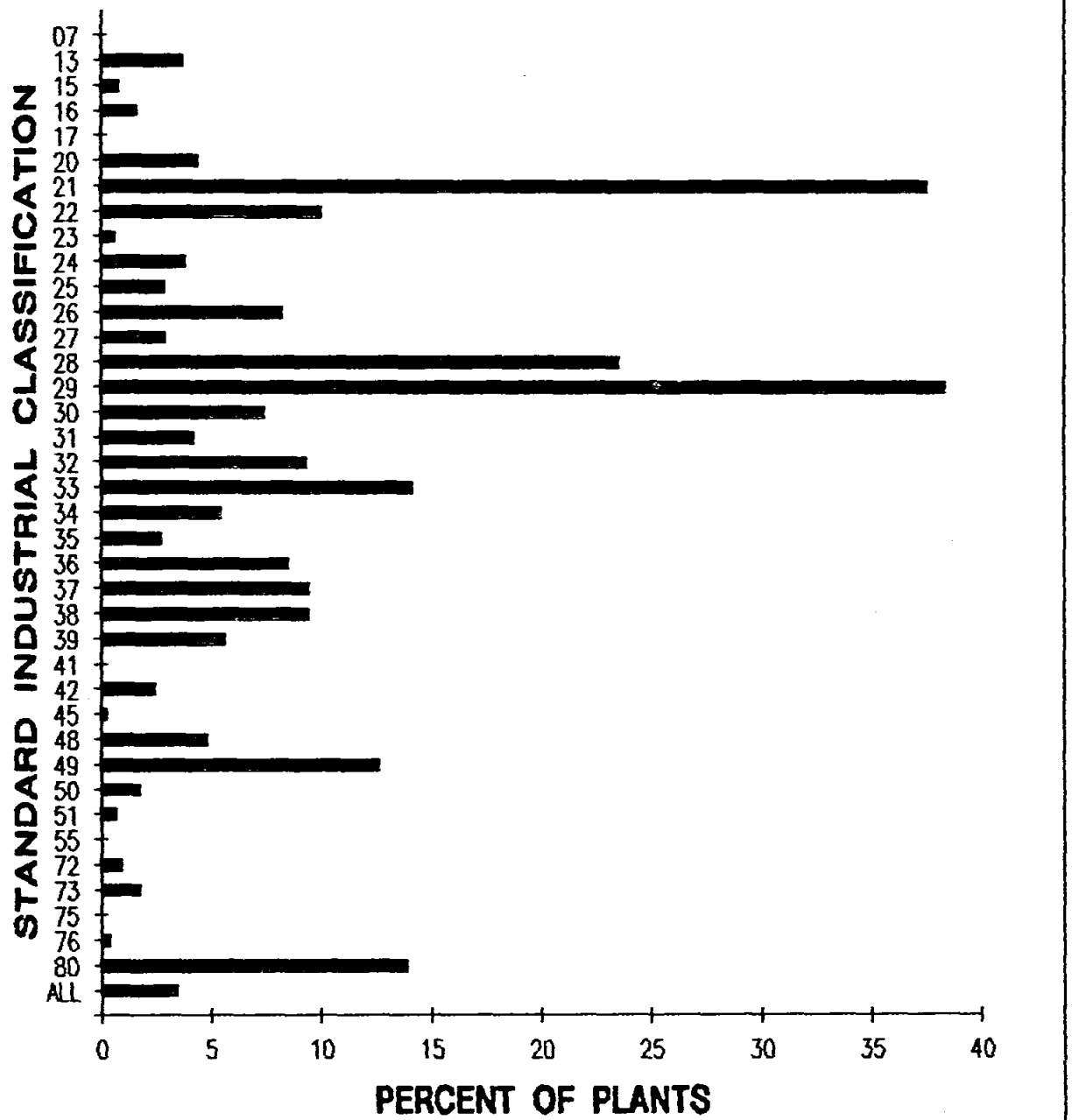
MAJOR GROUP	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
07	...	...	...	...	...	...	...	...
13	60* (65) .7%	306* (183) 30.0%	...	366* (198) 3.8%	3743* (4061) 1.8%	53967* (32688) 31.0%	...	57710* (33140) 13.9%
15-17	241* (216) .3%	185* (126) 4.5%	35* (47) 14.6%	461* (251) .5%	8002* (6954) .4%	21339* (13700) 2.9%	38283* (35875) 16.2%	67625* (37893) 2.2%
20-39	4246 (732) 2.8%	5150 (534) 16.2%	2708 (217) 43.2%	12103 (961) 6.3%	201884 (33327) 4.4%	1157064 (130721) 18.1%	4507450 (362619) 54.5%	5866398 (417130) 30.5%
40-49	2531* (1001) 4.8%	711* (233) 12.2%	132* (61) 28.2%	3374* (1081) 5.7%	113003* (43011) 7.9%	144652* (48986) 12.5%	129818* (49238) 22.6%	387473 (93092) 12.3%
50-59	421* (420) .7%	224* (173) 8.4%	...	645* (465) 1.1%	10447* (10095) .9%	52206* (45382) 12.8%	...	62654* (47527) 4.1%
70-79	206* (253) .3%	241* (81) 10.3%	135* (107) 38.2%	582* (266) .8%	4532* (5572) .3%	72227* (22200) 15.5%	162895* (97151) 48.0%	239654* (94596) 10.9%
80	...	415* (161) 19.2%	572 (78) 27.8%	987 (177) 14.0%	...	83819* (33212) 15.7%	895928 (134940) 29.6%	979747 (140287) 26.8%
ALL	7704 (1352) 1.7%	7231 (672) 14.5%	3582 (265) 37.9%	18518 (1585) 3.6%	341612 (56200) 3.1%	1585274 (156202) 16.1%	5734375 (403548) 46.0%	7661261 (464850) 22.9%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 37

PLANTS WHICH KEEP FUME MONITORING RECORDS "FOREVER"

(NOES 1981-1983)



NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH KEEP FUPE MONITORING RECORDS "FOREVER"

SIC CODE	PLANTS				EMPLOYEES			
	SMALL (8-99)	MEDIUM (100-499)	LARGE (≥500)	TOTAL	SMALL (8-99)	MEDIUM (100-499)	LARGE (≥500)	TOTAL
07	...	...	...	...	...	...	...	...
13	60* (65) .7%	306* (183) 30.0%	...	366* (198) 3.8%	3743* (4061) 1.8%	53967* (32688) 31.0%	...	57710* (33140) 13.9%
15	233* (215) .9%	...	5* (5) 3.7%	238* (215) .9%	7445* (6875) 1.3%	...	20157* (21701) 15.0%	27602* (22665) 3.1%
16	...	185* (126) 16.5%	30* (46) 28.4%	215* (126) 1.7%	...	21339* (13700) 10.3%	18126* (28085) 17.9%	39465* (28317) 6.7%
17	8* (10) .0%	...	...	8* (10) .0%	557* (729) .0%	...	...	557* (729) .0%
20	128* (82) 1.1%	368* (151) 11.4%	180* (71) 32.3%	676* (190) 4.5%	4361* (2778) 1.1%	72644* (24748) 10.8%	177583* (62372) 36.1%	254588* (68580) 16.4%
21	30* (43) 100.0%	...	11* (11) 13.5%	41* (42) 37.6%	1866* (2685) 100.0%	...	41763* (36135) 37.2%	43629* (35411) 38.3%
22	...	375* (151) 23.6%	112* (55) 37.5%	487* (141) 10.1%	...	99876* (41252) 28.8%	98613* (65140) 37.8%	198489* (63755) 27.8%
23	...	68* (52) 2.2%	47* (41) 19.4%	115* (72) .7%	...	7223* (5471) 1.2%	47062* (40984) 22.6%	54285* (42381) 4.4%
24	175* (182) 1.6%	267* (137) 23.2%	19* (8) 18.1%	461* (200) 3.9%	8023* (7237) 2.6%	40970* (20506) 22.3%	35767* (18789) 38.7%	84760* (29875) 14.6%
25	48* (74) 1.1%	26* (43) 2.5%	85* (74) 71.7%	159* (99) 3.0%	3348* (5195) 2.4%	10275* (16813) 4.0%	90475* (62473) 73.6%	104099* (64021) 20.1%
26	184* (136) 4.5%	204* (143) 13.0%	99* (63) 46.4%	487* (243) 8.3%	15793* (11419) 11.5%	53634* (36457) 19.1%	134681* (62745) 65.1%	204108* (88476) 32.6%
27	384* (230) 2.1%	137* (79) 7.3%	83* (50) 26.4%	604* (271) 3.0%	19205* (12304) 4.0%	29118* (17335) 8.1%	103446* (46659) 29.9%	151769* (53848) 12.8%
28	977* (373) 15.8%	613 (116) 52.8%	232* (68) 60.9%	1821 (413) 23.6%	33786* (10653) 18.7%	154831 (31919) 59.4%	319111* (121327) 67.0%	507728 (125626) 55.3%
29	249* (178) 24.6%	203* (115) 69.3%	87* (38) 86.5%	540* (227) 38.4%	17737* (11943) 43.3%	44393* (16813) 70.2%	77880* (33613) 66.3%	140009* (45779) 63.1%
30	263* (141) 3.9%	255* (162) 16.6%	120* (78) 53.5%	638* (184) 7.5%	16424* (8546) 7.3%	54155* (38654) 18.4%	114171* (71232) 48.9%	184750* (78354) 24.5%
31	...	65* (52) 11.4%	...	65* (52) 4.3%	...	20236* (16287) 14.9%	...	20236* (16287) 11.5%
32	354* (188) 4.0%	450* (144) 44.4%	134* (62) 72.9%	938* (252) 9.4%	17707* (9932) 7.5%	90036* (27308) 43.1%	101627* (48533) 78.8%	209370* (55202) 36.4%
33	138* (95) 3.3%	472* (147) 32.2%	234* (62) 69.3%	843 (199) 14.2%	10216* (6769) 7.4%	101434* (34598) 32.6%	438847 (66987) 70.6%	550496 (77836) 51.4%

SIC CODE	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
34	558* (251) 3.0%	512 (100) 16.4%	148* (60) 42.9%	1219 (292) 5.5%	22421* (9241) 4.0%	97447 (22701) 16.3%	141526* (73836) 40.3%	261394* (76161) 17.4%
35	59* (64) .3%	412* (164) 12.1%	273 (61) 34.9%	745* (191) 2.8%	3254* (3512) .5%	110619* (42294) 16.7%	444705 (83125) 40.0%	558578 (92851) 23.5%
36	146* (103) 2.1%	321* (135) 12.0%	447* (124) 56.8%	914* (247) 8.6%	8093* (6056) 3.5%	78745* (33919) 14.2%	806016 (170559) 68.2%	892853 (186942) 45.4%
37	53* (66) 1.3%	239* (126) 20.1%	237* (81) 56.9%	529* (153) 9.5%	3953* (4982) 3.1%	53889* (33543) 22.5%	1068795 (216157) 70.6%	1126637 (207188) 59.9%
38	207* (176) 7.7%	29* (26) 3.0%	149* (73) 35.8%	385* (156) 9.5%	8423* (6305) 8.1%	8684* (9312) 4.5%	245916* (102845) 53.4%	263023* (101712) 34.6%
39	292* (209) 4.5%	132* (335) 16.6%	10* (10) 3.0%	435* (385) 5.7%	7275* (5776) 4.4%	28855* (69969) 19.3%	19466* (18968) 9.3%	55595* (69146) 10.6%
41	...	...	...	...	...	...	...	...
42	488* (350) 2.4%	17* (20) 1.1%	25* (26) 30.7%	530* (344) 2.5%	36734* (26386) 7.5%	1689* (2029) .7%	20111* (20857) 26.9%	58535* (27698) 7.1%
45	...	...	13* (16) 8.8%	13* (16) .3%	...	...	25153* (25573) 9.5%	25153* (25573) 5.6%
48	751* (722) 5.1%	5* (5) .6%	3* (4) 10.1%	760* (722) 4.9%	16143* (14712) 3.8%	1043* (945) .6%	13226* (14092) 18.9%	30412* (19386) 4.5%
49	693* (474) 8.4%	513* (211) 27.5%	91* (62) 52.3%	1297* (569) 12.7%	50548* (36121) 18.8%	115906* (47732) 27.2%	71328* (48642) 48.7%	237782* (82520) 28.3%
50	348* (416) 1.1%	224* (173) 12.5%	...	572* (461) 1.8%	8552* (9990) 1.4%	52206* (45382) 18.4%	...	60758* (47403) 6.7%
51	73* (66) .8%	...	...	73* (66) .8%	1896* (1708) 1.0%	...	...	1896* (1708) .9%
55	...	...	...	...	...	...	...	...
72	206* (253) 1.0%	...	...	206* (253) 1.0%	4532* (5572) 1.2%	...	...	4532* (5572) 1.0%
73	...	204* (77) 13.7%	135* (107) 39.7%	340* (140) 1.8%	...	59554* (19426) 17.0%	162895* (97151) 49.5%	222450* (97621) 20.2%
75	...	...	...	...	...	...	...	...
76	...	36* (45) 29.4%	...	36* (45) .4%	...	12672* (15755) 52.1%	...	12672* (15755) 6.2%
80	...	415* (161) 19.2%	572 (78) 27.8%	987 (177) 14.0%	...	83819* (33212) 15.7%	895928 (134940) 29.6%	979747 (140287) 26.8%
ALL	7106 (1215) 1.6%	7055 (617) 14.2%	3582 (197) 38.0%	17743 (1332) 3.5%	332034 (43476) 3.0%	1559261 (148843) 16.0%	5734375 (319080) 46.0%	7625670 (350782) 22.9%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

NOES QUESTIONNAIRE ITEM NO. 38
Substitution of Chemical Materials

Intent

The intent of this question was to determine whether the facility had substituted chemical agents within the past five years.

This item was displayed on the questionnaire as:

38. Have any substitutions of chemical materials been made within the last 5 years?

1 Yes
2 No (Skip to Question 41)

Notes

The term "substitutions" used in this question means to cease use of one chemical material and initiate use of an alternative.

The exchange of one tradename compound for another was not considered a substitution unless it was related to the actual chemical content of both tradename products.

Analysis

One analysis of the responses to question 38 is presented.

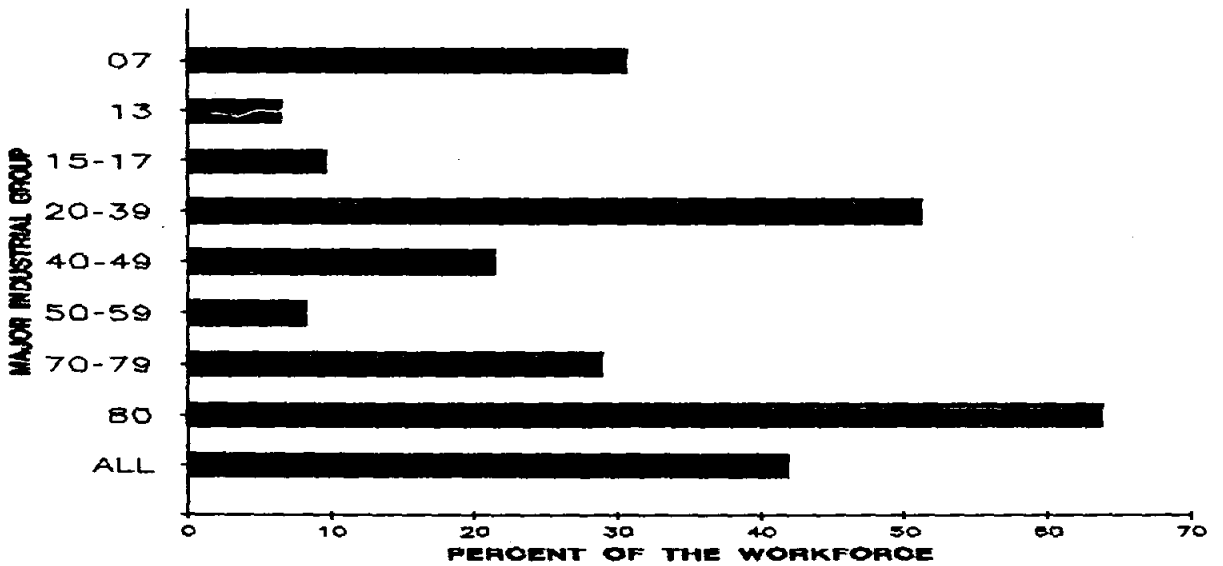
Response 38.1 - Chemical substitutions made in the last five years

The estimates of the plants which have substituted chemical materials in the past five years, and workers in those plants (by number and proportion of the total) are displayed in Figures IV-38, IV-39, IV-40, IV-41, IV-42, and IV-43, and Tables IV-41 and IV-42.

Figure IV-38	Workers in plants where chemicals were substituted (by major industrial group)
Figure IV-39	Workers in plants where chemicals were substituted (by 2-digit SIC)
Figure IV-40	Plants where chemicals were substituted (by major industrial group)
Figure IV-41	Plants where chemicals were substituted (by 2-digit SIC)
Figure IV-42	Substitution of chemical materials by plant size
Figure IV-43	Chemical substitution by workforce proportion and plant size
Table IV-41	Number and percent of plants and employees in plants which have substituted chemical materials in the last five years (by major industrial group)
Table IV-42	Number and percent of plants and employees in plants which have substituted chemical materials in the last five years (by 2-digit SIC)

FIGURE IV – 38

WORKERS IN PLANTS WHERE CHEMICALS WERE SUBSTITUTED
(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-41

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH HAVE SUBSTITUTED CHEMICAL MATERIALS IN THE LAST FIVE YEARS

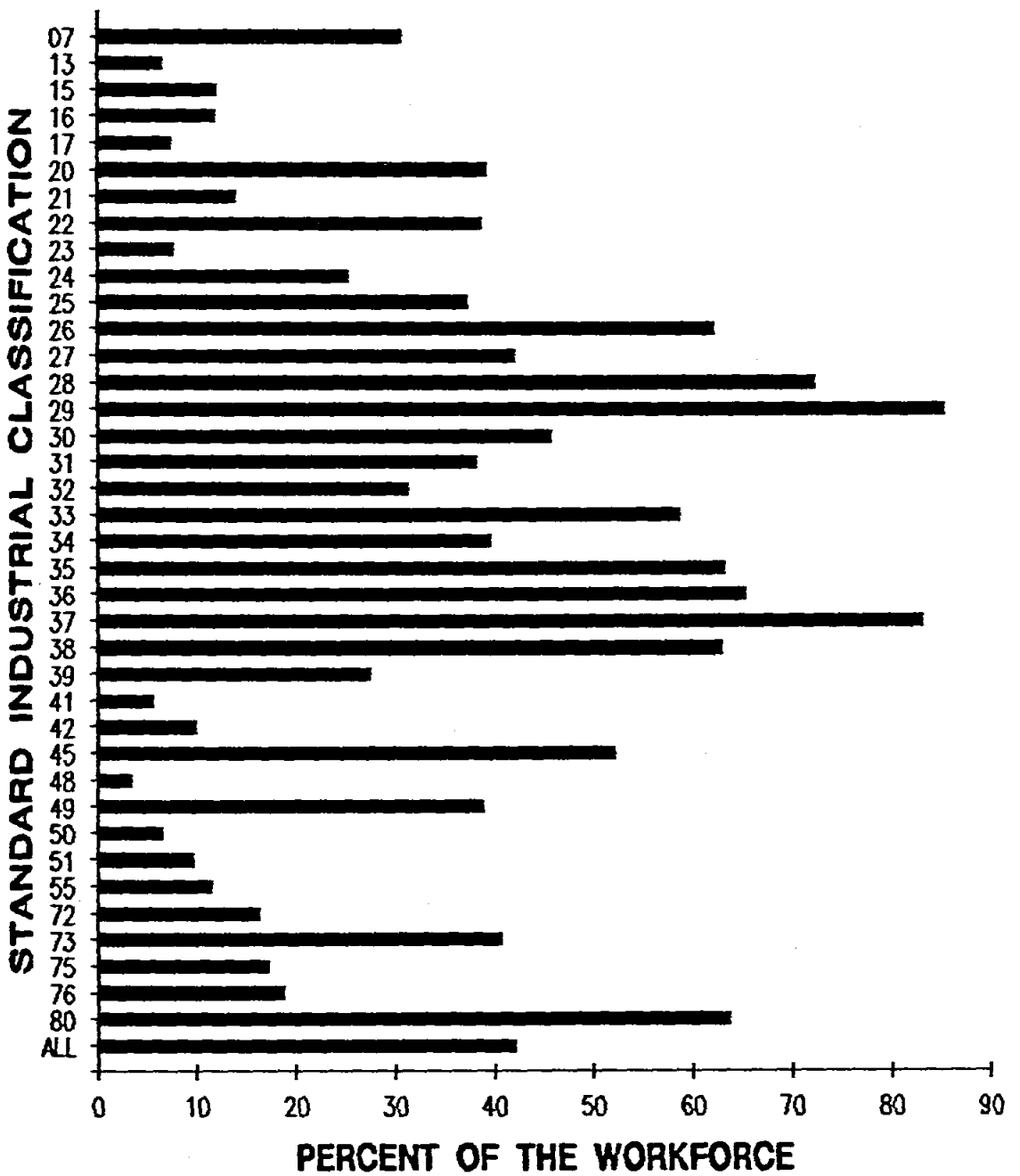
MAJOR GROUP	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
07	1739* (811) 31.3%	...	...	1739* (811) 30.9%	34136* (15807) 32.9%	...	...	34136* (15807) 30.8%
13	49* (44) .6%	113* (78) 11.1%	...	162* (118) 1.7%	2969* (2642) 1.4%	24972* (14292) 14.4%	...	27942* (16187) 6.7%
15-17	6682 (1318) 7.1%	390* (177) 9.4%	30* (29) 12.6%	7103 (1280) 7.2%	183063 (32312) 8.7%	55304* (23811) 7.5%	62494* (28273) 26.5%	300861 (42787) 9.8%
20-39	23501 (1879) 15.3%	13472 (910) 42.4%	3955 (206) 63.1%	40928 (1969) 21.4%	784746 (66973) 17.0%	2810729 (199425) 44.0%	6304411 (255180) 76.3%	9899887 (365337) 51.4%
40-49	2319* (709) 4.4%	974* (326) 16.7%	250* (82) 53.4%	3542 (830) 6.0%	91459* (26282) 6.4%	220678* (76927) 19.1%	370852* (93898) 64.6%	682989 (137956) 21.6%
50-59	4131* (1114) 7.1%	104* (88) 3.9%	...	4236* (1127) 6.9%	107786* (28226) 9.6%	21161* (16297) 5.2%	...	128947* (32697) 8.4%
70-79	12898 (2022) 17.6%	797* (209) 34.0%	209* (120) 59.1%	13904 (1976) 18.3%	221340 (37403) 15.9%	189122* (50795) 40.7%	228258* (99604) 67.2%	638720 (98188) 29.1%
80	901* (445) 31.7%	1026 (229) 47.4%	1321 (199) 64.1%	3248 (546) 46.0%	29717* (15348) 29.2%	248494* (62214) 46.5%	2058182 (261382) 68.1%	2336393 (274645) 63.9%
ALL	52221 (3458) 11.6%	16876 (1037) 33.7%	5766 (322) 61.1%	74863 (3514) 14.7%	1455216 (94384) 13.1%	3570460 (230598) 36.2%	9024198 (391119) 72.4%	14049874 (490902) 42.1%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 39

WORKERS IN PLANTS WHERE CHEMICALS WERE SUBSTITUTED

(NOES 1981-1983)



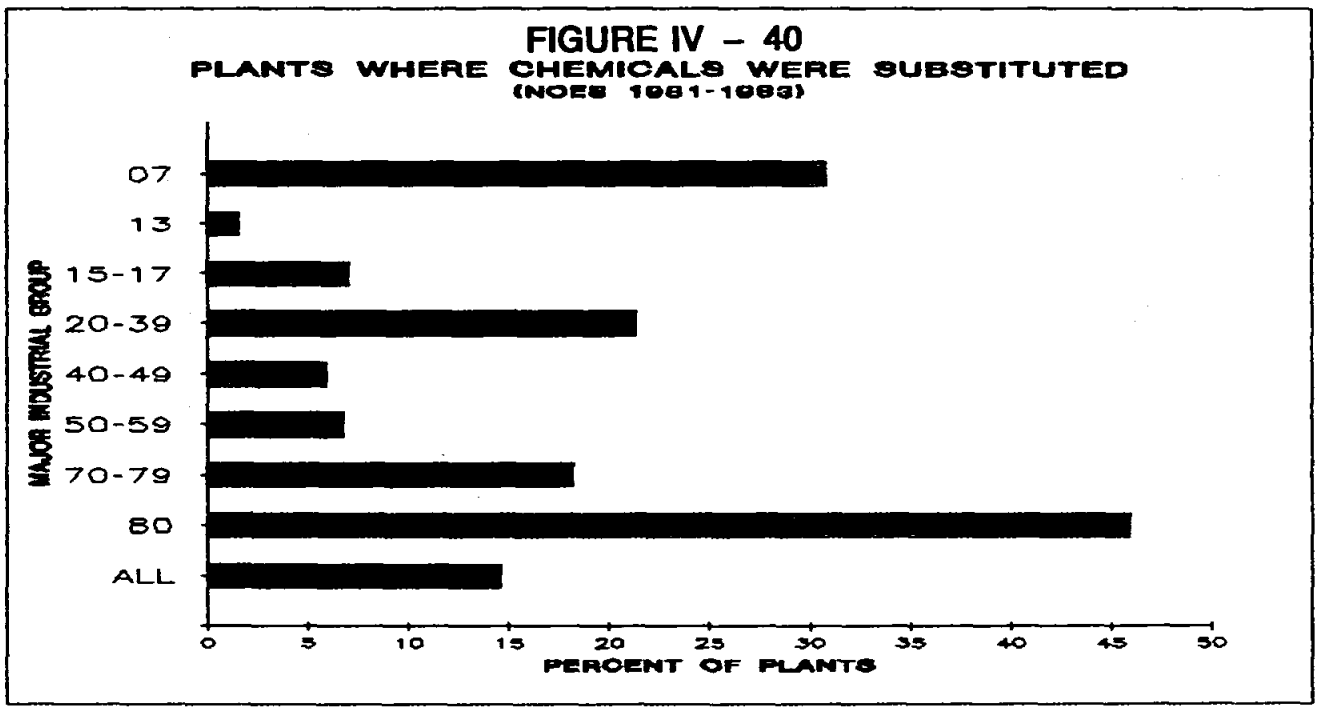


FIGURE IV – 40
PLANTS WHERE CHEMICALS WERE SUBSTITUTED
(NOES 1981-1983)
MAJOR INDUSTRIAL GROUP
07
13
15-17
20-39
40-49
50-59
70-79
80
ALL
0
5
10
15
20
25
30
35
40
45
50
PERCENT OF PLANTS

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH HAVE SUBSTITUTED CHEMICAL MATERIALS IN THE LAST FIVE YEARS

SIC CODE	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
07	1739* (811) 31.3%	...	...	1739* (811) 30.9%	34136* (15807) 32.9%	...	...	34136* (15807) 30.8%
13	49* (44) .6%	113* (78) 11.1%	...	162* (118) 1.7%	2969* (2642) 1.4%	24972* (14292) 14.4%	...	27942* (16187) 6.7%
15	2004 (441) 8.0%	138* (79) 12.5%	10* (4) 7.4%	2152 (451) 8.2%	57059* (17137) 10.1%	15790* (8689) 8.0%	36379* (12499) 27.0%	109227 (20519) 12.2%
16	773* (465) 6.9%	83* (83) 7.5%	20* (29) 19.1%	877* (468) 7.0%	29823* (15135) 10.5%	15298* (10865) 7.4%	26115* (22662) 25.8%	71236* (24308) 12.0%
17	3905* (1112) 6.7%	169* (121) 8.8%	...	4074* (1092) 6.8%	96181 (22550) 7.7%	24216* (18085) 7.3%	...	120397 (25950) 7.6%
20	599* (268) 5.2%	1163 (258) 36.2%	315* (108) 56.3%	2076 (359) 13.7%	31103* (16764) 8.0%	277522 (64690) 41.2%	302920* (98216) 61.6%	611544 (110475) 39.4%
21	...	...	7* (11) 9.4%	7* (11) 6.8%	...	...	16019* (23625) 14.3%	16019* (23625) 14.1%
22	120* (95) 4.1%	692 (146) 43.6%	116* (70) 38.8%	928 (155) 19.3%	8653* (6282) 8.2%	149835 (33066) 43.2%	119392* (73613) 45.7%	277880* (88426) 38.9%
23	...	249* (108) 8.0%	47* (41) 19.4%	296* (120) 1.9%	...	50967* (23859) 8.4%	47062* (40984) 22.6%	98029* (49969) 7.9%
24	231* (190) 2.2%	579* (199) 50.5%	19* (8) 18.1%	830* (294) 6.9%	8876* (6334) 2.9%	102911* (35470) 56.1%	35767* (18789) 38.7%	147554* (41556) 25.5%
25	365* (239) 8.8%	544 (90) 51.2%	32* (25) 26.7%	940* (238) 17.6%	12655* (9300) 9.1%	132299 (20154) 51.6%	48937* (30396) 39.8%	193891 (33868) 37.4%
26	914* (284) 22.2%	705 (162) 44.9%	193* (67) 90.4%	1812 (332) 30.7%	45308* (14277) 32.9%	150815* (41430) 53.6%	193890* (61422) 93.7%	390012 (76201) 62.3%
27	3929 (916) 21.7%	838 (170) 44.7%	193* (72) 61.0%	4960 (853) 24.4%	103902 (21662) 21.7%	161451 (39555) 44.7%	235823* (70333) 68.2%	501175 (80058) 42.3%
28	2298 (386) 37.2%	671 (110) 57.9%	339* (91) 89.2%	3308 (392) 42.9%	80039 (9473) 44.3%	143594 (20406) 55.1%	442270* (114002) 92.8%	665903 (121372) 72.5%
29	345* (232) 34.2%	181* (75) 61.9%	101* (42) 100.0%	628* (264) 44.7%	21404* (13620) 52.2%	50598* (20286) 80.0%	117545* (70259) 100.0%	189547* (76773) 85.5%
30	1232* (448) 18.4%	584* (282) 38.0%	168* (75) 74.9%	1984* (575) 23.4%	48358 (11746) 21.5%	108794* (52717) 36.9%	188813* (76690) 80.8%	345965* (92221) 45.9%
31	50* (39) 5.3%	194* (74) 34.1%	25* (24) 100.0%	269* (84) 17.6%	2188* (1707) 8.8%	49635* (19206) 36.6%	15664* (16901) 100.0%	67487* (24430) 38.3%
32	1237* (523) 14.1%	434* (129) 42.9%	90* (50) 48.8%	1761* (527) 17.6%	42779* (15457) 18.0%	78088* (26051) 37.4%	59706* (31035) 46.3%	180573 (40483) 31.4%
33	514* (179) 12.4%	492* (173) 33.5%	201* (65) 59.7%	1207 (283) 20.3%	22626* (9426) 16.3%	119048* (41032) 38.3%	487752 (94666) 78.5%	629426 (114179) 58.8%

SIC CODE	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
34	3012 (596) 16.3%	1402 (238) 44.9%	235* (79) 68.0%	4649 (618) 21.1%	100099 (18640) 18.0%	227403 (38719) 38.1%	270171* (101893) 77.0%	597673 (105999) 39.8%
35	4228 (1007) 18.7%	1915 (362) 56.2%	667 (81) 85.1%	6810 (1045) 25.4%	133666 (25199) 22.0%	379558 (56834) 57.4%	996496 (130288) 89.5%	1509719 (158492) 63.4%
36	1934* (605) 27.2%	1366 (184) 50.9%	536 (126) 68.1%	3836 (585) 36.3%	55732 (13303) 24.2%	316898 (40232) 57.3%	913399 (146532) 77.2%	1286029 (158155) 65.4%
37	521* (264) 13.1%	816 (141) 68.6%	328* (85) 78.9%	1666 (342) 29.9%	15583* (7954) 12.3%	164018 (35547) 68.6%	1387350 (231282) 91.6%	1566952 (216612) 83.3%
38	478* (302) 17.8%	321* (92) 33.5%	306* (104) 73.6%	1105* (286) 27.2%	16836* (8629) 16.1%	76763* (29744) 39.5%	385437* (118299) 83.7%	479036 (116868) 63.1%
39	1493* (549) 22.8%	328* (685) 41.1%	36* (26) 10.7%	1856* (839) 24.1%	34940* (12407) 21.1%	70534* (161387) 47.2%	39998* (24337) 19.1%	145472* (161158) 27.7%
41	273* (251) 6.2%	...	...	273* (251) 5.5%	11472* (10554) 9.8%	...	...	11472* (10554) 5.8%
42	962* (377) 4.8%	72* (49) 4.8%	24* (16) 29.4%	1057* (382) 4.9%	35750* (14047) 7.3%	18890* (11975) 7.3%	27982* (20103) 37.4%	82622* (27818) 10.1%
45	23* (34) .7%	55* (46) 9.4%	98* (45) 66.6%	177* (75) 4.4%	1514* (2181) 2.0%	8070* (6702) 7.4%	226538* (80730) 85.7%	236122* (81343) 52.3%
48	...	61* (47) 6.7%	3* (4) 10.1%	64* (48) .4%	...	11000* (8392) 6.2%	13226* (14092) 18.9%	24226* (17160) 3.6%
49	1061* (576) 12.9%	786* (292) 42.2%	124* (65) 71.9%	1971* (698) 19.2%	42724* (19298) 15.9%	182718* (68929) 42.9%	103105* (46434) 70.3%	328547* (99193) 39.0%
50	1682* (692) 5.5%	104* (88) 5.8%	...	1786* (694) 5.6%	39844* (15990) 6.3%	21161* (16297) 7.5%	...	61004* (19819) 6.7%
51	591* (472) 6.5%	...	...	591* (472) 6.3%	20805* (17108) 11.2%	...	...	20805* (17108) 9.8%
55	1859* (713) 9.8%	...	...	1859* (713) 9.5%	47137* (22281) 15.3%	...	...	47137* (22281) 11.6%
72	4766 (894) 23.1%	...	13* (19) 100.0%	4779 (895) 22.4%	67191 (15228) 17.7%	...	10670* (15114) 100.0%	77861* (22207) 16.5%
73	2185* (685) 13.2%	673* (177) 45.2%	196* (113) 57.5%	3055 (697) 16.6%	66957* (22746) 15.9%	164781* (46172) 47.1%	217588* (94537) 66.2%	449326 (93049) 40.8%
75	5108* (1550) 19.5%	...	...	5108* (1550) 19.5%	73187* (24554) 17.7%	...	...	73187* (24554) 17.4%
76	839* (831) 8.6%	123* (94) 100.0%	...	962* (864) 9.7%	14005* (13184) 7.8%	24341* (19716) 100.0%	...	38346* (28619) 18.9%
80	901* (445) 31.7%	1026 (229) 47.4%	1321 (199) 64.1%	3248 (546) 46.0%	29717* (15348) 29.2%	248494* (62214) 46.5%	2058182 (261382) 68.1%	2336393 (274645) 63.9%
ALL	52221 (2756) 11.7%	16876 (889) 34.1%	5766 (338) 61.2%	74863 (2992) 14.8%	1455216 (89065) 13.2%	3570460 (186927) 36.5%	9024198 (363943) 72.4%	14049874 (441721) 42.2%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 41

PLANTS WHERE CHEMICALS WERE SUBSTITUTED

(NOES 1981-1983)

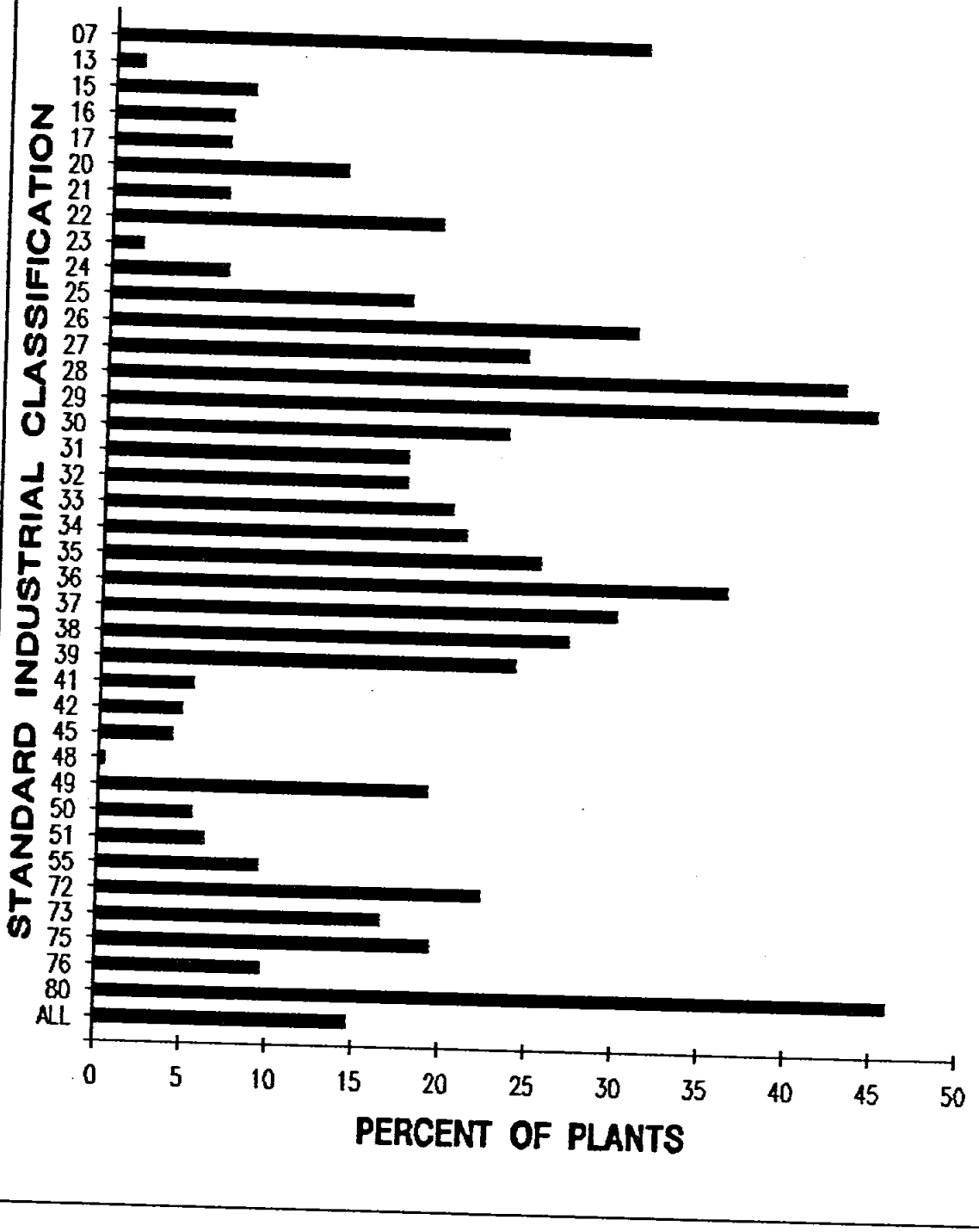


FIGURE IV – 42
SUBSTITUTION OF CHEMICAL MATERIALS BY PLANT SIZE
(NOES 1981-1983)

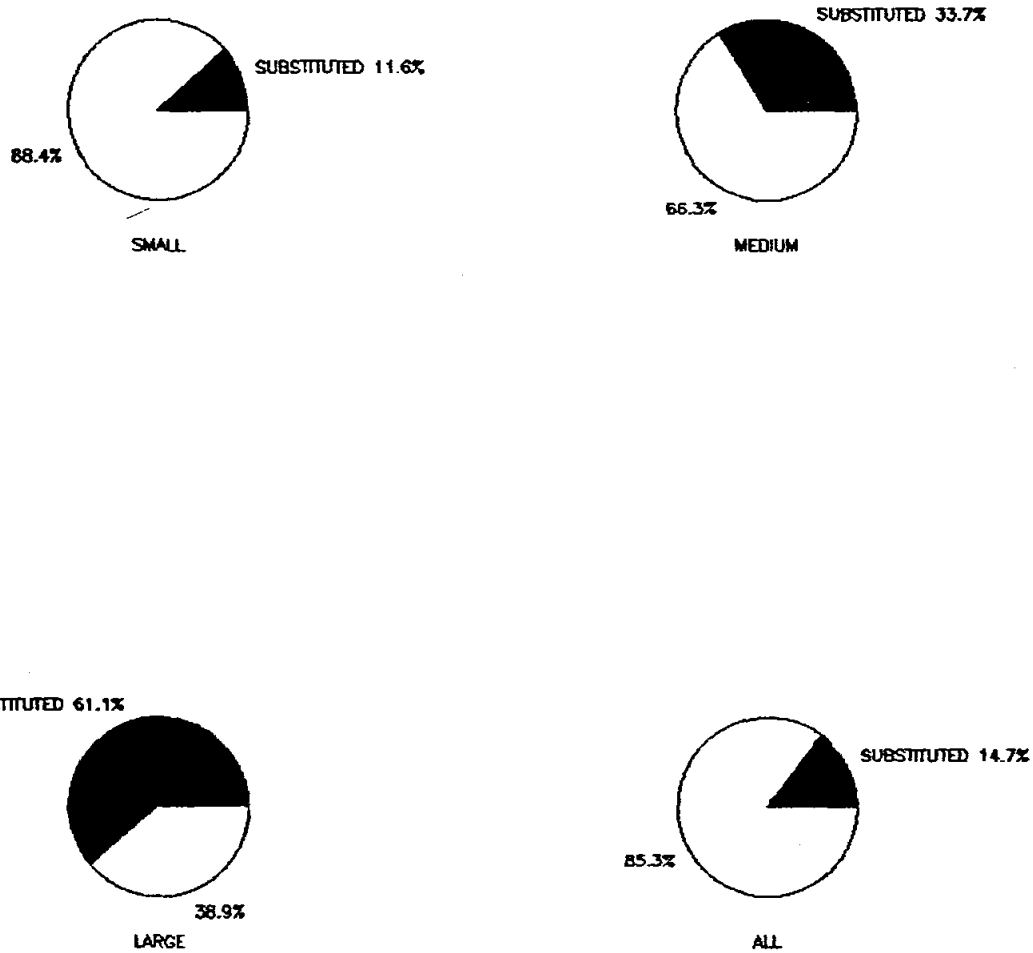
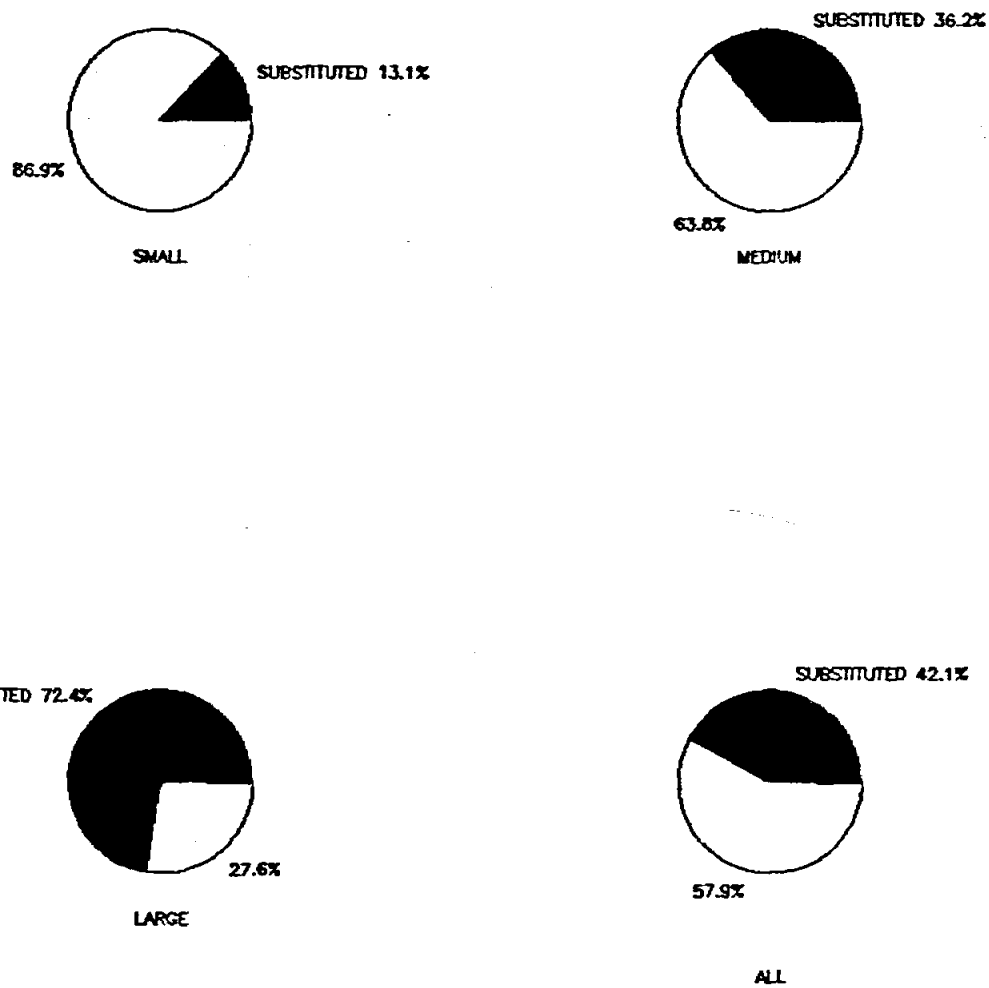


FIGURE IV – 43

CHEMICAL SUBSTITUTION BY WORKFORCE PROPORTION AND PLANT SIZE (NOES 1981-1983)



NOES QUESTIONNAIRE ITEM NO. 39
Chemical Substitutions Made to Reduce Worker Exposure

Intent

The intent of this question was to determine if a chemical substitution was made for the primary purpose of reducing or eliminating worker exposure to specific chemical agents.

This item was displayed on the questionnaire as:

39. Were any of these substitutions made for the primary purpose of reducing employee exposures?

    1 Yes
    2 No

Notes

Exchanges of raw materials, ingredients, intermediates, or finished (tradename) products for the primary purpose of protecting employee health were considered affirmative responses.

Substitutions made due to regulatory requirements or a ban on the production, trade, or marketing of a specific chemical agents was also an affirmative response.

Substitutions or exchanges made for economic or any reasons other than those relating to worker health were considered a negative response to this question.

Analysis

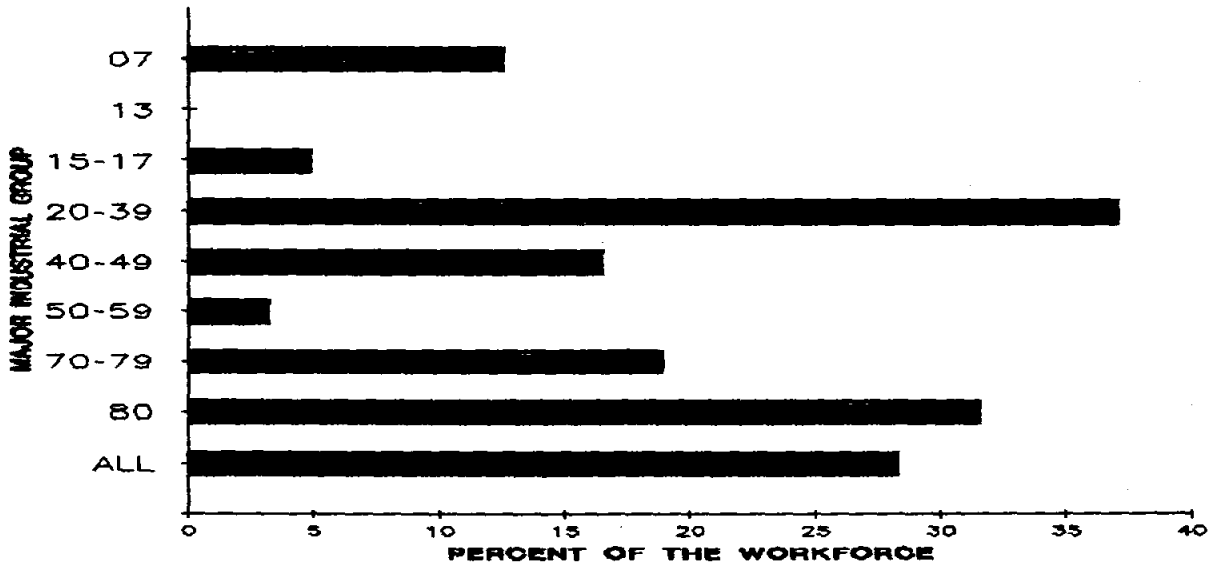
One analysis of the responses to question 39 is presented.

Response 39.1 - Substitutions made to reduce employee exposure.

The estimates of the plants which have substituted chemical agents for the express purpose of reducing or eliminating worker exposure to specific agents, and workers in those plants (by number and proportion of the total) are displayed in Figures IV-44, IV-45, IV-46, IV-47, IV-48, and IV-49, and Tables IV-3 and IV-44.

Figure IV-44	Chemical substitution to reduce occupational exposure (by major industrial group)
Figure IV-45	Chemical substitution to reduce occupational exposure (by 2-digit SIC)
Figure IV-46	Substitution of chemicals to reduce worker exposure (by major industrial group)
Figure IV-47	Substitution of chemicals to reduce worker exposure (by 2-digit SIC)
Figure IV-48	Plants reducing worker exposure by substituting chemical materials (by major industrial group)

FIGURE IV – 44
CHEMICAL SUBSTITUTION TO REDUCE OCCUPATIONAL EXPOSURE
(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-43

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH HAVE SUBSTITUTED CHEMICALS TO REDUCE WORKER EXPOSURE

MAJOR GROUP	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
07	793* (489) 14.2%	...	...	793* (489) 14.1%	14097* (8608) 13.6%	...	...	14097* (8608) 12.7%
13	...	...	...	...	...	...	...	...
15-17	2335* (754) 2.5%	153* (93) 3.7%	25* (29) 10.5%	2514* (728) 2.5%	73112* (19022) 3.5%	30515* (16866) 4.1%	49912* (25611) 21.1%	153539 (31655) 5.0%
20-39	12798 (1462) 8.4%	7552 (660) 23.8%	2842 (195) 45.3%	23192 (1562) 12.1%	441494 (59864) 9.6%	1621683 (160130) 25.4%	5106574 (293563) 61.8%	7169750 (399888) 37.2%
40-49	1043* (470) 2.0%	779* (285) 13.3%	172* (63) 36.8%	1995* (577) 3.4%	38951* (15710) 2.7%	183213* (68520) 15.9%	302692* (92915) 52.8%	524856 (122437) 16.6%
50-59	1678* (840) 2.9%	104* (88) 3.9%	...	1783* (853) 2.9%	29915* (15820) 2.7%	21161* (16297) 5.2%	...	51075* (23162) 3.3%
70-79	5249* (1939) 7.2%	518* (157) 22.1%	178* (116) 50.4%	5946* (1871) 7.8%	87809* (32015) 6.3%	127581* (36994) 27.5%	202056* (96529) 59.5%	417446 (95385) 19.0%
80	316* (319) 11.1%	593 (135) 27.4%	684 (171) 33.2%	1593 (349) 22.5%	3161* (3189) 3.1%	132572* (34705) 24.8%	1023702 (207970) 33.9%	1159435 (207788) 31.7%
ALL	24213 (2781) 5.4%	9700 (759) 19.4%	3902 (292) 41.3%	37815 (2810) 7.4%	688538 (74511) 6.2%	2116724 (182920) 21.5%	6684936 (384757) 53.6%	9490199 (478318) 28.4%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 45

CHEMICAL SUBSTITUTION TO REDUCE OCCUPATIONAL EXPOSURE

(NOES 1981-1983)

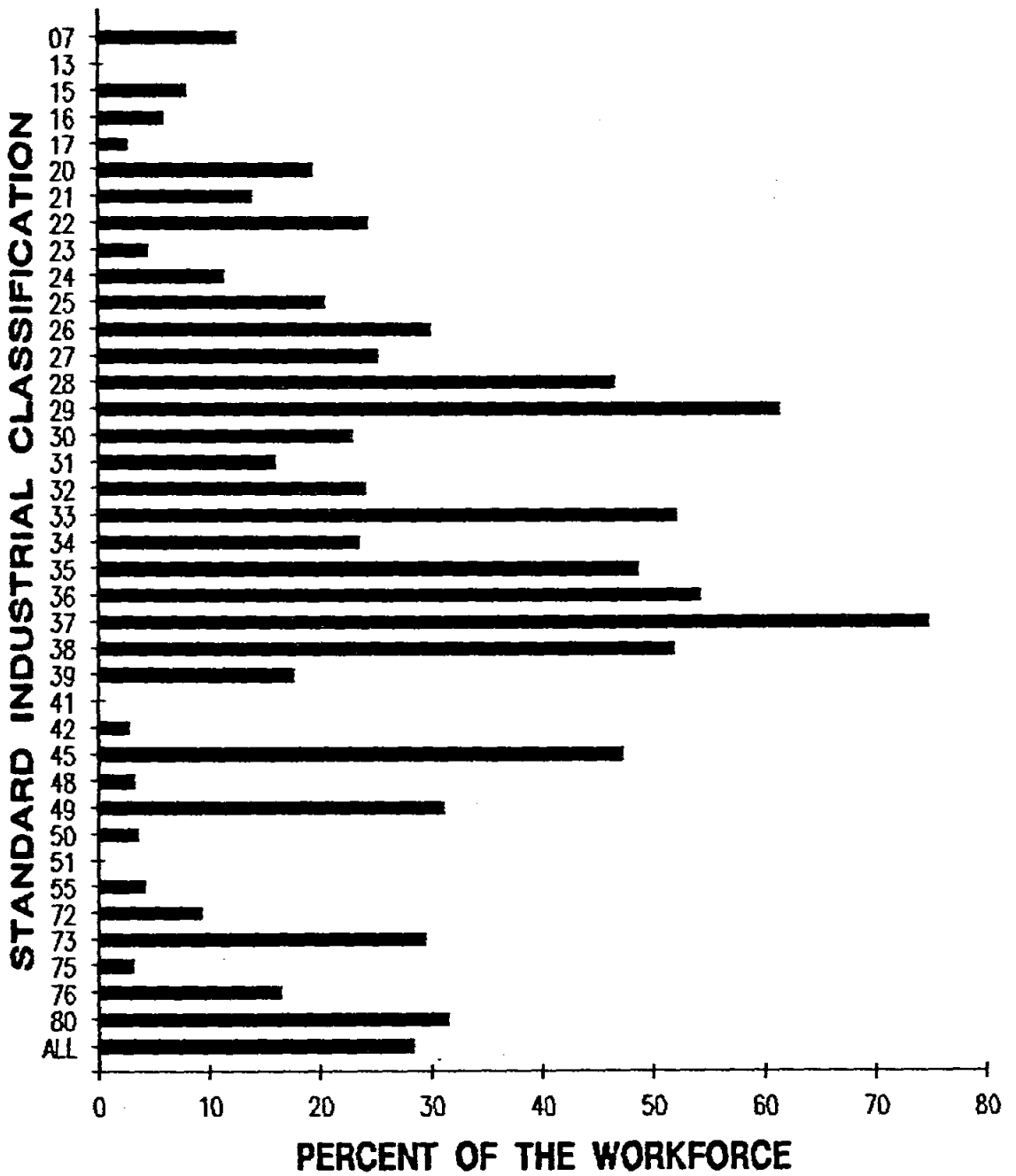
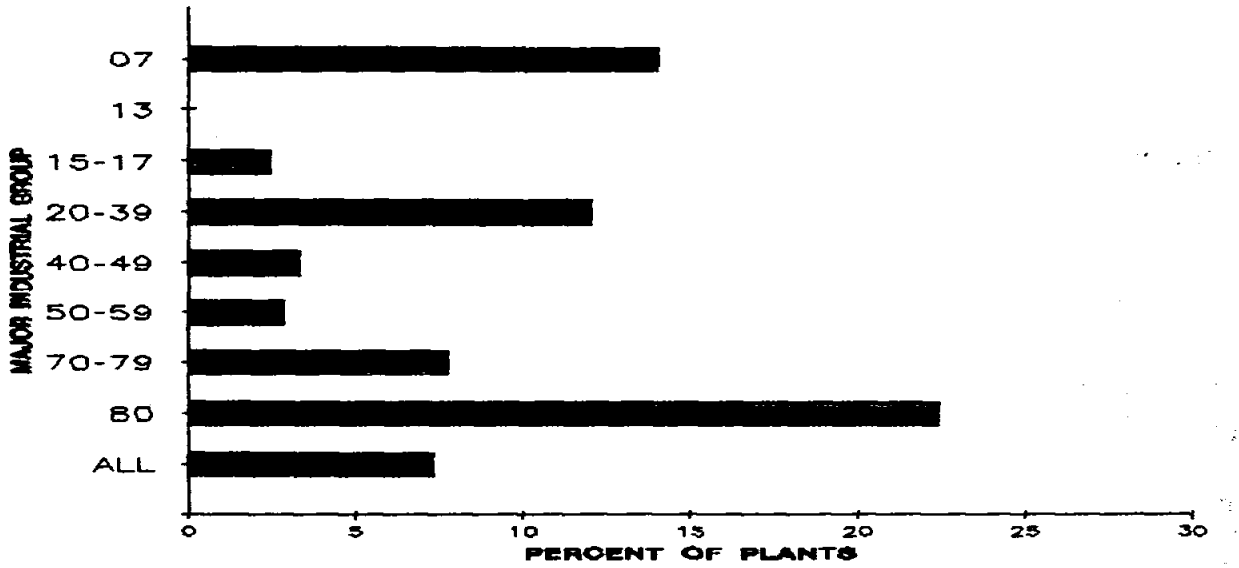


FIGURE IV – 46

SUBSTITUTION OF CHEMICALS TO REDUCE WORKER EXPOSURE
(NOES 1981-1983)



NATIONAL OCCUPATIONAL EXPOSURE SURVEY (1981-1983) TABLE NO. IV-44

NUMBER AND PERCENT OF PLANTS AND EMPLOYEES IN PLANTS WHICH HAVE SUBSTITUTED CHEMICALS TO REDUCE WORKER EXPOSURE

SIC CODE	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
07	793* (489) 14.2%	...	...	793* (489) 14.1%	14097* (8608) 13.6%	...	...	14097* (8608) 12.7%
13	...	...	...	...	...	...	...	...
15	1177* (473) 4.7%	16* (14) 1.4%	10* (4) 7.4%	1203* (473) 4.6%	32826* (10220) 5.8%	3106* (2726) 1.6%	36379* (12499) 27.0%	72311 (14836) 8.1%
16	418* (406) 3.7%	32* (30) 2.9%	15* (29) 14.4%	466* (408) 3.7%	13158* (10460) 4.6%	9667* (8879) 4.7%	13534* (21494) 13.4%	36358* (20966) 6.1%
17	739* (376) 1.3%	105* (95) 5.5%	...	845* (335) 1.4%	27128* (11283) 2.2%	17742* (15978) 5.4%	...	44870* (16125) 2.8%
20	273* (180) 2.4%	500* (196) 15.5%	209* (110) 37.3%	982 (233) 6.5%	13242* (9763) 3.4%	120530* (36297) 17.9%	169850* (82728) 34.5%	303623* (84806) 19.5%
21	...	...	7* (11) 9.4%	7* (11) 6.8%	...	...	16019* (23625) 14.3%	16019* (23625) 14.1%
22	120* (95) 4.1%	328* (106) 20.7%	69* (48) 23.0%	517* (137) 10.7%	8653* (6282) 8.2%	73627* (26056) 21.2%	92707* (59949) 35.5%	174986* (75654) 24.5%
23	...	60* (22) 1.9%	47* (41) 19.4%	107* (45) .7%	...	11297* (4497) 1.9%	47062* (40984) 22.6%	58359* (41985) 4.7%
24	231* (190) 2.2%	166* (96) 14.5%	19* (8) 18.1%	416* (236) 3.5%	8876* (6334) 2.9%	22258* (12462) 12.1%	35767* (18789) 38.7%	66901* (25719) 11.5%
25	316* (231) 7.6%	300* (153) 28.3%	29* (25) 24.0%	645* (251) 12.1%	9961* (7513) 7.2%	69104* (39340) 26.9%	28020* (27305) 22.8%	107085* (48053) 20.7%
26	436* (185) 10.6%	384* (125) 24.5%	60* (37) 28.0%	879* (222) 14.9%	25605* (12016) 18.6%	66390* (24189) 23.6%	96186* (36941) 46.5%	188181 (44699) 30.1%
27	2265* (710) 12.5%	372* (118) 19.9%	129* (62) 40.9%	2767* (725) 13.6%	64905* (16981) 13.6%	73583* (28108) 20.4%	162979* (61915) 47.1%	301467 (69516) 25.4%
28	796* (298) 12.9%	370* (127) 31.9%	192* (72) 50.4%	1357 (321) 17.6%	27337* (7468) 15.1%	86235* (29034) 33.1%	314785* (105880) 66.1%	428356* (109603) 46.7%
29	176* (181) 17.4%	120* (47) 41.0%	69* (40) 68.4%	365* (200) 26.0%	11069* (11377) 27.0%	34779* (14413) 55.0%	90619* (69338) 77.1%	136466* (71944) 61.5%
30	176* (125) 2.6%	249* (165) 16.2%	103* (48) 46.2%	529* (210) 6.2%	11862* (8181) 5.3%	40751* (27115) 13.8%	121377* (49195) 51.9%	173990* (53643) 23.1%
31	50* (39) 5.3%	86* (63) 15.1%	...	136* (79) 8.9%	2188* (1707) 8.8%	26350* (19103) 19.5%	...	28537* (19427) 16.2%
32	1043* (535) 11.8%	259* (119) 25.6%	86* (56) 46.9%	1387* (545) 13.9%	33933* (16334) 14.3%	49195* (20592) 23.5%	56098* (36137) 43.5%	139226* (47812) 24.2%
33	285* (179) 6.9%	375* (131) 25.6%	193* (69) 57.3%	853* (241) 14.4%	7766* (4601) 5.6%	79208* (25511) 25.5%	473246 (96711) 76.1%	560220 (103619) 52.3%

SIC CODE	PLANTS SMALL (8-99)	PLANTS MEDIUM (100-499)	PLANTS LARGE (≥500)	PLANTS TOTAL	EMPLOYEES SMALL (8-99)	EMPLOYEES MEDIUM (100-499)	EMPLOYEES LARGE (≥500)	EMPLOYEES TOTAL
34	1488* (384) 8.0%	738* (188) 23.6%	128* (56) 36.9%	2354 (438) 10.7%	51260* (14029) 9.2%	134059* (37413) 22.5%	171308* (94331) 48.8%	356627* (111536) 23.7%
35	2538* (807) 11.2%	1400 (242) 41.1%	522 (90) 66.6%	4461 (838) 16.6%	92820* (24787) 15.3%	274525 (42308) 41.5%	793799 (107219) 71.3%	1161144 (116899) 48.8%
36	1157* (497) 16.3%	898 (181) 33.4%	440* (123) 55.9%	2495 (501) 23.6%	31687 (7652) 13.7%	233272 (45384) 42.2%	804986 (137584) 68.1%	1069945 (145794) 54.4%
37	145* (115) 3.7%	482* (136) 40.5%	279* (74) 67.1%	906 (183) 16.2%	9002* (7146) 7.1%	119903* (34231) 50.1%	1281495 (216422) 84.6%	1410400 (209029) 75.0%
38	352* (285) 13.1%	218* (80) 22.8%	234* (75) 56.3%	804* (263) 19.8%	12657* (8363) 12.1%	52332* (22849) 26.9%	329739* (100472) 71.6%	394727* (99210) 52.0%
39	950* (377) 14.5%	246* (542) 30.9%	26* (26) 7.7%	1223* (620) 15.9%	18671* (8011) 11.3%	54287* (135279) 36.3%	20532* (20670) 9.8%	93490* (139150) 17.8%
41	...	...	...	...	...	...	...	...
42	258* (216) 1.3%	16* (16) 1.1%	9* (9) 11.6%	284* (215) 1.3%	8964* (6415) 1.8%	6910* (6767) 2.7%	8340* (8340) 11.1%	24214* (12696) 2.9%
45	23* (34) .7%	55* (46) 9.4%	88* (45) 59.8%	166* (75) 4.2%	1514* (2181) 2.0%	8070* (6702) 7.4%	204453* (83528) 77.4%	214037* (84149) 47.4%
48	...	56* (47) 6.2%	3* (4) 10.1%	59* (47) .4%	...	9956* (8286) 5.6%	13226* (14092) 18.9%	23182* (16342) 3.4%
49	762* (406) 9.3%	653* (272) 35.0%	71* (45) 41.3%	1486* (537) 14.5%	28473* (13774) 10.6%	158277* (65082) 37.2%	76674* (39327) 52.3%	263424* (89905) 31.3%
50	502* (476) 1.7%	104* (88) 5.8%	...	606* (479) 1.9%	12550* (11912) 2.0%	21161* (16297) 7.5%	...	33711* (19596) 3.7%
51	...	...	...	...	...	...	...	...
55	1176* (684) 6.2%	...	...	1176* (684) 6.0%	17364* (10254) 5.6%	...	...	17364* (10254) 4.3%
72	2591* (937) 12.6%	...	13* (19) 100.0%	2604* (938) 12.2%	34005* (12704) 8.9%	...	10670* (15114) 100.0%	44675* (20357) 9.4%
73	973* (636) 5.9%	395* (124) 26.5%	165* (109) 48.4%	1533* (613) 8.3%	30728* (18719) 7.3%	103240* (32481) 29.5%	191386* (91211) 58.2%	325354* (90780) 29.6%
75	1084* (874) 4.1%	...	...	1084* (874) 4.1%	13837* (11427) 3.3%	...	...	13837* (11427) 3.3%
76	601* (776) 6.2%	123* (94) 100.0%	...	724* (800) 7.3%	9238* (11772) 5.2%	24341* (19716) 100.0%	...	33580* (25582) 16.6%
80	316* (319) 11.1%	593 (135) 27.4%	684 (171) 33.2%	1593 (349) 22.5%	3161* (3189) 3.1%	132572* (34705) 24.8%	1023702 (207970) 33.9%	1159435 (207788) 31.7%
ALL	24213 (2495) 5.4%	9700 (675) 19.6%	3902 (296) 41.4%	37815 (2716) 7.5%	688538 (79136) 6.2%	2116724 (145384) 21.7%	6684936 (357097) 53.7%	9490199 (442971) 28.5%

*Standard error >25% of the estimate. The estimate may be unreliable.
...No facilities observed.

FIGURE IV – 47

SUBSTITUTION OF CHEMICALS TO REDUCE WORKER EXPOSURE

(NOES 1981-1983)

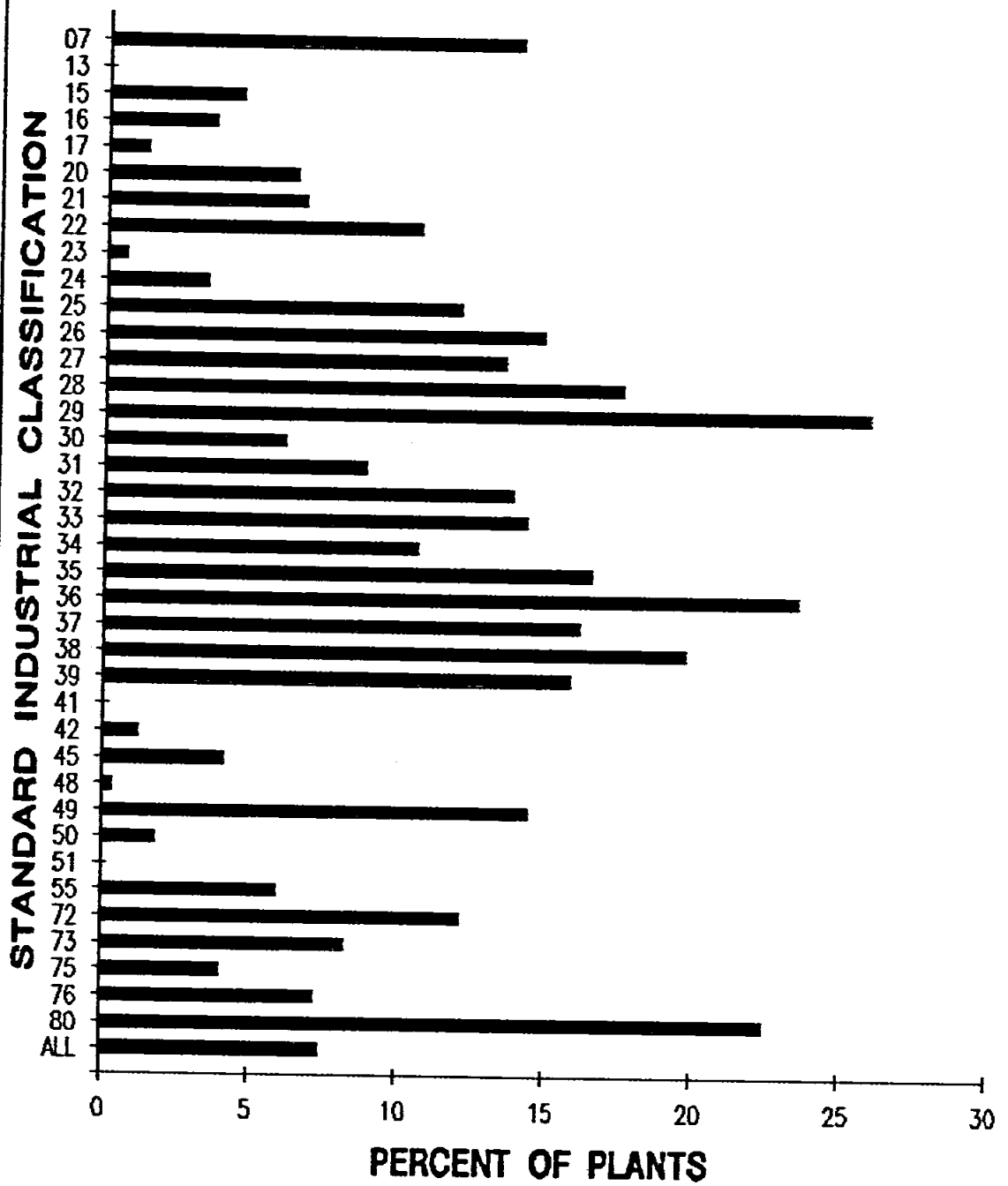


FIGURE IV – 48

PLANTS REDUCING WORKER EXPOSURE BY SUBSTITUTING CHEMICAL MATERIALS

(NOES 1981-1983)

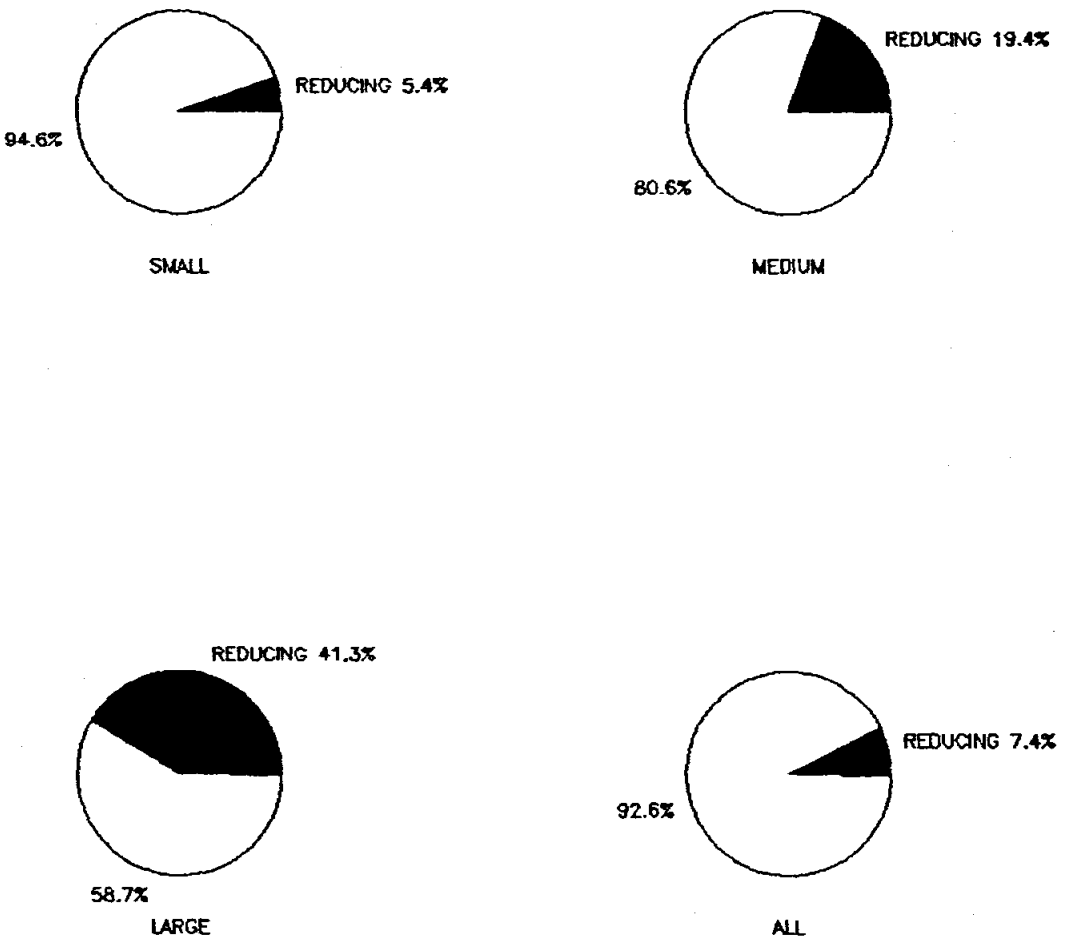


FIGURE IV – 49
WORKERS IN PLANTS WHERE OCCUPATIONAL EXPOSURE WAS REDUCED BY CHEMICAL SUBSTITUTION (NOES 1981-1983)