START

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MEETING MINUTES

Subject: Expedited Response Action Weekly Interface

TO: Distribution BUILDING: 2440 Stevens Center

FROM: G. C. Henckel CHAIRMAN: G. C. Henckel

Dept-Operation-Component	Area	Shift	Meeting Dates	Number Attending
Environmental Engineering	RCHN	Day	12/06/93	12

Distribution

State of Washington Department of Ecology
G. Freedman
T. Wooley

U.S. Army Corps of Engineers
M. D. Mahoney A5-19

U.S. Department of Energy
G. I. Goldberg* A5-19

Ebasco
J. Grover
R. Cameron

U.S. Environmental Protection Agency
D. R. Einan B5-01
D. A. Faulk

Westinghouse Hanford Company
S. A. Driggers H6-04
G. C. Henckel H6-04
V. J. Rohay H6-04
EPIC H6-08
ERAG Route H6-04
GCH File

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A special topic meeting was held to status the 200 West Area Carbon Tetrachloride Expedited Response Action, specifically the Granular Activated Carbon (GAC) Overheating Incident, for the U.S. Department of Energy, Richland Operations Office (RL), the U.S. Environmental Protection Agency, and the State of Washington Department of Ecology.

The Westinghouse Hanford Company (WHC) contractor that performed the analysis of the GAC Overheating Incident presented a summary of the findings and conclusions. Brief descriptions of each of the major areas investigated were presented (attached). The preliminary summary report was reviewed by WHC and RL. The document was revised to incorporate comments and the results of the most recent laboratory testing to determine the heat of adsorption of carbon tetrachloride and co-contaminants. The revised document, WHC-SD-EN-TI-203, Summary of the Granular Activated Carbon (GAC) Canister Overheating Incident at the Carbon Tetrachloride Expedited Response Action Site, Revision 0, will be completed by the end of December 1993. The document will then be placed in the clearance process and should be available by the end of January 1994.

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DELIVERED PRESENTATION 6 DEC 93

SUMMARY OF REPORT

GAC CANISTER OVERHEATING INCIDENT AT CARBON TETRACHLORIDE ERA SITE

MARC DIPPRE

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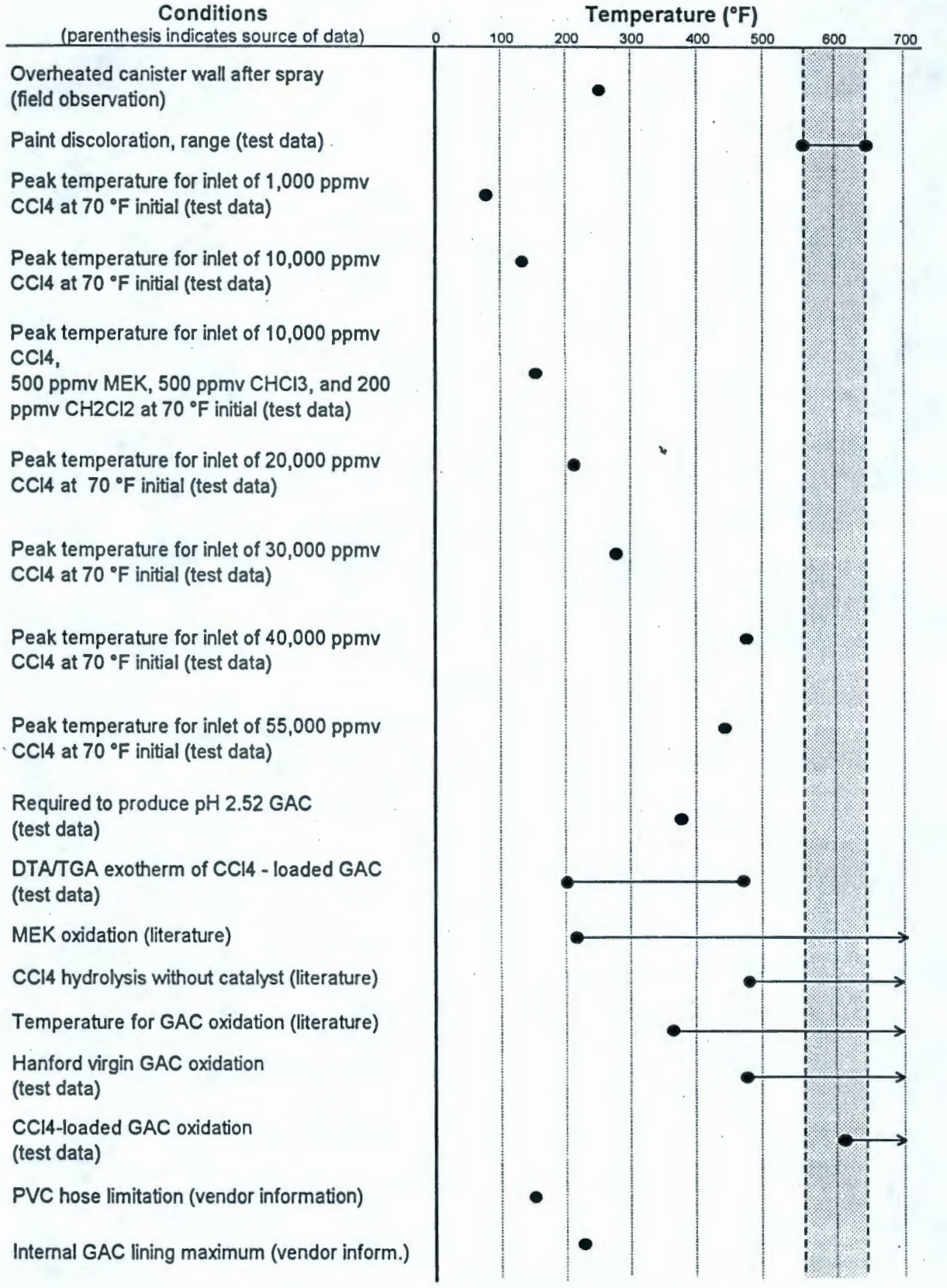
SUMMARY OF TEMPERATURES RELATED TO OVERHEATING INCIDENT



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TOPICS

- SUMMARY OF REPORT ON OVERHEATING INCIDENT
- CONCLUSIONS AND RECOMMENDATIONS
- POTENTIAL ENGINEERING CONTROLS

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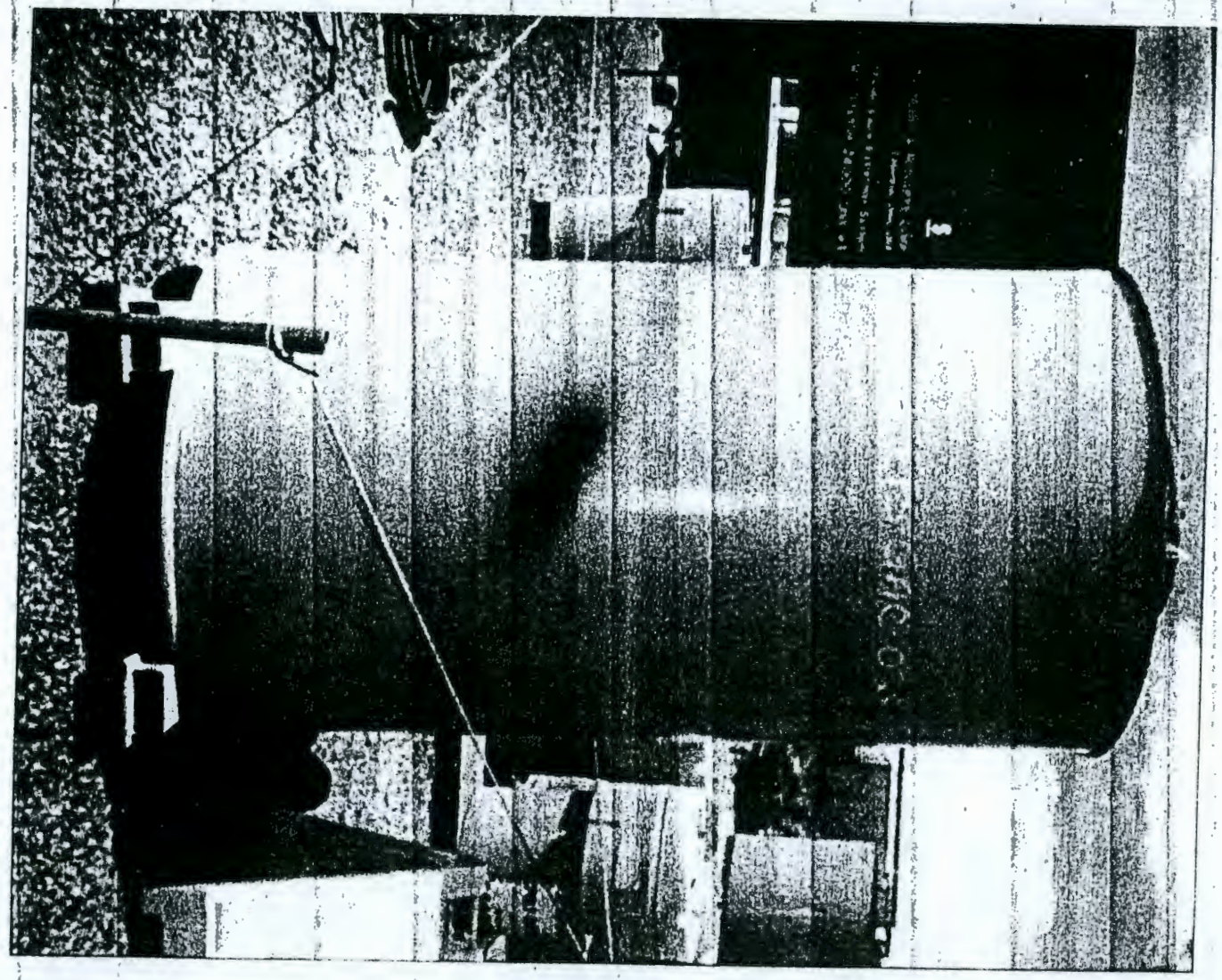

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SUMMARIES AND FINDINGS

OF

REPORTS ON OVERHEATING INCIDENT

Appendix A

SUMMARY BACKGROUND REPORT

- GAC INDUSTRY DOES NOT HAVE SUFFICIENT INFORMATION ON OVERHEATING MECHANISMS
- EXPERT OPINIONS REGARDING INCIDENT CAUSES AND ENGINEERING CONTROLS VARY WIDELY
- LITERATURE DESCRIBES OVERHEATING INCIDENTS RELATING TO OXIDIZABLE SOLVENTS AND SOLVENT RECOVERY PROCESSES
- SAVANNAH RIVER DOE EXPERIENCED OVERHEATING DURING PCE/TCE OFFGAS TREATMENT
- PRE-BID DISCUSSIONS DID NOT ADDRESS SPECIFICS OF HEAT GENERATION DURING ADSORPTION
- MANY POTENTIAL ENGINEERING CONTROLS POSSIBLE

HISTORY OF OVERHEATED GAC CANISTER

- LOADED ABOUT 40 lb OF CCl_4 AND UNKNOWN AMOUNTS OF OTHER SOIL GASES FROM WELL 299-W15-217 AND CPT WELLS AS A 2° CANISTER PREVIOUS TO USE AS 1° GAC CANISTER
- CALCULATED AMOUNT OF CCl_4 LOADED WAS 357 lb, WHICH CORRESPONDS TO 60% OF CARBON CAPACITY AT A LOADING FACTOR OF 34% BY WEIGHT
- UNIFORM FLOW CORRESPONDS TO LOADING RATE WHICH PLACES DISCOLORED PAINT AT EXPECTED LOCATION
- ACCORDING TO TWO EXPERTS, COMPOUNDS WHICH ARE PREFERENTIALLY DESORBED BY CCl_4 CAN CONCENTRATE AT 50% TO 100% HIGHER THAN INLET CONCENTRATION

Appendix B

SUMMARY REFERENCES REPORT

- PROVIDED INSIGHT INTO BEHAVIOR OF OXIDIZABLE ORGANICS, ESPECIALLY MEK
- PROVIDED A BASIS FOR HEAT TRANSFER MODELING
- GENERATED EXPERT CONTACTS

Appendix C

GAC EXPERT FINDINGS REPORT

- GAC "FIRES" UNKNOWN IN DOCUMENTED LITERATURE IN SOLVENT ADSORPTION
- OVERHEATING INCIDENT WAS PROPERLY HANDLED BY SITE PERSONNEL WITH EXISTING KNOWLEDGE
- SOME RISK OF OVERHEATING INHERENT IN EXTRACTING SOIL VAPOR ONTO GAC
- BENCH-SCALE STUDIES ARE NEEDED
- ACQUIRE REPRESENTATIVE SOIL GAS SAMPLE AND CHARACTERIZE FULLY

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Appendix D

LABORATORY ANALYSES AND BENCH-SCALE TESTING REPORT

- ORGANIC ANALYSES OF INCIDENT WELL HEADSPACE
- ORGANIC ANALYSIS OF OVERHEATED GAC
- THERMOGRAVIMETRIC ANALYSES
- FULL-SCALE THERMOCOUPLE RESPONSE TESTS
- BENCH-SCALE ADSORBER TESTS
- CANISTER PAINT COUPON TESTS

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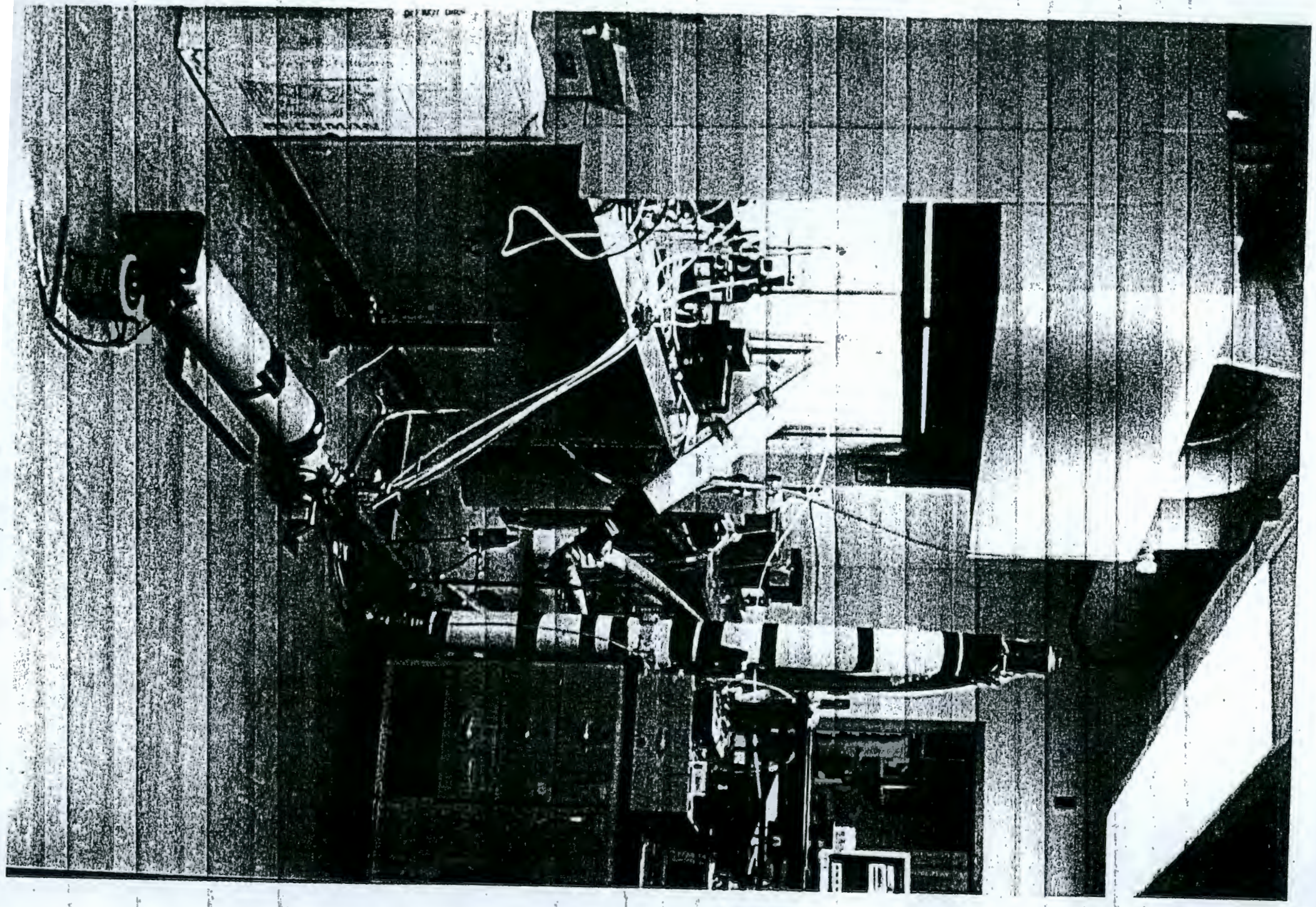

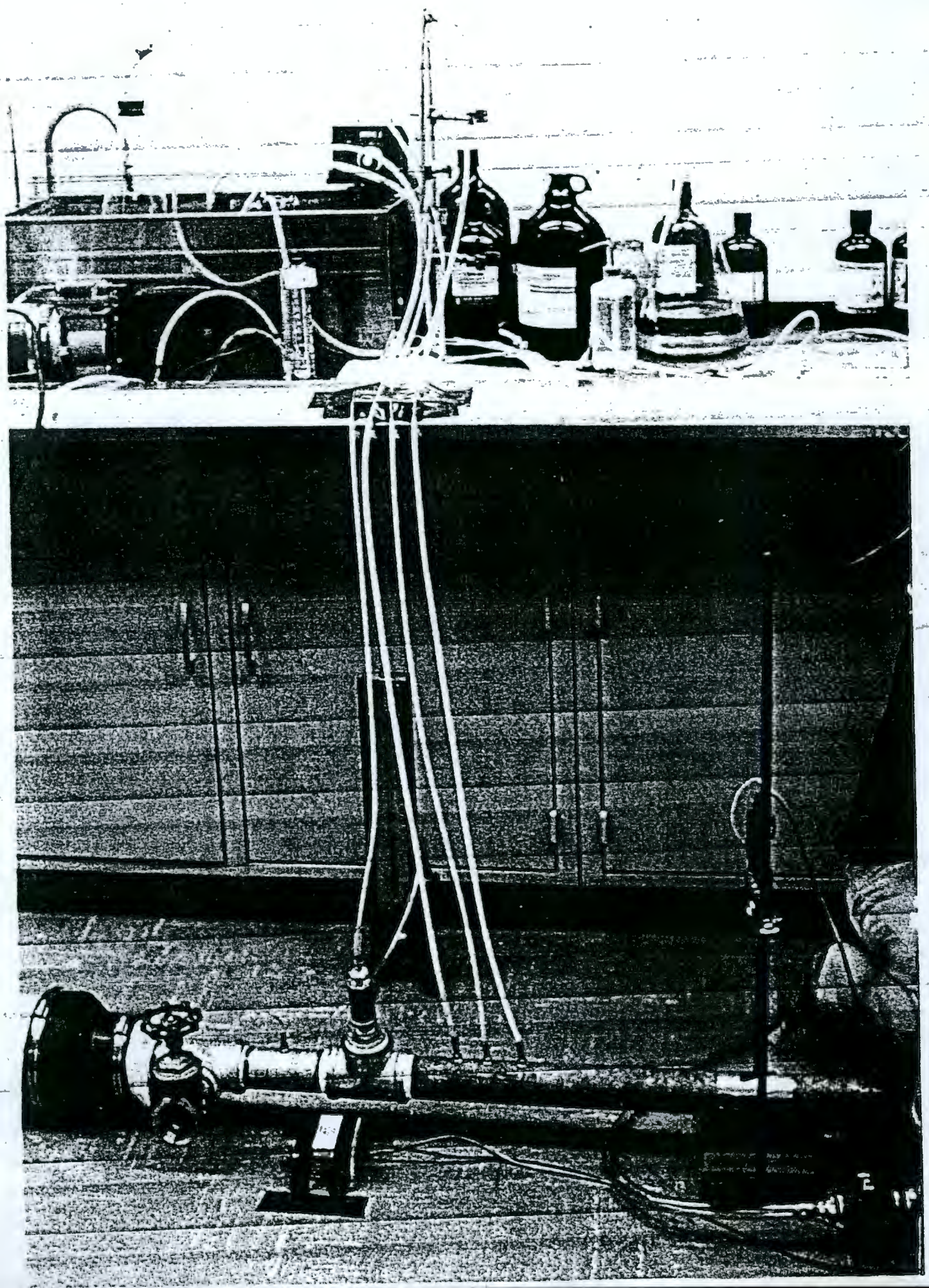

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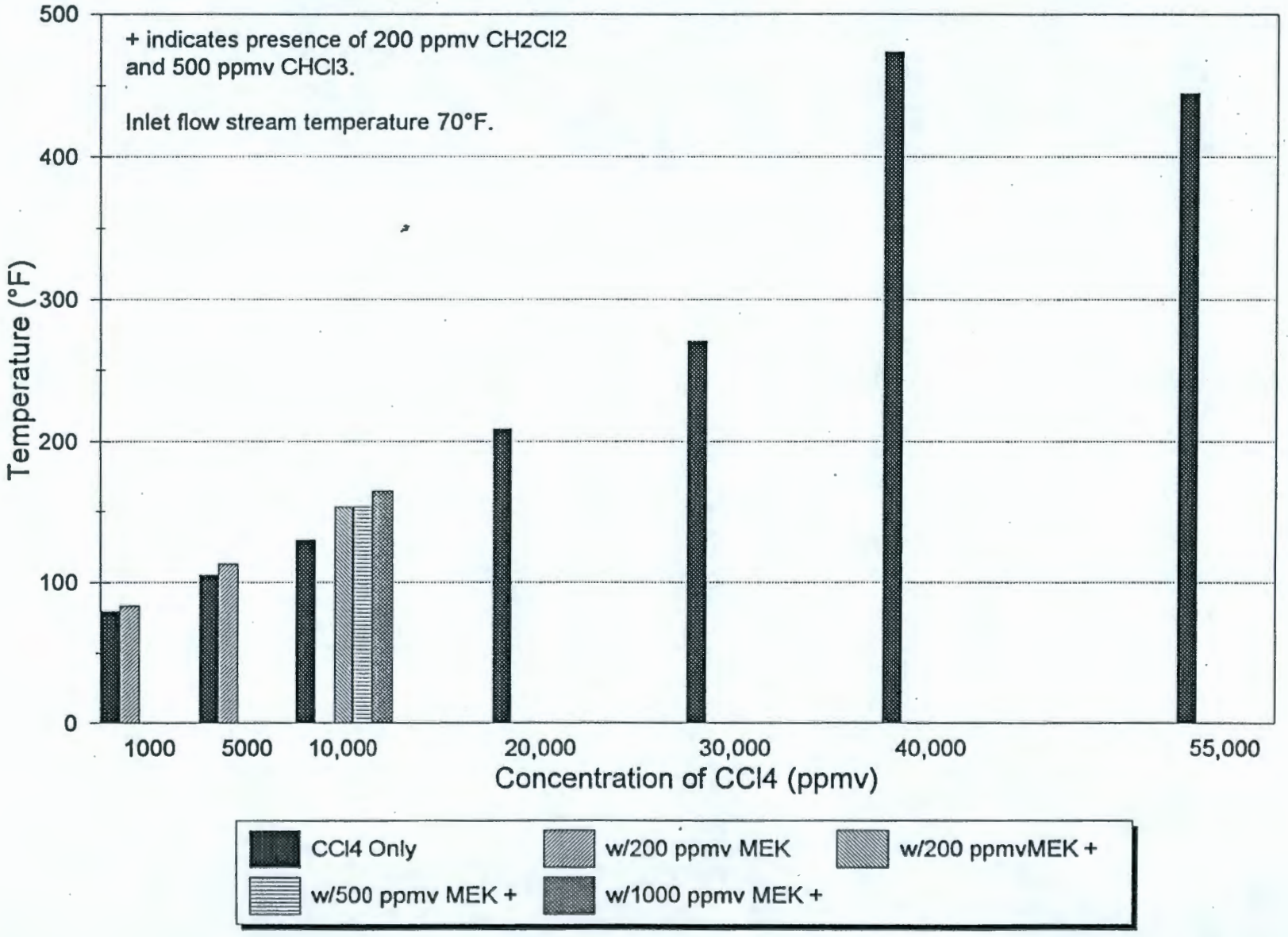
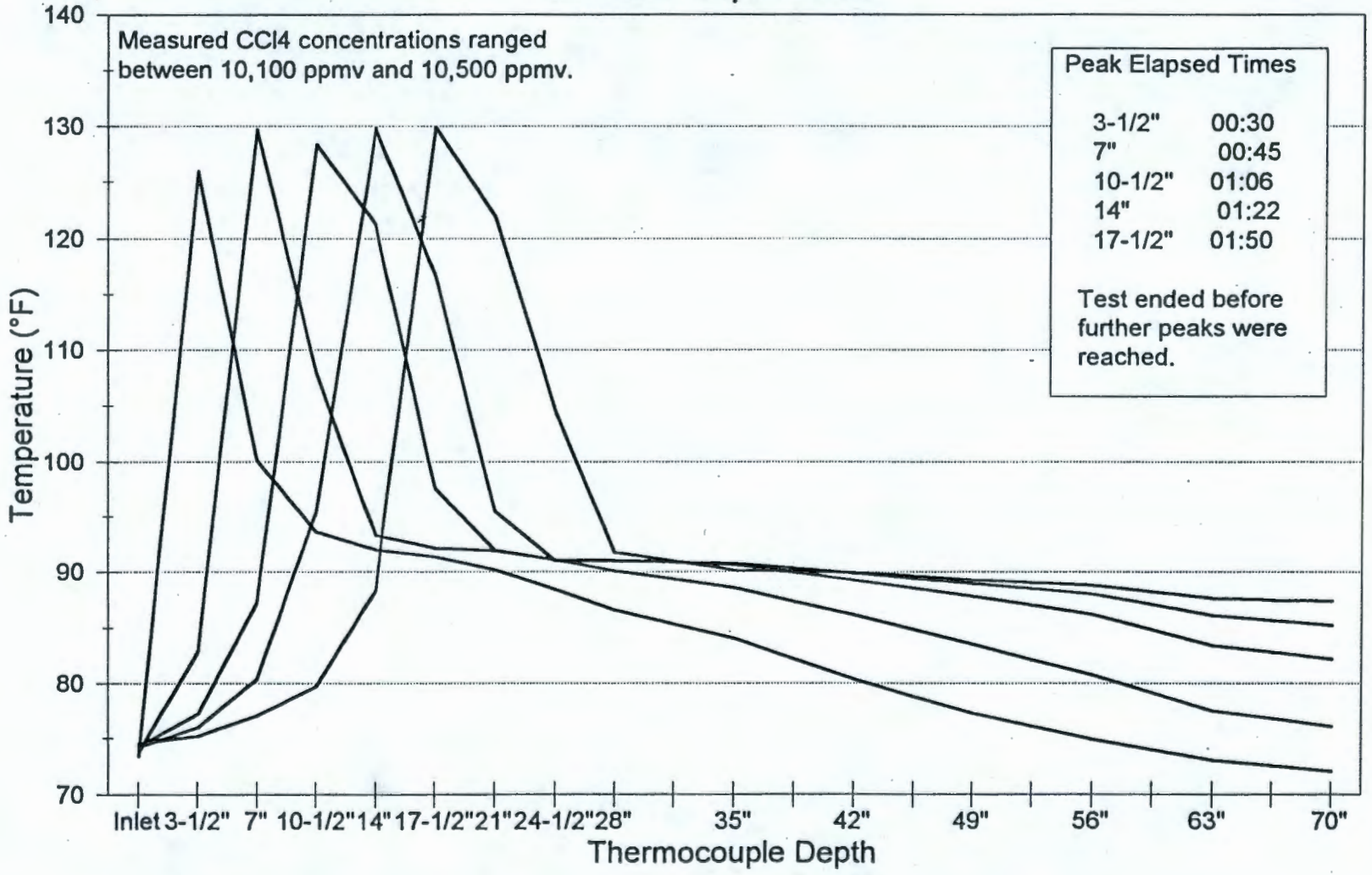
Observed Bench-Scale Test GAC Peak Temperatures vs. CCl4 Concentration - 500 cfm Equivalent Flow



GAC Column Bench-Scale Test Peak Temperature Profiles

10,000 ppmv CCl4
500 cfm Equivalent



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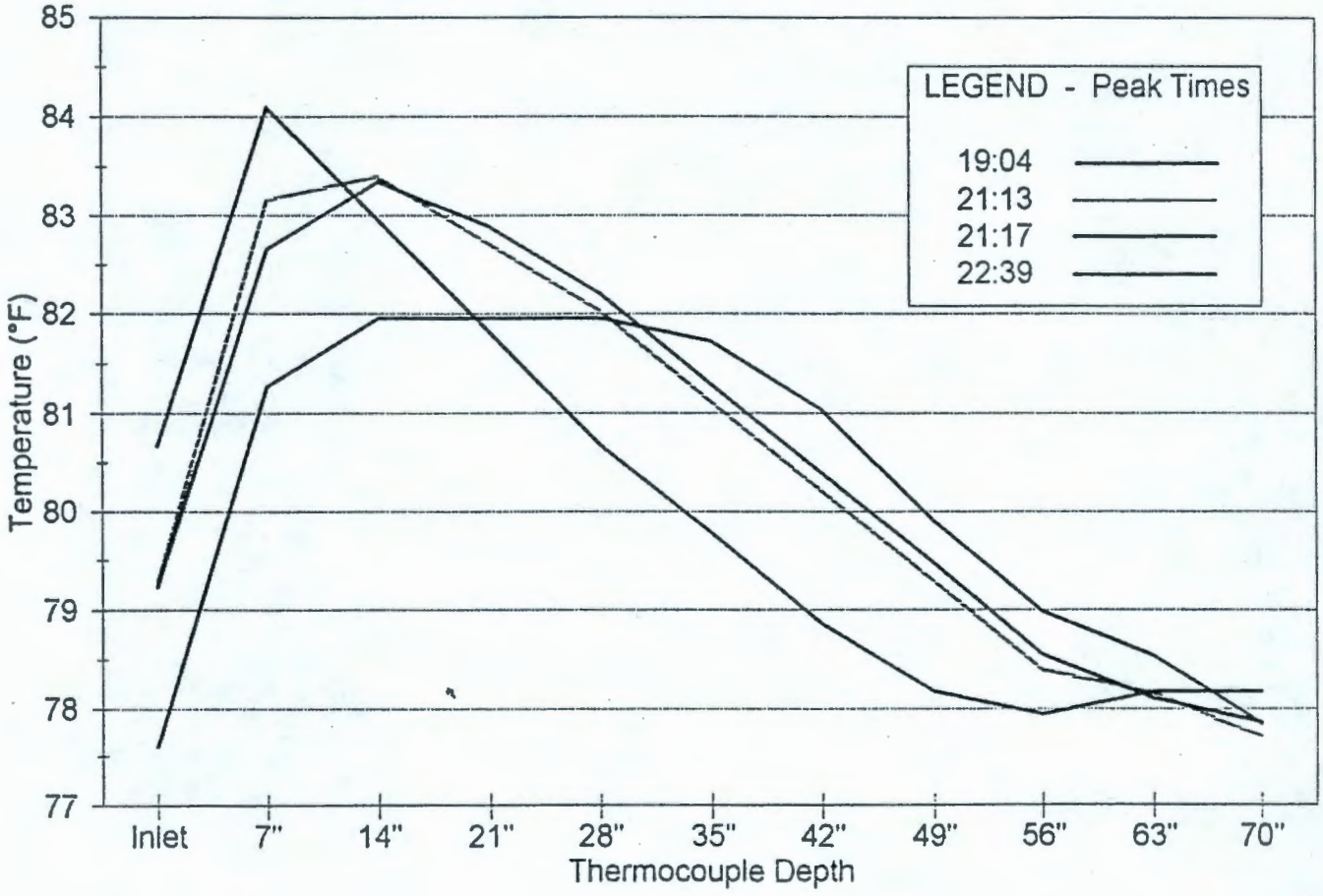
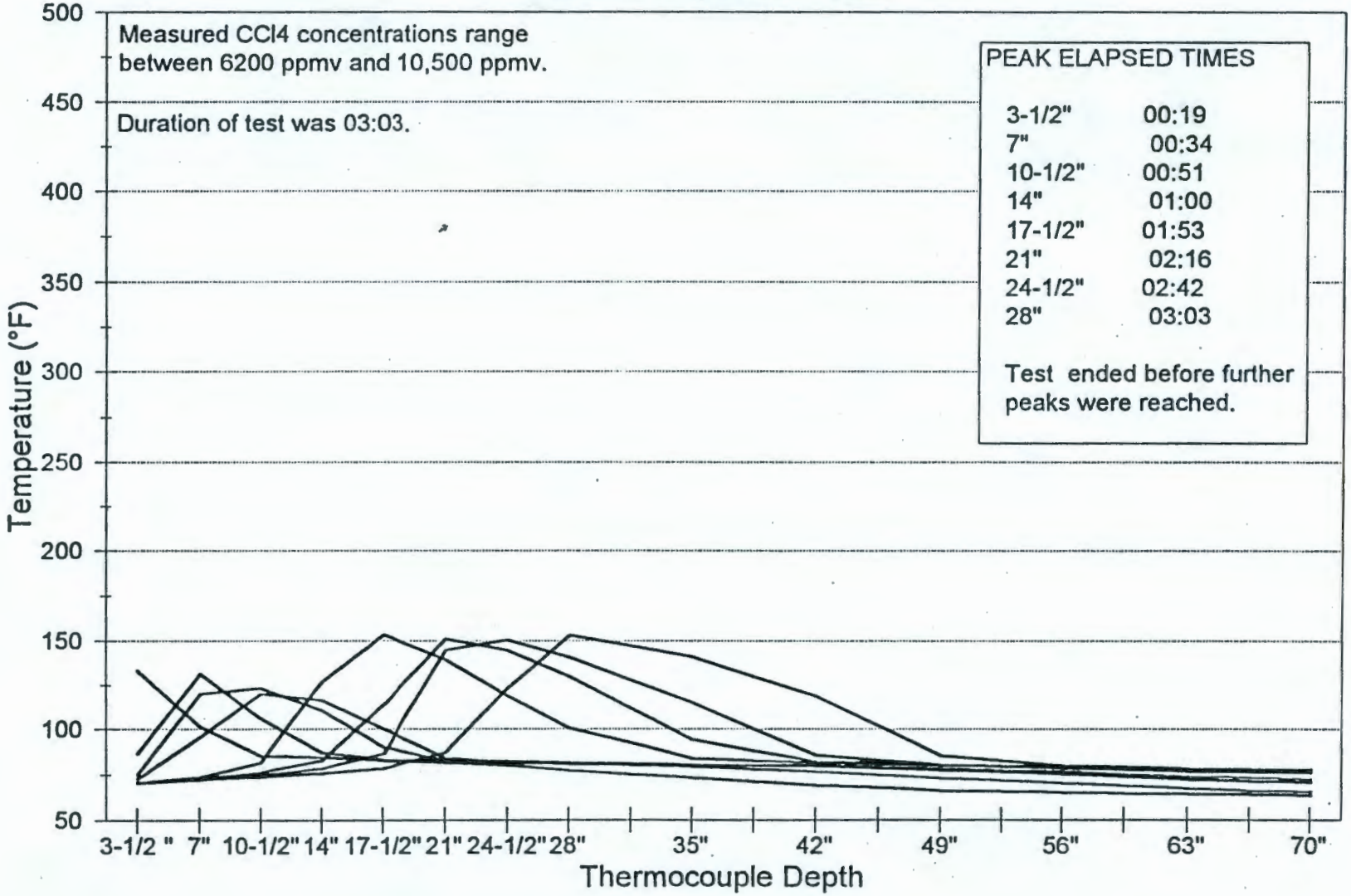
GAC Canister Bench-Scale Test
1,000 ppm CCl4, 500 cfm Equivalent
Maximum Temperatures vs. Thermocouple Depth



GAC Column Bench-Scale Test Peak Temperature Profiles

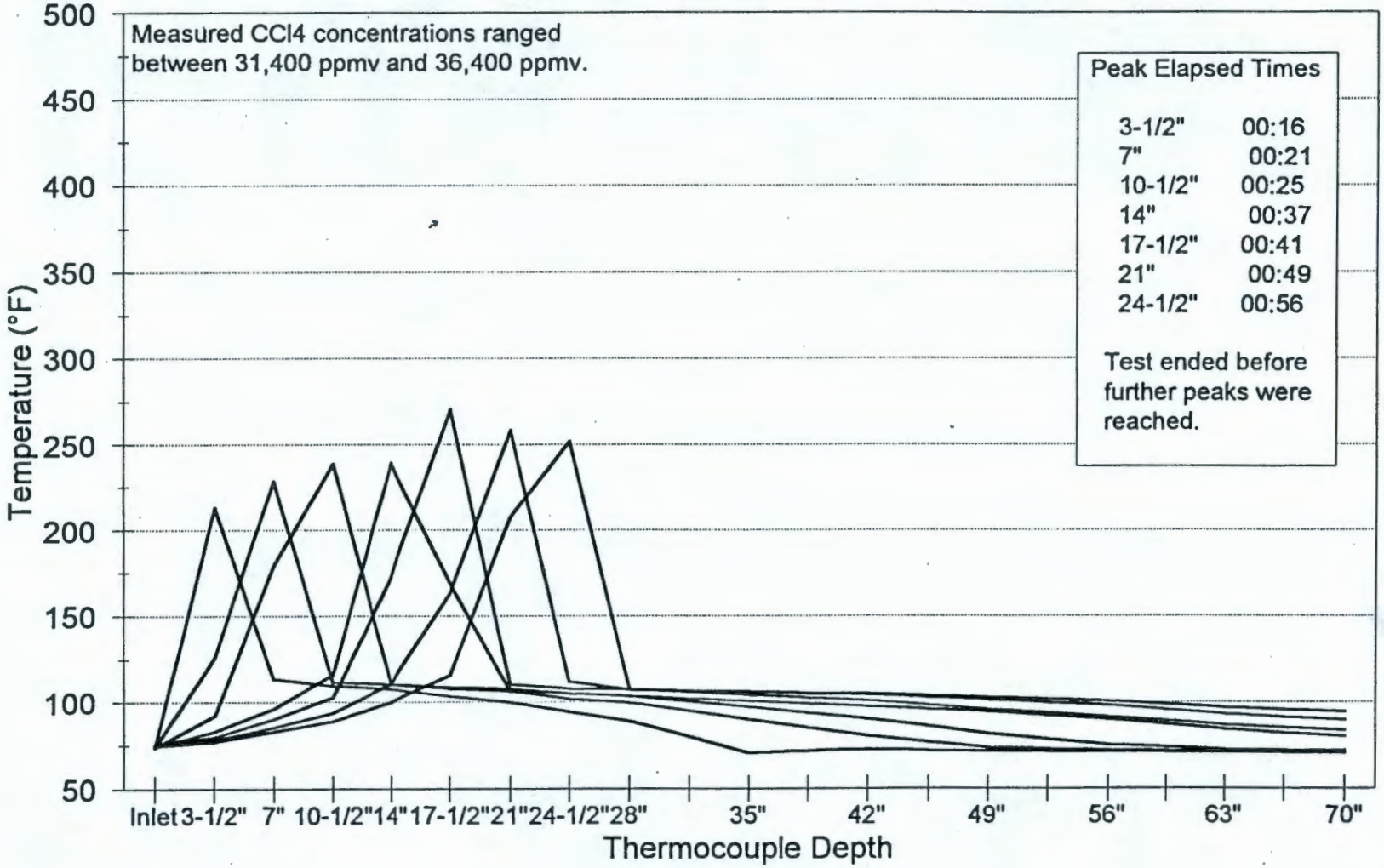
10,000 ppmv CCl4, 500 ppmv MEK, 200 ppmv CH2Cl2, 500 ppmv CHCl3
500 cfm Equivalent Flow



GAC Column Bench-Scale Test Peak Temperature Profiles

30,000 ppm CCl4

500 cfm Equivalent Flow



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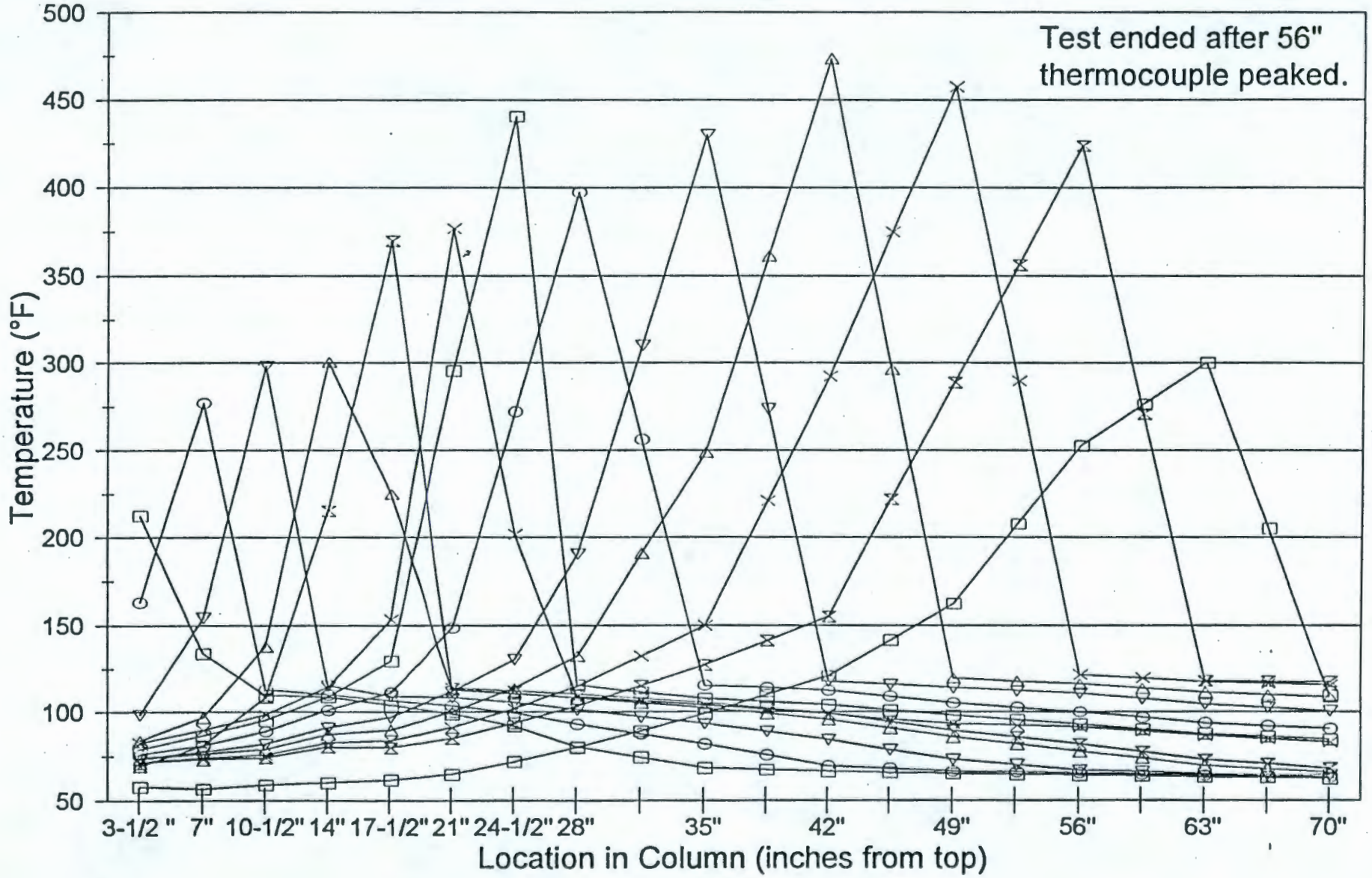
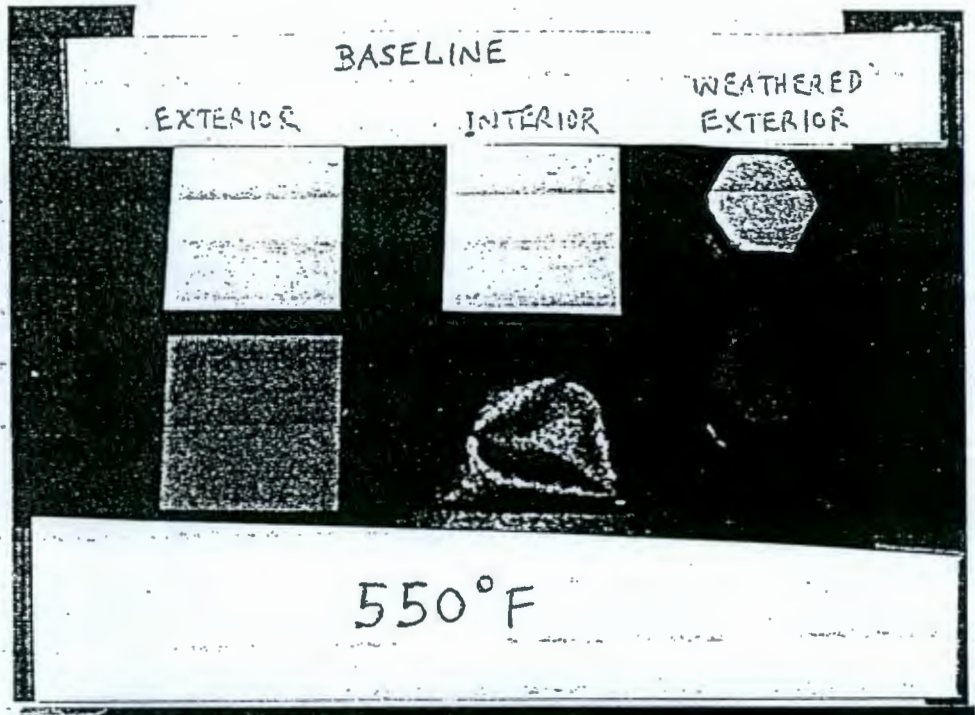
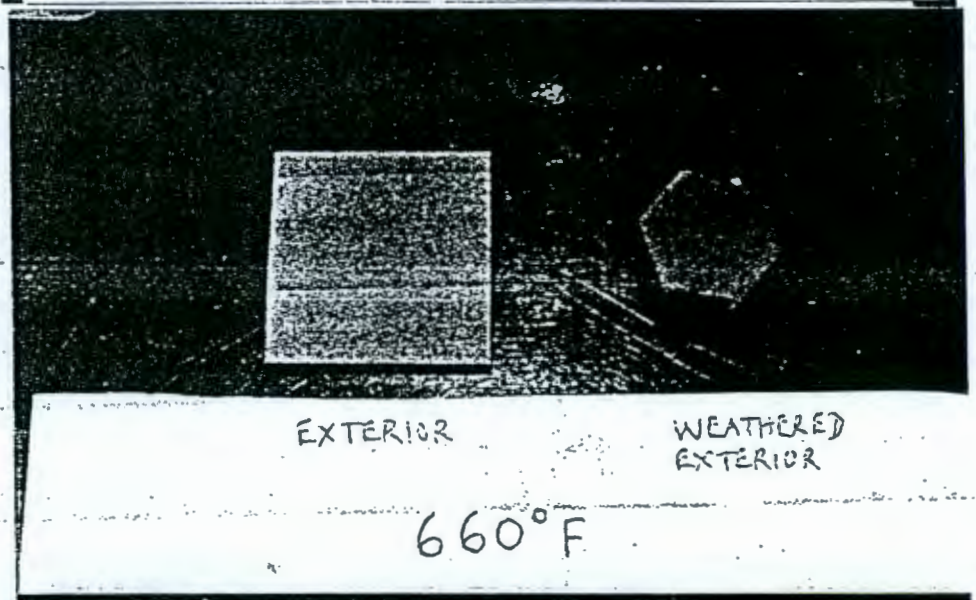
GAC Column Bench-Scale Peak Temperature Profiles

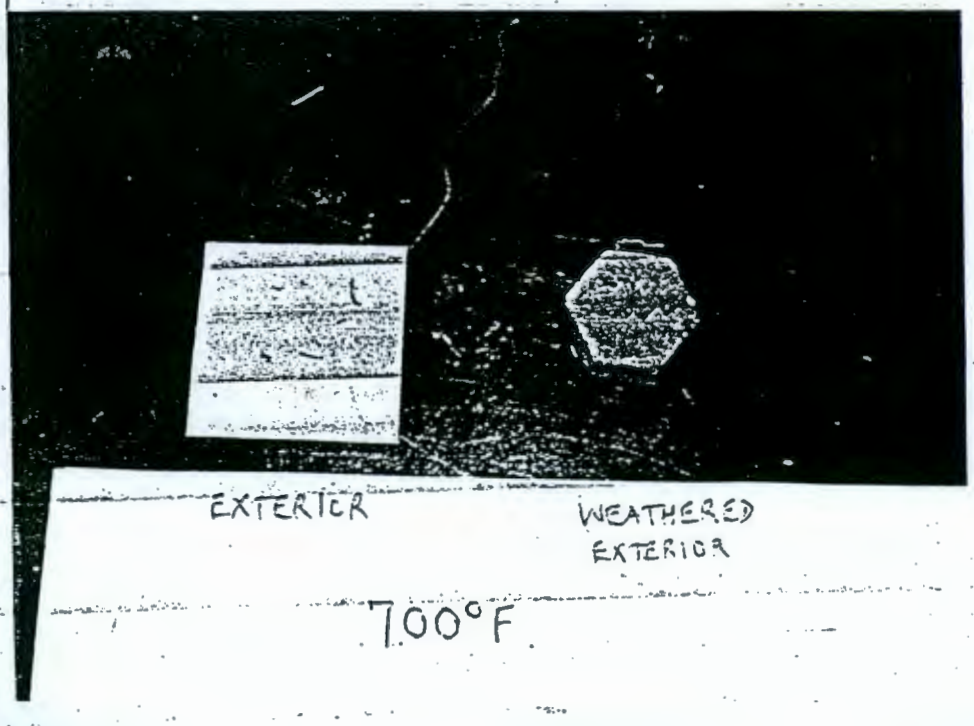
40,000 ppmv CCl4

500 cfm Equivalent Flow









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Appendix E

HEAT TRANSFER MODELING REPORT

- COMPLEXITY OF HEAT TRANSFER MECHANISMS
- GAC LOADING AND HEAT OF ADSORPTION VARIABILITY
- IMPACTS OF CHEMICAL REACTIONS
- NEED FOR FUTURE BENCH-SCALE TESTS TO DEFINE SAFE CCl_4 OPERATING LEVELS

Vendor Supplied Isotherm Plot for CCl4 Adsorption on GAC.

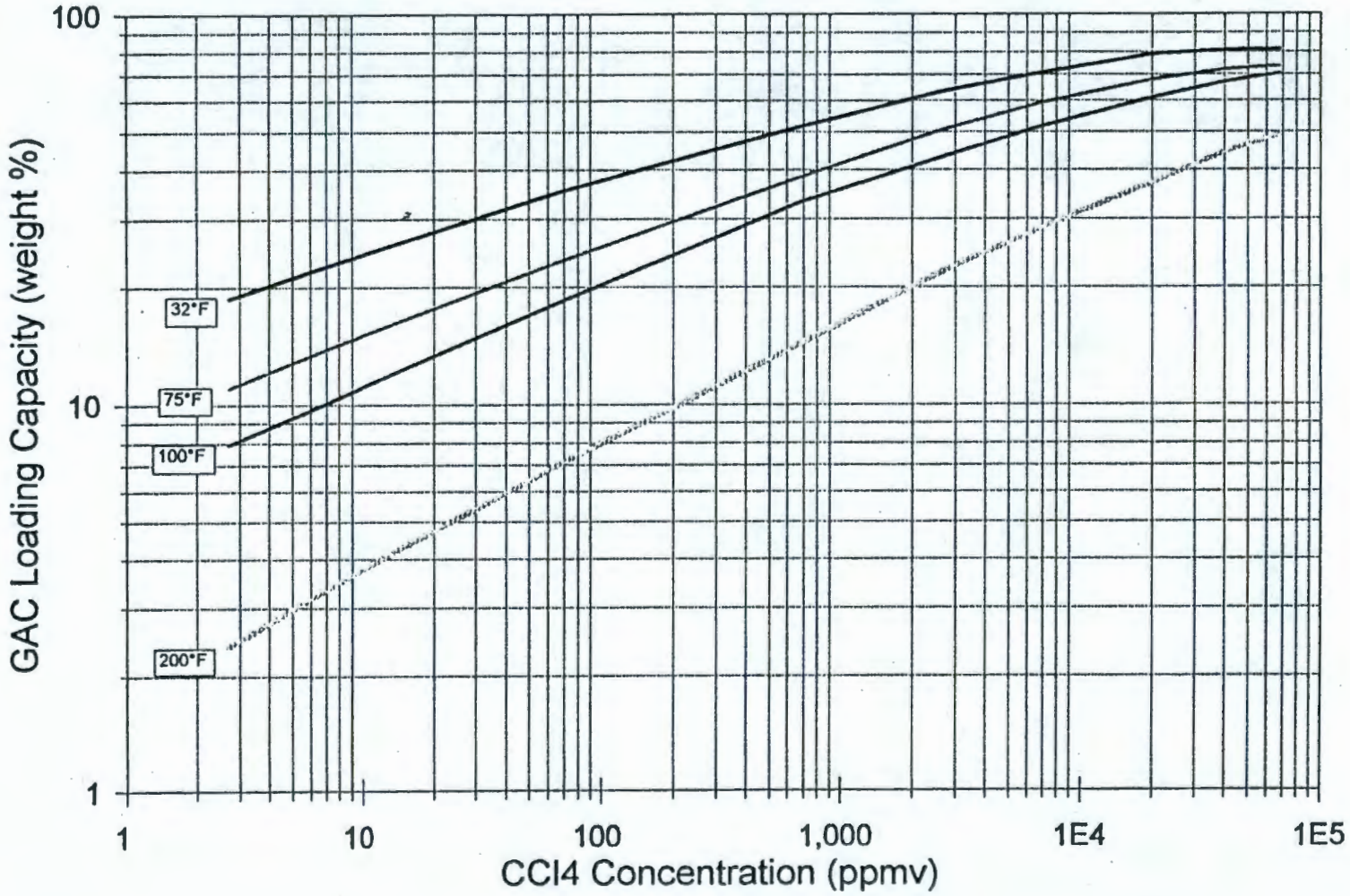
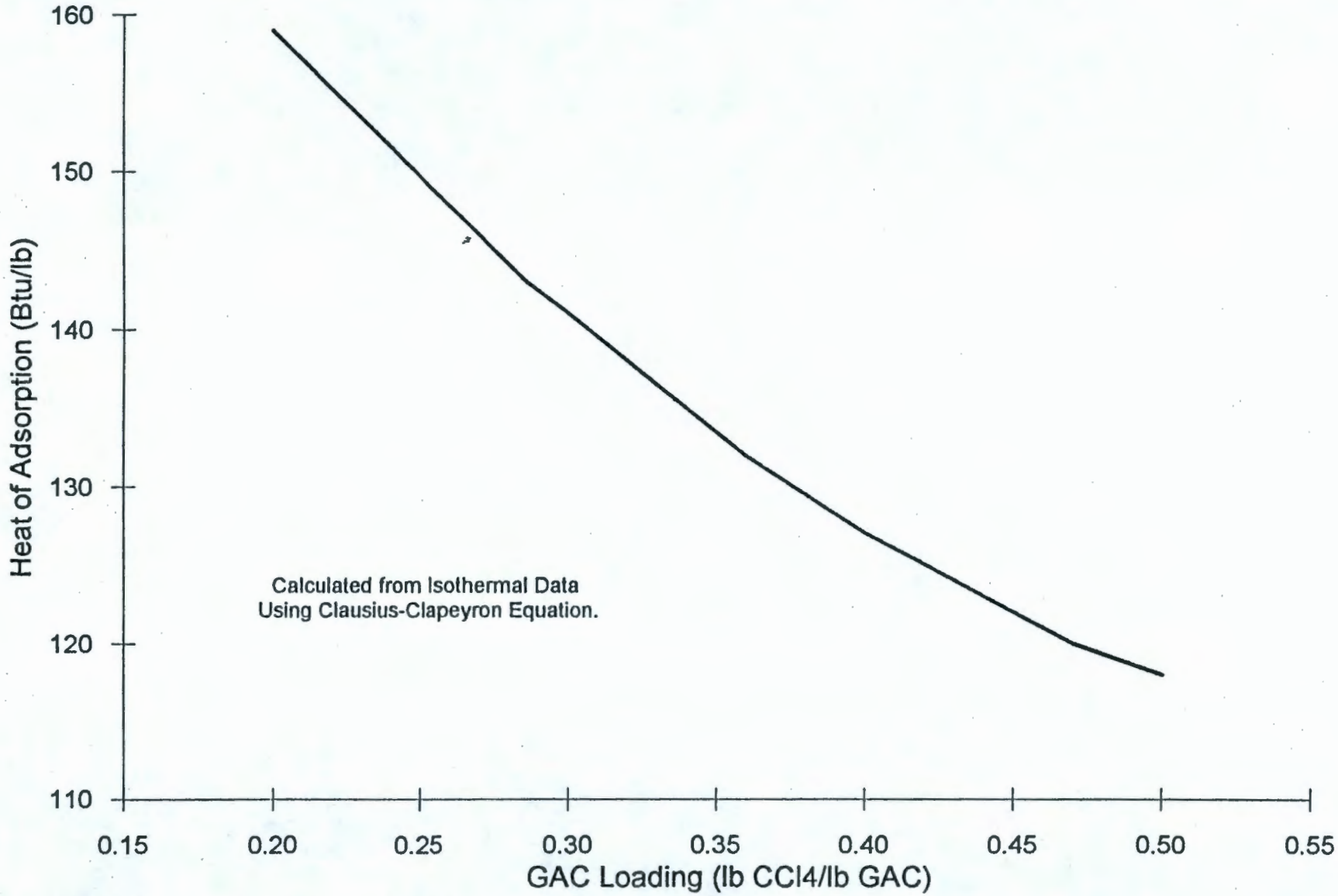


Figure 4-2. Predicted Heat of Adsorption versus GAC Loading.



WSUPLOT.XLS Chart 1

Reaction Heat Release and Relative Temperature Rises.

REACTANT	REACTION	HEAT OF REACTION (Btu/lb)	REACTANT QUANTITY (lb)	RELATIVE TEMPERATURE RISE [a]	INITIATION TEMPERATURE °F	SOURCE
CCl_4	hydrolysis	~482	0.5	x 5	>300 (?)	Ebasco, 1993a
$CHCl_3$	hydrolysis	1350	0.2	x 6	unknown	
CH_2Cl_2	oxidation	2260	0.2	x 10	unknown	
MEK	oxidation	14,600	0.2	x 60	> = 212	Naujokas, 1979
GAC	oxidation	14,100	1.0	x 300	> = 480	Ebasco, 1993b
physical adsorption	NA	118 [b]	0.5	x 1	none	Ebasco, 1993a

(a) Relative temperatures rise compared to the 200 °F rise measured in bench-scale test at 30,000 ppm carbon tetrachloride inlet.

(b) Assumed heat of adsorption.

Appendix F

POTENTIAL PHOSGENE GENERATION REPORT

- PHOSGENE WAS GENERATED DURING OVERHEATING INCIDENT
- MOST OF PHOSGENE CONVERTED TO CO_2 AND HCl
- REMAINDER OF PHOSGENE CAPTURED IN 2° AND 3° CANISTERS
- PHOSGENE ESCAPE FROM THE VAPOR EXTRACTION SYSTEM WAS LESS THAN PERMISSIBLE EXPOSURE LIMIT

Appendix G

TREATMENT COMPARISONS REPORT

- CONDENSING IS COST EFFECTIVE
- ONSITE INCINERATION IS ALSO COST EFFECTIVE
- NO DECISION BY WHC ON WHETHER TREATMENT ALTERNATIVES WILL BE EMPLOYED

CORRELATIONS OF REPORT CONCLUSIONS

- PAINT DISCOLORATION TEMPERATURES SHOW INTERNAL GAC TEMPERATURE > 550 °F
- HEAT OF ADSORPTION AT 28,500 ppm_v CCl_4 CANNOT GENERATE HEAT REQUIRED TO DISCOLOR PAINT
- CHEMICAL REACTION APPARENTLY CREATED HCl
- INCIDENT WELL HEADSPACE DID NOT CONTAIN OXIDIZABLE SUBSTANCES AT LEVELS OF CONCERN

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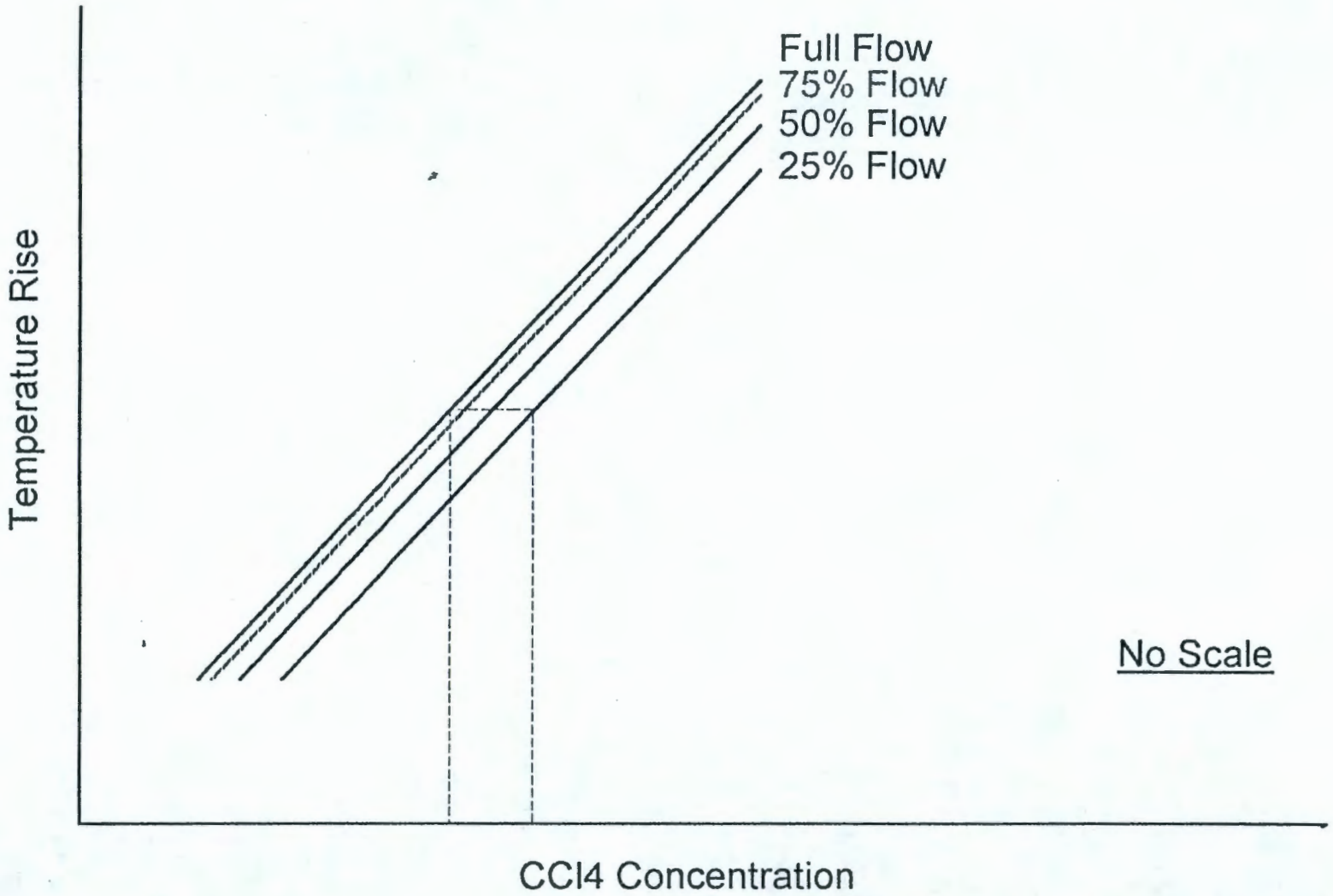
CONCLUSIONS AND RECOMMENDATIONS

Temperature Rise in GAC Canister vs. Concentration and Flow



CONCLUSIONS

- EXPERIMENTAL DATA ARE MORE USEFUL THAN MATHEMATICAL MODELING
- TEMPERATURE IN TEST COLUMN MAXIMIZED AT ABOUT 480°F WITH PURE CCl_4 STREAMS UP TO 55,000 ppm_v
- OVERHEATING INCIDENT COULD NOT OCCUR DUE TO PURE CCl_4 AT A CONCENTRATION OF 28,500 ppm_v
- THE PRESENCE OF OTHER COMPOUNDS OR OTHER MECHANISMS ARE SUSPECTED AS INITIATORS OF THE OVERHEATING INCIDENT
- EXTRACTION OPERATIONS AT GAC INLET CCl_4 CONCENTRATIONS OF 1,000 ppm_v CCl_4 POSE LITTLE POTENTIAL FOR OVERHEATING
- EXTRACTION OPERATIONS AT GAC INLET CONCENTRATIONS UP TO 10,000 ppm_v CCl_4, 500 ppm_v MEK, 500 ppm_v $CHCl_3$, AND 200 ppm_v CH_2Cl_2 POSE A LOW POTENTIAL FOR OVERHEATING

RECOMMENDATIONS

- DETERMINE CO BASELINE FOR DETECTING GAC COMBUSTION
- DETERMINE EFFECTIVENESS AND IMPACT OF PREWETTING
- DETERMINE EFFECTS OF ELEVATED INLET FLOW STREAM TEMPERATURES
- CONTINUE STUDY OF TREATMENT ALTERNATIVES FOR HIGH INLET CCl_4 CONCENTRATIONS
- DEVELOP METHODS FOR FULLY CHARACTERIZING SOIL GAS WHILE PERFORMING EXTRACTION OPERATIONS
- SET EXTRACTION LIMIT CONCENTRATIONS AT 10,000 ppm_v CCl_4, 500 ppm_v MEK, 500 ppm_v $CHCl_3$, AND 200 ppm_v CH_2Cl_2
- INVESTIGATE POTENTIAL ENGINEERING CONTROLS

POTENTIAL ENGINEERING CONTROLS AT HIGHER CCl_4 CONCENTRATIONS

- KEEP INLET FLOW STREAM TEMPERATURES 80 °F MAXIMUM
- PROVIDE PRE-ADSORPTIVE AND/OR POST-ADSORPTIVE AMBIENT AIR COOLING
- MONITOR SOIL GAS FOR COMBUSTIBLE ORGANICS
- PROVIDE INTERNAL THERMOCOUPLES IN GAC
- PROVIDE PRE-WETTING WATER BEFORE ADSORPTION
- ADD HUMIDITY TO INLET FLOW STREAM
- PROVIDE CO OR CO_2 MONITORING OF OUTLET FLOW STREAM
- PROVIDE NITROGEN PURGE GAS
- PROVIDE WATER QUENCHING SYSTEM