

APPENDIX B

SIKORSKY STRATFORD AC-6 INDOOR AIR INVESTIGATION SUMMARY

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USEPA Sikorsky Stratford Corrective Action Program

SYNOPSIS: The results from the indoor air investigation, which took place over a solvents and chromium groundwater plume at the Stratford plant, were favorable: (1) indoor air samples were non-detect for solvents and OSHA/NIOSH/ACGIH limits are not exceeded (Table 1); and (2) soil gas solvents were detected but below the Connecticut DEP Remediation Standards for industrial/commercial land use (Table 2). This investigation took place in the machine shop portion of the main manufacturing building and in the basement of the Administration Building (Figure 1).

A groundwater plume consisting of dissolved concentrations of solvents (primarily trichloroethene and its various breakdown products), and chromium, beneath the southern portion of the main manufacturing building at the Sikorsky Stratford facility, extends to the Housatonic River. The solvent portion of this plume was caused by the former solvent degreasing operations that were located in and near the Anodize Room. The chromium portion of this plume was caused by the Anodize Room chromic acid process. The chromium portion of the plume has been previously investigated, and was not sampled under the indoor air investigation as it is not an air pollutant when dissolved in groundwater.

To assess whether this plume has affected indoor air, and as part of the USEPA Corrective Action Program requirements, the following steps were performed:

1. Differential air pressure readings were obtained to measure pressure differences between subsurface air and indoor air;
2. Six indoor air samples were collected and analyzed for various solvents/volatiles; and
3. Four soil vapor samples were collected and analyzed, primarily for solvents detected in the underlying groundwater.

A work plan for this investigation was prepared by Sikorsky voluntarily in late 1999 and reviewed by the USEPA in early 2000. A couple of additions requested by the USEPA were incorporated into the work plan. This investigation was performed at the same time that the Phase II RCRA Facility Investigation (RFI) was being performed.

The indoor air and soil gas results are presented in two tables, which include the analytical results, analytical detection limits and comparison to human health and environmental regulatory limits. Table 1 shows the indoor air sample results, the analytical detection levels by compound and comparison to the following human health limits: OSHA PEL, NIOSH REL and ACGIH TLVs. Table 2 shows the soil gas sample results, the analytical detection limits by compound and comparison to the applicable environmental regulatory limits for soil gas (CTDEP RSRs for industrial/commercial sites). Figure 1 is a map of the study area and shows where the samples were collected.

Differential air pressure readings were obtained using data loggers to help determine the best time to collect indoor air samples, which is considered to be during the period when airflow would most likely be from the subsurface into the building air space (e.g. subsurface air pressure higher than the indoor air pressure). It would be most likely under these conditions that solvent vapors from the groundwater plume could enter the indoor air, if this occurred at all. The data logger readings were collected over an extended period of time, prior to the collection of indoor air and soil gas samples. These measurements were taken from the subsurface using tubes that were

installed through the concrete floor under the wooden floor blocks. The tubes were sealed against the concrete to isolate the open bottom of the tubes from indoor air. Indoor and outside differential air pressure readings were also obtained. Review of these measurements indicated that samples could be collected almost anytime, as there was not a significant pressure difference except during the occurrence of a high barometric pressure front entering the region which caused a greater pressure within the building, therefore, soil vapors would be less likely to enter the manufacturing building.

Soil vapor samples were collected from the subsurface through the same tubes that were installed to obtain the air pressure readings. Two of the soil vapor samples were collected above the more concentrated portion of the contaminant plume (one of these was immediately downgradient of the Anodize Room). Two additional soil vapor samples were collected further downgradient in the vicinity of a former degreasing unit, but these were still above the middle of the groundwater plume. The soil vapor samples were collected with Summa canisters and submitted to an off-site laboratory for analysis. Sufficient sample volume was collected to attain low (ppbv) level detection limits (note: Table 2 units are in ppmv). Sampling and analysis followed the USEPA analytical method TO-15 for volatile compounds in air. The volatile constituents groups analyzed included:

- aromatics (e.g., benzene);
- chlorinated aromatics (e.g., chlorobenzene);
- chlorinated aliphatics (e.g., tetrachloroethene and trichloroethene);
- ketones (e.g., acetone); and
- halogenated methanes (e.g., bromomethane).

Indoor air samples were collected over the daytime 8-hour work shift, during a weekday and at the same time that the soil gas samples were collected. The samples were collected during stable and moderate barometric conditions when subsurface air is somewhat more likely to enter the indoor air. Sampling was conducted from within the machine shop area in the main manufacturing facility (near column number G8), near the Anodize Room (G7 and J6), and near a former degreasing unit (R5). In addition, sampling was conducted in the basement (Q3 and JK3) of the Administration Building that is immediately south of the groundwater plume. Sampling was conducted with solid sorbent sampling tubes, in accordance with procedures for assessing compliance with OSHA work place criteria. The samples were analyzed by an off-site laboratory via OSHA Method 69 (acetone) and NIOSH Methods 1003 (chloroform and tetrachloroethene), 1022 (trichloroethene), 1015 (1,1-dichloroethene), 1007 (vinyl chloride), and 1501 (benzene). The tubes and sampling times were selected to provide detection limits below the OSHA PEL/NIOSH REL/ACGIH TLV criteria. Table 1 shows, for each compound, the analytical detection limits and the regulatory/guidance limits.

The results from the indoor air investigation were favorable, as summarized below:

- Indoor air samples were non-detect for solvents (Table 1) and OSHA/NIOSH/ACGIH limits were not exceeded for indoor air. In fact, all of the results were below the analytical detection limits. There was one minor exception, for benzene, where the detection limit (0.4) was slightly above the NIOSH REL guidance limit (0.32). Benzene is most likely from the former Amoco gasoline release, and is not a component of the groundwater plume caused by the manufacturing process areas;
- Solvents were detected (Table 2) in soil vapor but were below the Connecticut DEP Remediation Standard Regulations for industrial/commercial land use (CTRSR I/C

standards). The solvent with the highest concentration relative to the criterion was TCE at 15 % of the CTRSR limit of 16 ppmv; and

- No immediate action is needed to address the results. The sample data are being input into a vapor transport model, as the last step of the investigation workplan.

The results will be incorporated into a vapor transport computer model, as the last step of the investigation work plan that was reviewed by the USEPA. The results of the model will be evaluated to determine if any additional investigation or periodic sampling is needed. Once completed, a final report will be submitted to the USEPA. Summary information has already been provided in Monthly Progress Reports.

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Table 1: AC6 Indoor Air Results

ALL RESULTS BELOW REGULATORY LIMITS

COMPOUND	DETECTION LIMITS			SAMPLE VOLUME L	RESULTS 6 SAMPLES mg/m ³	HUMAN HEALTH CRITERIA		
	NMAM	LOQ PLANNED mg/m ³	LOQ ACHIEVED mg/m ³			Regulatory	Guidance	
						OSHA PEL mg/m ³	NIOSH REL mg/m ³	ACGIH TLV mg/m ³
chloroform*	1003	1.4	1.4	7 ^a	ND	C-240	49	9.78
tetrachloroethene*	1003	1.4	1.4	7 ^a	ND	678	ca/lfc 2.71	170
trichloroethene*	1022	1.4	1.4	7 ^a	ND	537	134	269
1,1-dichloroethene*	1015	1.4	1.4	7 ^a	ND	NC	ca/lfc 1.58	20
benzene*	1501	0.43	0.4	7 ^a	ND	3.19	0.32	1.6
acetone*	OSHA 69	3.3	3.3	3 ^b	ND	2400	590	1188
vinyl chloride	1007	0.4	0.67	3 ^b	ND	2.6	2.6	2.6

Detection limits: "planned" is what was calculated for the workplan (from planned sample volume and time)
"achieved" is what was accomplished by actual sampling conditions

^a - charcoal tube (SKC 226-01) ^b - Carbosorb SIII (ORBO 91)

* - compound detected in groundwater under manufacturing facility

C - ceiling

LOQ - limit of quantitation

NMAM - NIOSH Manual of Analytical Methods (or OSHA method as noted above)

PEL - regulatory Permissible Exposure Level (Occupational Safety and Health Administration)

REL - guidance Recommended Exposure Level (National Institute of Occupational Safety and Health)

TLV - guidance Threshold Limit Value (American Conference of Government and Industrial Hygienists)

NA - not analyzed

ND - not detected

NC - no criterion available

ca - potential occupational carcinogen

lfc - lowest feasible concentration; NIOSH recommended LOQ shown
regulatory limits and guidance criteria are shaded

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Table 2: AC6 Vapor Results Over Groundwater Plume

ALL RESULTS BELOW REGULATORY LIMITS

Compound	Location ID: Sample ID: Units:	LOQ ACHIEVED ppmv	AC0006SA S003740S ppmv	AC0006SB S003741S ppmv	AC0006SC S003742S ppmv	AC0006SD S003743S ppmv	CTDEP RSR I/C Soil Vapor ppmv
chloromethane		0.0020	ND	ND	ND	ND	NC
vinyl chloride		0.0020	ND	ND	ND	ND	1
bromoethane		0.0020	ND	ND	ND	ND	NC
chloroethane		0.0020	ND	ND	ND	ND	NC
1,1-dichloroethene*		0.0020	ND	0.001J	ND	ND	1
acetone*		0.0020	0.009	0.014	0.005	0.0090	8,250
carbon disulfide		0.0020	ND	ND	ND	0.001	NC
methylene chloride		0.0020	ND	ND	ND	ND	2907
trans 1,2-dichloroethene		0.0020	ND	ND	ND	0.0005J	NC
1,1-dichloroethane		0.0020	ND	ND	ND	ND	3037
cis 1,2-dichloroethene		0.0020	0.0005	0.006	0.0020	0.1	NC
methyl ethyl ketone (2-butanone)		0.0020	0.003	0.004	0.001J	0.007	8,285
chloroform*		0.0020	0.092	0.069	0.019	0.015	10.4
1,1,1-trichloroethane		0.0020	0.001	0.007	0.001J	0.0020	4,520
carbon tetrachloride		0.0020	ND	ND	ND	ND	27
1,2-dichloroethane		0.0020	ND	ND	ND	ND	1
benzene*		0.0020	0.0006	0.0006	0.0004J	0.0009J	113
trichloroethene*		0.012	0.81	0.35	2.4	1.8	16
1,2-dichloropropane		0.0020	ND	ND	ND	ND	1
bromodichloromethane		0.0020	0.0004	0.003	0.0005J	ND	NC
cis-1,3-dichloropropene		0.0020	ND	ND	ND	ND	1
4-methyl-2-pentanone (methylisobutylketone)		0.0020	ND	ND	ND	ND	480
toluene		0.0020	0.015	0.018	0.0090	0.025	2,615
trans-1,3-dichloropropene		0.0020	ND	ND	ND	ND	1
1,1,2-trichloroethane		0.0020	ND	ND	ND	ND	93
tetrachloroethene*		0.030	1.7	2.3	2.7	0.62	127
2-hexanone (methylbutylketone)		0.0020	ND	ND	ND	ND	NC
dibromochloromethane		0.0020	ND	ND	ND	ND	1
1,2-dibromoethane		0.0020	ND	ND	ND	ND	1
chlorobenzene		0.0020	ND	ND	ND	ND	106
ethylbenzene		0.0020	0.0020	0.0020	0.0030	0.0020	5,672
m/p-xylene		0.0020	0.0050	0.0060	0.0060	0.0040	1,702
o-xylene		0.0020	0.0020	0.0020	0.0020	0.0020	1,702
styrene		0.0020	0.0030	0.0040	0.0070	0.0020	28
bromoform		0.0020	ND	ND	ND	ND	6
1,1,2,2-tetrachloroethane		0.0020	ND	ND	ND	ND	1
1,3-dichlorobenzene		0.0020	ND	ND	ND	ND	818
1,4-dichlorobenzene		0.0020	ND	ND	ND	ND	3270
1,2-dichlorobenzene		0.0020	ND	ND	ND	ND	818

* - compound detected in groundwater plume under manufacturing facility; also in bold font

LOQ - level of quantitation

ND - not detected

NC - no criterion available

J - compound detected, but concentration estimated as it is below LOQ

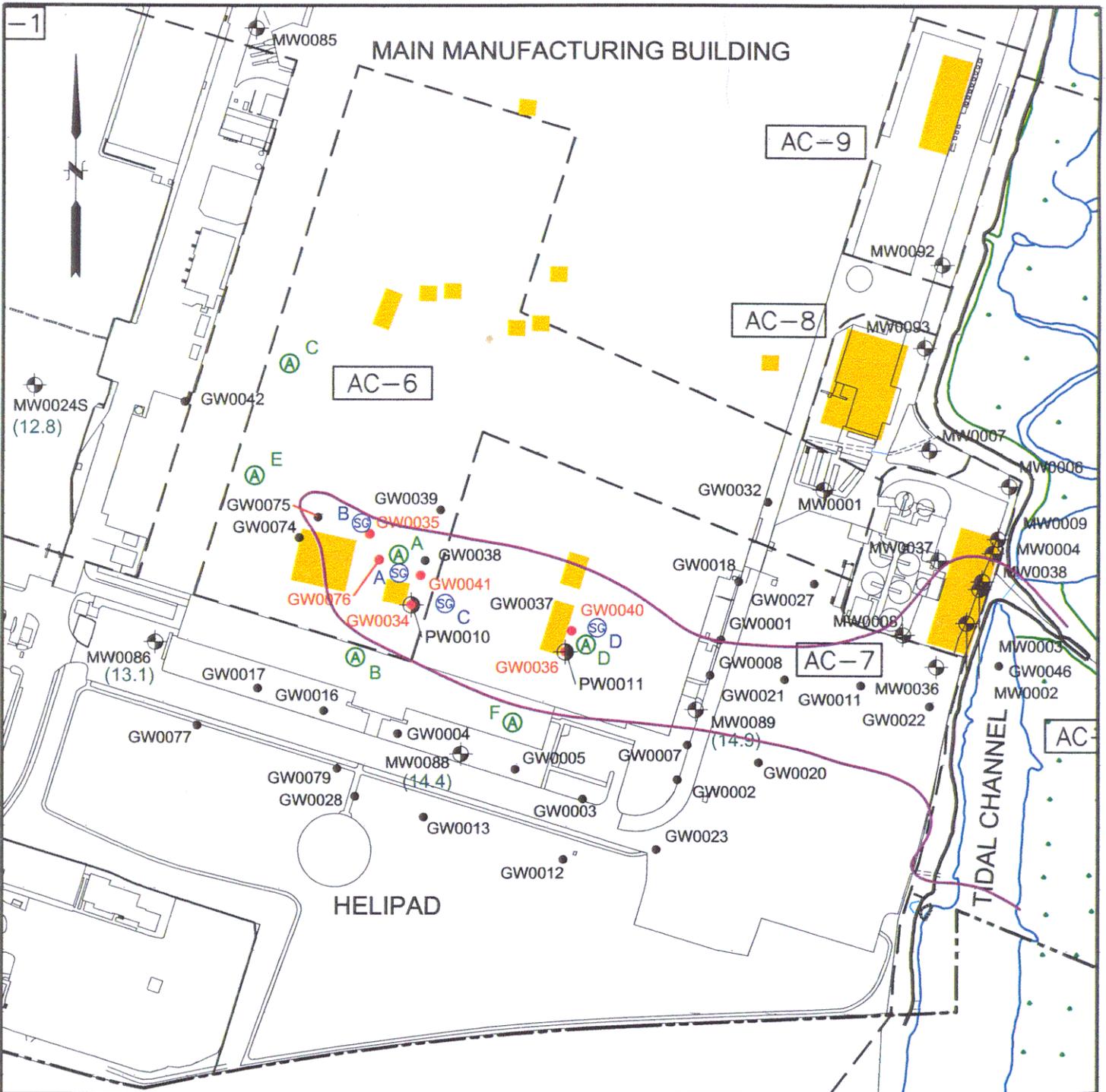
ppmv - parts per million by volume

RSR I/C - Connecticut Department of Environmental Protection Remediation Standard Regulation for industrial/commercial setting

lfc - lowest feasible concentration; NIOSH recommended LOQ shown

analyses originally reported as parts per billion by volume and converted to ppmv

regulatory limits and guidance criteria are shaded



LEGEND

- A A AIR SAMPLE LOCATIONS
- A SG SOIL GAS SAMPLE LOCATIONS (INDOOR/SUBFLOOR DIFFERENTIAL PRESSURE MEASURED AT LOCATION A SG)
- (6.9) VADOSE ZONE THICKNESS (FEET)
- VOC PLUME (WORST CASE TCE > 1,000 µg/L, PCE > 1,000, OR 1,2 - DCE > 100)
- GW0036 SHALLOW GROUNDWATER SAMPLE REPRESENTING POTENTIAL VOLATILIZATION CONCERN
- MW0089 EXISTING MONITORING WELL
- PW0010 EXISTING PIEZOMETER
- POTENTIAL SOURCE AREA

0 100 200 400 FEET

SCALE: 1"=200'



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FIGURE 1
AC-6 VAPOR INTRUSION SAMPLING LOCATIONS
RCRA CORRECTIVE ACTION PROGRAM
STRATFORD, CT.

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