D3

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RECENT ADVANCES IN MATERIALS TOXICOLOGY

OUTLINE

- OVERVIEW OF JSC FIRE TOXICOLOGY PROGRAM
  - PRINCIPAL OBJECTIVE
  - APPROACH
- LABORATORY METHODS OF ASSESSING PYROLYSIS PRODUCT TOXICITY
  - EXPERIMENT 1: COMPARISON OF TEST END POINTS
  - EXPERIMENT 2: EVALUATION OF OPERANT TECHNIQUES
- COMPARISON OF FULL-SCALE AND LABORATORY TOXICITY TESTS
  - EXPERIMENT 3: PRELIMINARY WORK
- FUTURE RESEARCH PLANS AT JSC

OVERVIEW OF JSC FIRE TOXICOLOGY PROGRAM

- PRINCIPAL PROGRAM OBJECTIVE: ASSIST IN THE DEVELOPMENT OF TOXICOLOGIC SCREENING PROCEDURES

- PROGRAM APPROACH: RESEARCH IN TWO AREAS

  - LABORATORY METHODS FOR ASSESSING PYROLYSIS PRODUCT TOXICITY

  - COMPARISON OF FULL-SCALE AND LABORATORY TOXICITY TESTS

- COMPARATIVE NATURE OF EXPERIMENTS

LABORATORY METHODS OF ASSESSING PYROLYSIS PRODUCT TOXICITY

- EXPERIMENT 1: COMPARISON OF BEHAVIORAL END POINTS

  - PURPOSE: DO TEST BEHAVIORS VARY IN SUSCEPTIBLITY TO TOXIC INCAPACITATION?
  - METHOD:
  - RESULT:
  - CONCLUSION: TUF IS A FUNCTION OF MECHANISM OF INCAPCITATION AND BEHAVIORAL REQUIREMENTS OF TEST.

LABORATORY METHODS OF ASSESSING PYROLYSIS PRODUCT TOXICITY

- EXPERIMENT 2: EMPLOY OPERANT TECHNIQUES TO ASSESS THE TOXICITY OF 2 POLYURETHAN FOAMS.
  - PURPOSE: EVALUATE OPERANT TECHNIQUES FOR TOXICOLOGICAL SCREENING.
  - METHOD:
  - RESULTS: 1. CO ANALYSIS
    2. CUMULATIVE RECORDS
    3. STATISTICAL SUMMARY

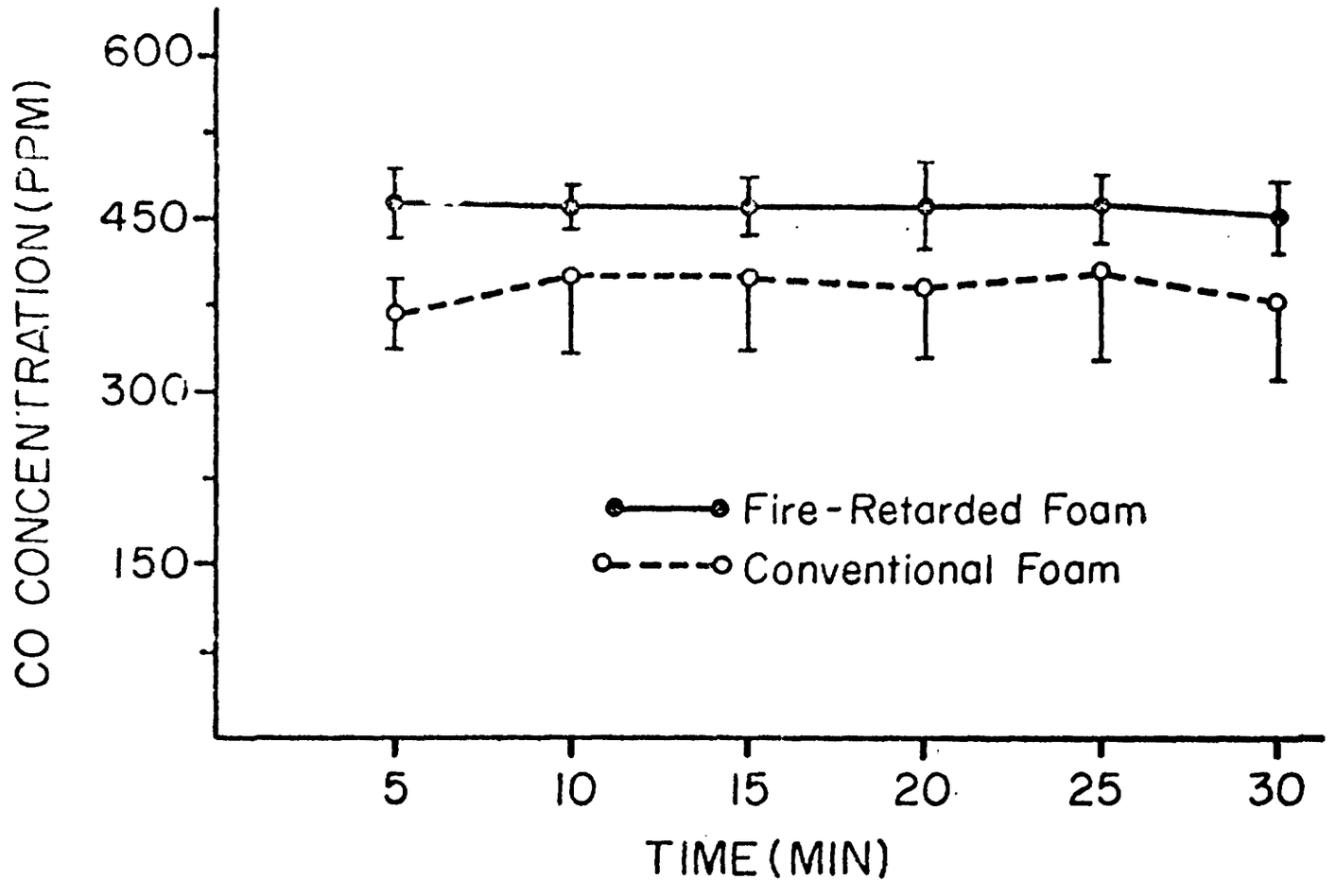


FIGURE 1. Mean CO Concentration ± 1 S.E. as a Function of Test Time.

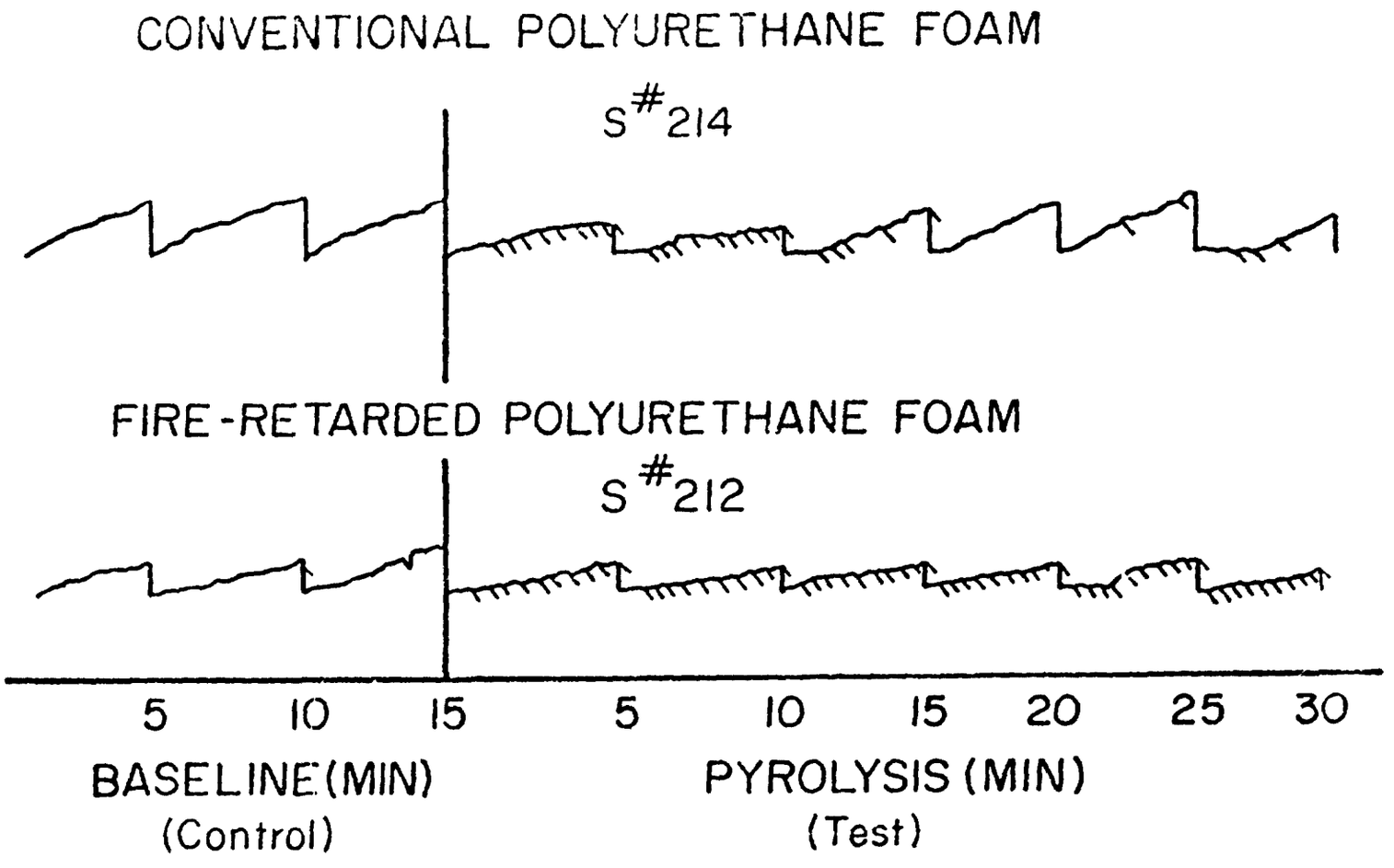


FIGURE 2. Cumulative Records Showing Effect of Foam Pyrolysis on Signalled (Discriminative) Shock Avoidance. (Upward Displacement of Line Indicates Bar Response and Downward Slash Represents Shock Occurence.)

TABLE 1. Pyrolysis-Induced Changes in Operant Performance. Each Cell Represents The Results of a Paired T-Test. NS = No Significant Change ($p>.05$), ↑ = Significant increase ($p<.05$), ↓ = Significant Decrease ($p<.05$)

UNSIGNALLED (SIDMAN) AVOIDANCE															
	FIRE-RETARDED FOAM							CONVENTIONAL FOAM							
RATES (PER MIN)	TEST MIN.							TEST MIN.							
	5	10	15	20	25	30	TOT	5	10	15	20	25	30	TOT
AVOIDANCE	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
ESCAPE	NS	↑	NS	NS	NS	NS	NS	NS	↑	↑	NS	NS	↑	NS
NO. OF UNESCAPED SHOCKS	↑	↑	NS	NS	NS	NS	↑	NS	NS	NS	NS	NS	NS	NS
% ESCAPE	↓	↓	NS	NS	NS	NS	↓	NS	NS	NS	NS	NS	NS	NS
SHOCK TIME	↑	↑	↑	NS	NS	↑	↑	↑	↑	NS	NS	NS	NS	NS
SIGNALLED (DISCRMINATIVE) AVOIDANCE															
10 TRIAL BLOCKS	TEST MIN.							TEST MIN.							
	5	10	15	20	2	30	TOT	5	10	15	20	25	30	TOT
AVOIDANCE	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
ESCAPE	NS	NS	NS	NS	NS	↑	NS	NS	NS	NS	NS	↑	↑	↑
NO. OF UNESCAPED SHOCKS	NS	NS	NS	↑	↑	↑	↑	NS	↑	NS	NS	NS	NS	NS
SHOCK TIME	↑	↑	↑	↑	↑	↑	↑	↑	↑	NS	NS	NS	NS	NS

CONCLUSIONS FROM EXPERIMENT 2

DISADVANTAGES:
1. TRAINING TIME
2. DATA BASE ESTABLISHED WITH ALTERNATIVE TECHNIQUES

ADVANTAGES:
1. REMOTE MONITORING OF BEHAVIOR
2. CONTINUOUS MONITORING OF BEHAVIORAL CHANGES
3. QUANTIFY BEHAVIORAL CHANGES
4. CORRELATION WITH GAS CONCENTRATIONS

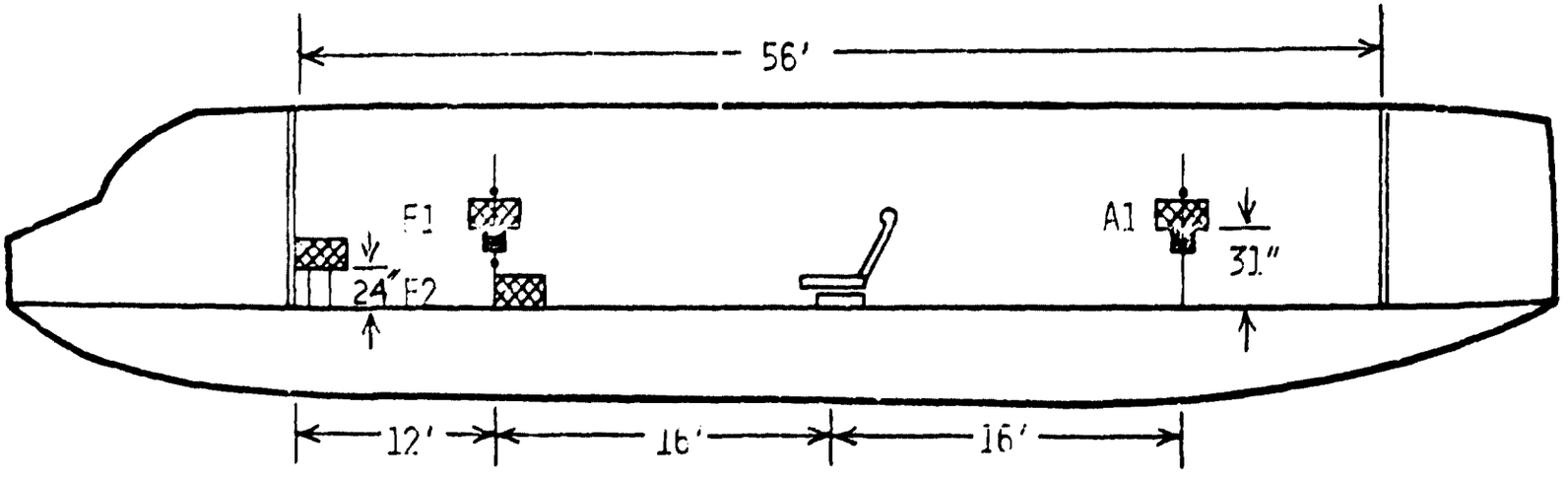
COMPARISON OF FULL-SCALE AND LABORATORY TOXICITY TESTS

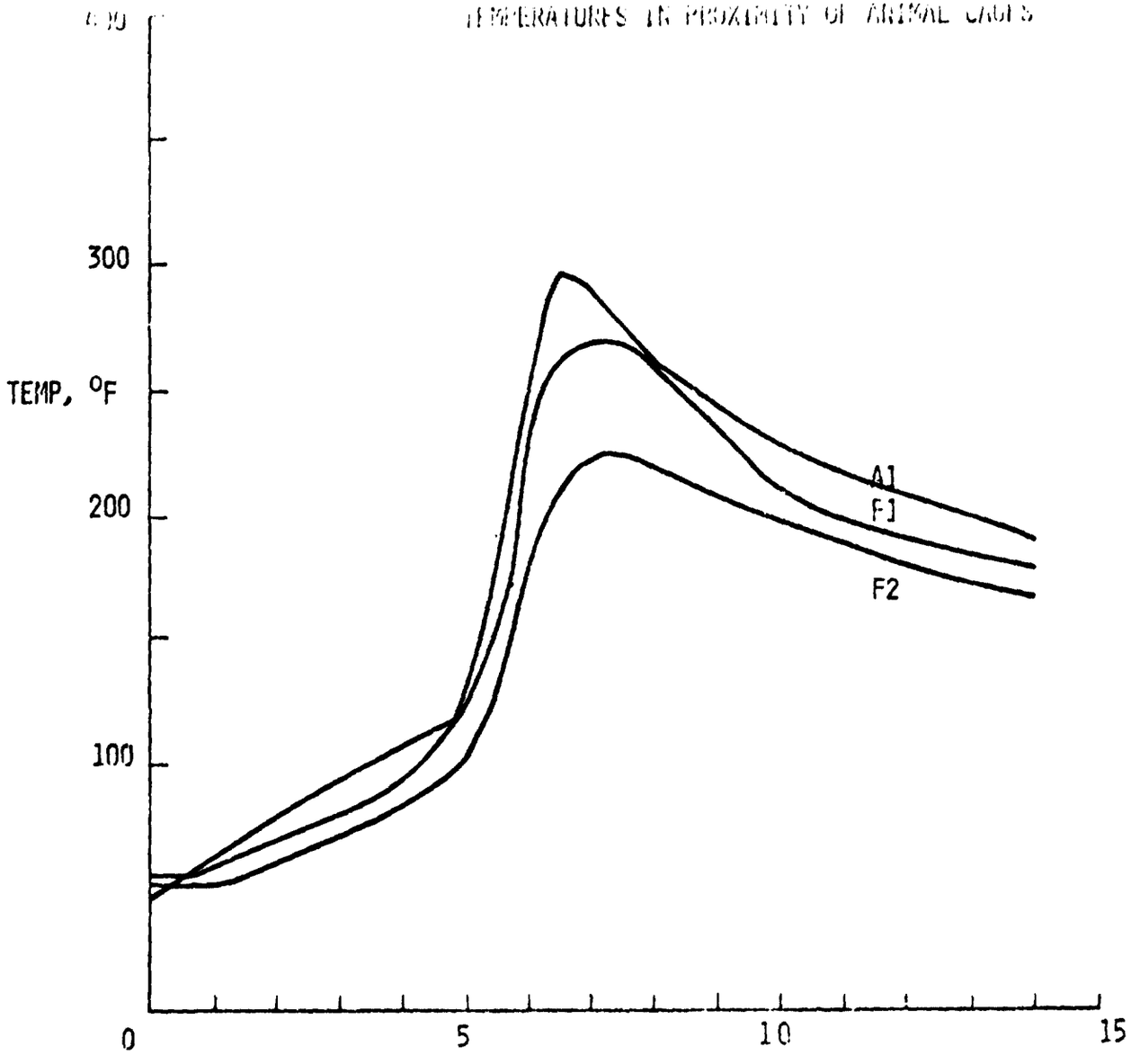
EXPERIMENT 3: PRELIMINARY WORK

- PURPOSE: DETERMINE ANIMAL SURVIVABILITY IN FULL-SCALE TESTS
- METHOD:
- RESULTS:
  1. TEMPERATURE PROFILES
  2. CO AND HCN ANALYSES
  3. SURVIVAL AND $COHb$ ANALYSES

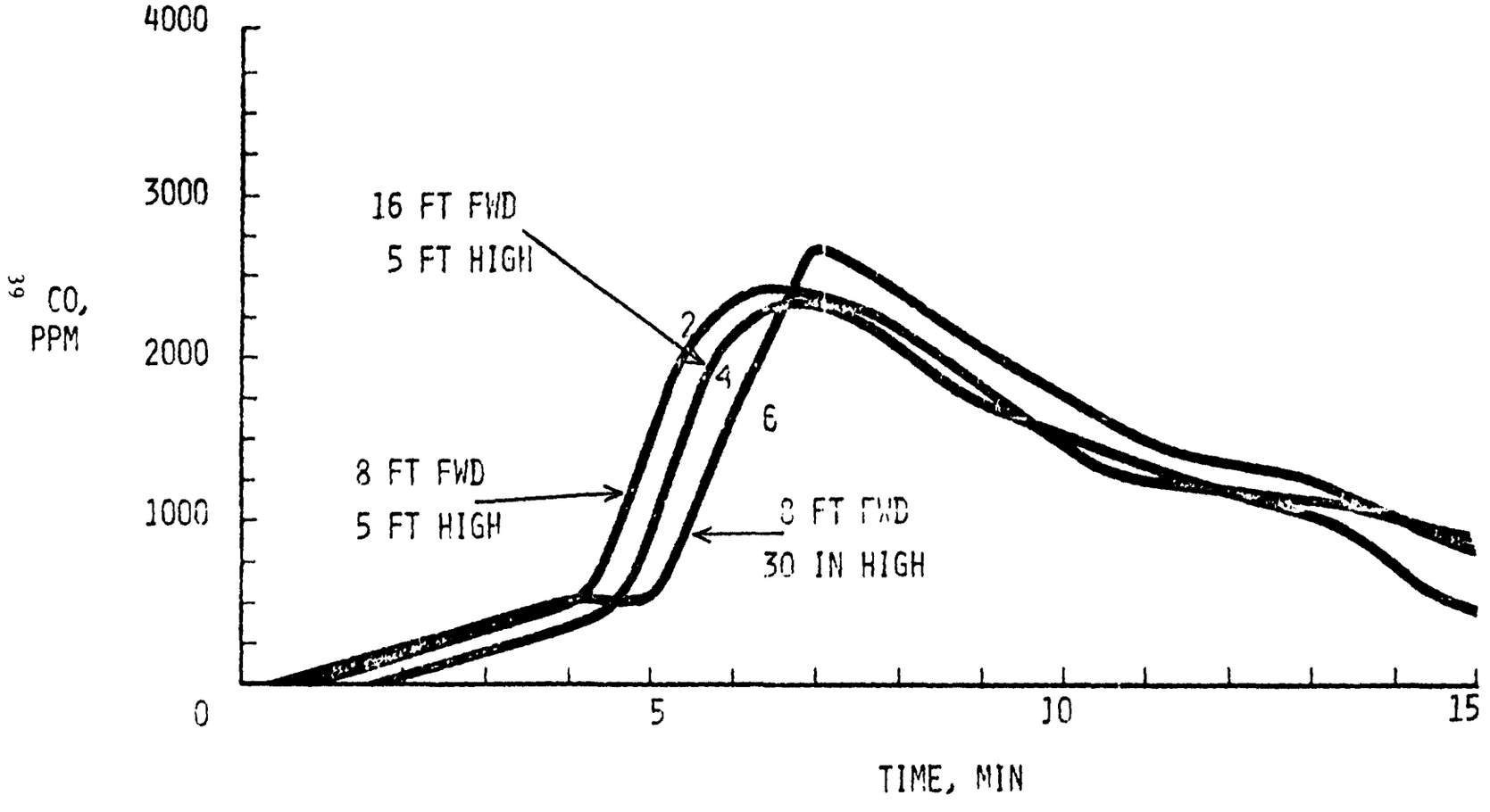
737 TEST SECTION

- VOLUME - 3920 FT^3
- VENTILATION RATE - 1500 CFM

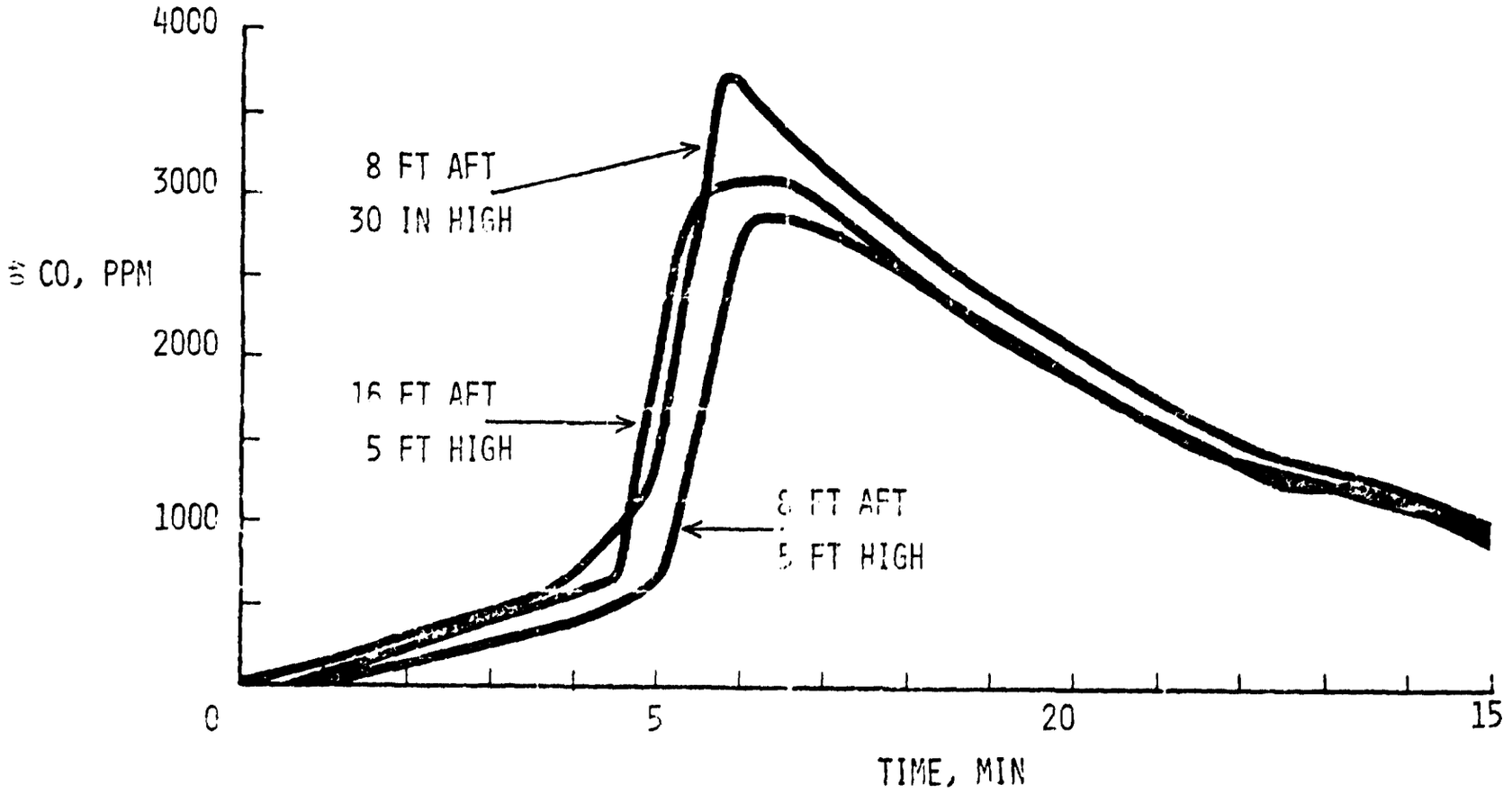


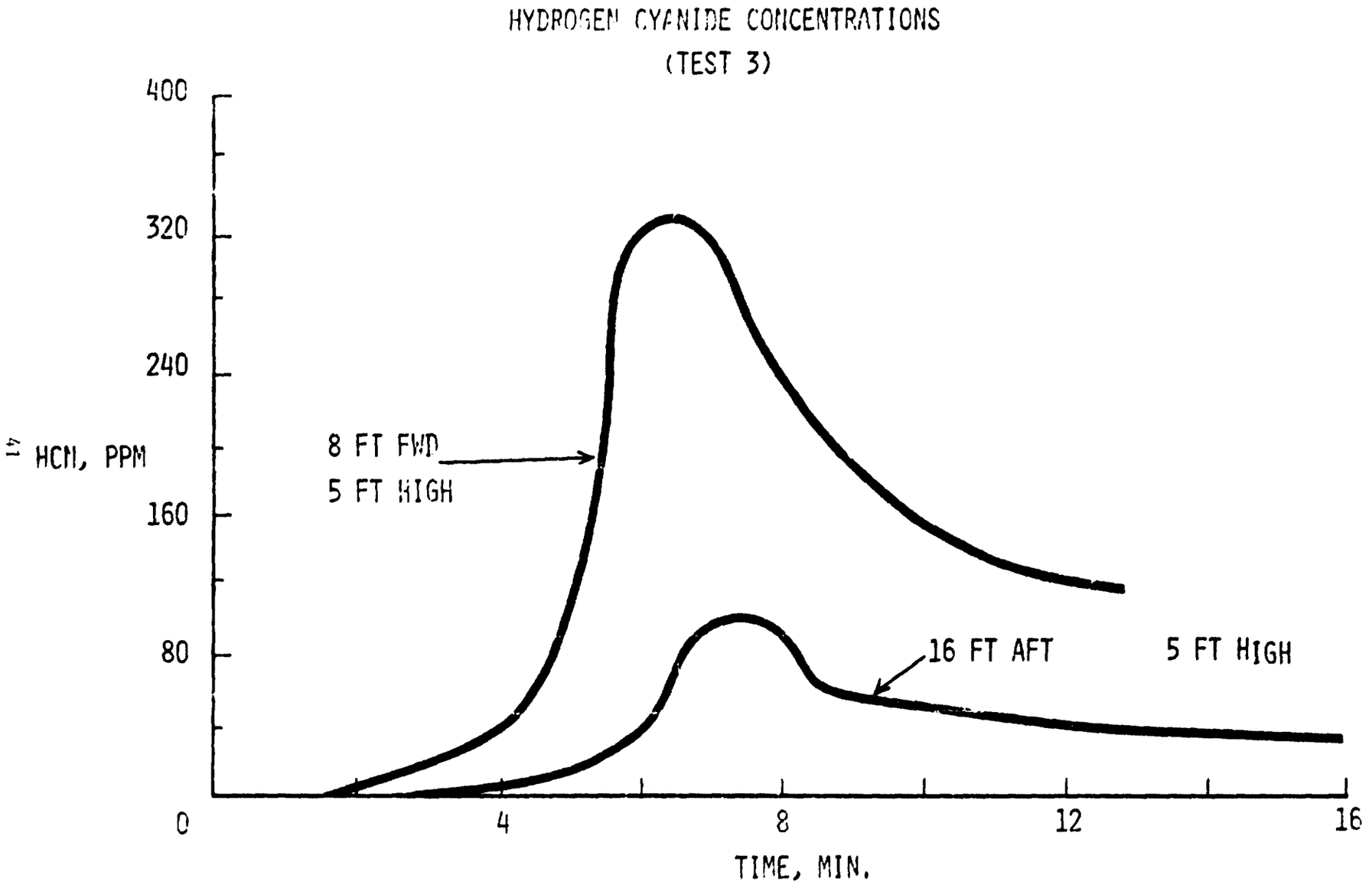

TEMP, °F
300
200
100
0
5
10
15
A1
F1
F2

CARBON MONOXIDE CONCENTRATIONS



CARBON MONOXIDE CONCENTRATION
(TEST 3)




HYDROGEN CYANIDE CONCENTRATIONS
(TEST 3)
400
320
240
160
80
0
HCN, PPM
8 FT FWD
5 FT HIGH
16 FT AFT
5 FT HIGH
4
8
12
16
TIME, MIN.

CONCLUSIONS FROM EXPERIMENT 3

1. FULL-SCALE VARIATIONS IN TEMPERATURE AND GAS CONCENTRATIONS

2. TOXICITY ASSESSMENTS LIKELY TO VARY

3. STANDARDIZATION AND REFINEMENT OF TECHNIQUES

FUTURE RESEARCH PLANS AT JSC

1. FURTHER COMPARISONS OF LABORATORY METHODS: SEATING MATERIAL TESTS

2. FULL-SCALE TOXICITY TESTS: USE OF DIFFERENT BEHAVIORAL TASKS

3. COMPARISON OF FULL-SCALE AND LABORATORY TOXICITY ASSESSMENTS

4. DELINEATION OF LABORATORY METHODS