SPECIAL PROCEDURE

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* MANDATORY IN HAND PROCEDURE *
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TSSP-002-91
REV 0
DATE:02/07/91

CONTROL ROOM HVAC DUCT IN-LEAKAGE TEST

TSSP-002-91

TABLE OF CONTENTS

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TABLE OF CONTENTS CONTINUED

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TABLE OF CONTENTS CONTINUED

THIS PROCEDURE CONTAINS 113 PAGES

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1.0 PURPOSE:

The purpose of this procedure is to conduct tracer gas testing on the control room envelope and the associated HVAC systems. LAT corporation will determine the quantity of air in-leakage into the control room envelope via the control room HVAC system(PV) negative pressure ducting outside of the control room envelope and the positive pressure ducting inside the control room envelope of the computer and miscellaneous system(OV). All testing will be done in the accident mode for the PV and OV HVAC systems.

2.0 SCOPE:

The scope of this test is outlined in a letter to D. B. Wozniak, CECo., from D. H. Flens, Sargent & Lundy, dated 12/26/90. A copy of this letter is contained in attachment 12 for reference purposes. The following two paragraphs summarize the scope of the test.

The in-leakage testing on the negative pressure ducting on the PV system will be done in 5 different locations. These locations consist of the return air duct work in the TSC, unit 2 outer cable spreading room(630' level), corridor outside of the HVAC equipment room(617' level), HVAC equipment room, and the unit 2 purge exhaust plenum. In these locations a homogeneous concentration of the tracer gas is established outside of the ducting, either in a room or in a visqueen tent, and samples are taken for analysis from inside the ducting. The testing done in the HVAC equipment room and the unit 2 purge exhaust plenum will be done with a worst case single failure open of the PV train bubble tight damper.

The in-leakage testing done on the positive pressure ducting of the OV system will be done in one location, the control room. A homogeneous concentration of the tracer gas is established inside the ducting and samples are taken for analysis from outside the ducting.

A piping and instrumentation diagram(P&ID) along with a physical diagrams will be included in each attachment of the test for locations being tested in that attachment. All drawings will be attached to the test at the time of the test.

All tracer gasses that are used are non-toxic and are used in extremely small quantities and concentration(parts per million thru trillion(PPM, PPB, PPT) range). The tracer gasses that are being used are SF6(sulfur-hexafloride) in different concentrations. The injection gasses used, use SF6 mixed with nitrogen(N2) to predetermined mixture ratioes(1 to 20%) by the test vendor. These mixtures are then injected into the injection areas to get desired concentrations(PPM-PPT). All tracer gasses that are used have a Material Safety Data Sheet(MSDS) on file with the Industrial Hygiene and Safety Coordinator. A copy of the MSDS is included in attachment 13.

3.0 PREREQUESITES:

3.1 OA PV TRAIN SHALL BE OPERABLE.

3.2 OB PV TRAIN SHALL BE OPERABLE.

3.3 ONE OV SYSTEM TRAIN SHALL BE OPERABLE.

3.4 1 AUXILIARY BUILDING SUPPLY FAN SHALL BE RUNNING.

3.5 2 AUXILIARY BUILDING EXHAUST FANS SHALL BE RUNNING, AT LEAST ONE ON EACH UNIT VENT STACK.

3.6 ALL DOORS IN CONTROL ROOM ARE CLOSED.

3.7 ALL DOORS IN CONTROL ROOM HAVE "TEST IN PROGRESS PLEASE KEEP DOORS CLOSED EXCEPT FOR NORMAL EGRESS" SIGNS HUNG ON THEM.

3.8 THE FOLLOWING DRAWINGS ARE INCLUDED IN THE APPLICABLE ATTACHMENTS FOR THE SEGMENT OF THE TEST BEING PERFORMED. THE DRAWINGS ARE M-81, M-315, M-317 SHT 1, M-318, M-319, M-382 SHT 1.

4.0 PRECAUTIONS:

THERE ARE NO SPECIAL PRECAUTIONS NEEDED.

5.0 SPECIAL TEST EQUIPMENT:

ALL TEST EQUIPMENT WILL BE SUPPLIED BY THE TEST VENDOR.

6.0 PROCEDURE:

NOTE:
ALL TRACER GASSES USED IN THIS TEST ARE NON-TOXIC AND USED IN EXTREMELY SMALL QUANTITIES AND CONCENTRATIONS(PPM TO PPT RANGES). THE MATERIAL SAFETY DATA SHEETS FOR ALL TRACER GASSES USED FOR THIS TEST ARE ON FILE WITH THE INDUSTRIAL HYGIENE AND SAFETY COORDINATOR.

NOTE:
THIS TEST WILL BE DONE IN 6 DIFFERENT SEGMENTS. THE SEGMENTS WILL BE DONE IN THE ORDER OF THE TEST ENGINEER DISCRETION. EACH SEGMENT CAN BE DONE INDEPENDENTLY OF ANOTHER. STEPS NOT PERFORMED MAY BE MARKED NOT APPLICABLE(N/A) BY THE TEST ENGINEER. INITIAL BLANKS DESIGNATED TO A DEPARTMENT CAN BE SIGNED OFF BY ANY DEPARTMENT.

SEGMENT 1

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE NEGATIVE PRESSURE PV DUCT IN VERTICAL CHASE UP TO AND INCLUDING DUCT IN CEILING OF OLD TSC.

6.1.1 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.1.2 VERIFY THAT VISQUEEN TENT IS BUILT AROUND THE DUCTING IN THE TECHNICAL SUPPORT CENTER ON THE 642' LEVEL. _____

6.1.3 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.1.4 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.1.5 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST. _____

6.1.6 RECORD PV SYSTEM TRAIN THAT IS RUNNING. _____ _____

6.1.7 SECURE OR VERIFY SECURED ONE TRAIN ON THE OV SYSTEM. _____ OP

6.1.8 START OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.1.9 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.1.10 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.1.11 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 1) IS CORRECT. _____ TS

6.1.12 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 1 ON THE DUCTING IN THE VERTICAL PIPE CHASE AND CEILING OF OLD TSC. _____

6.1.13 WHEN TESTING IS FINISHED ON RUNNING PV TRAIN, THEN START THE PV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.1.14 SECURE THE PV SYSTEM TRAIN THAT WAS JUST TESTED(RECORDED IN IN STEP 6.1.6). _____ OP

6.1.15 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.1.16 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.1.17 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 2) IS CORRECT. _____ TS

6.1.18 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 2 ON THE DUCTING IN THE VERTICAL PIPE CHASE AND CEILING OF OLD TSC. _____

6.1.19 WHEN TESTING IS FINISHED ON THE RUNNING PV TRAIN THEN, START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.1.20 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.1.21 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.1.22 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

SEGMENT 2

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE NEGATIVE PRESSURE PV DUCT LOCATED IN CABLE SPREADING ROOM(RISER).

6.2.1 VERIFY VISQUEEN TENT IS BUILT AROUND THE FIRE DAMPER ACCESS DOOR IN THE UNIT 2 CABLE SPREADING ROOM. _____

6.2.2 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.2.3 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.2.4 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.2.5 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST _____

6.2.6 RECORD PV SYSTEM TRAIN THAT IS RUNNING. _____ _____

6.2.7 SECURE OR VERIFY SECURED ONE TRAIN ON THE OV SYSTEM. _____ OP

6.2.8 RUN OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.2.9 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.2.10 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.2.11 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 3) IS CORRECT. _____ TS

6.2.12 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 3 ON THE NEGATIVE PRESSURE PV DUCT IN THE CABLE SPREADING ROOM(RISER). _____

6.2.13 WHEN TESTING IS IS FINISHED ON THE RUNNING PV TRAIN, THEN START THE PV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.2.14 SECURE THE PV SYSTEM TRAIN THAT WAS JUST TESTED (RECORDED IN IN STEP 6.2.6). _____ OP

6.2.15 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.2.16 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.2.17 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 4) IS CORRECT. _____ TS

6.2.18 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 4 ON THE NEGATIVE PRESSURE PV DUCT IN THE CABLE SPREADING ROOM(RISER). _____

6.2.19 WHEN TESTING IS FINISHED ON THE RUNNING PV TRAIN THEN, START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.2.20 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.2.21 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.2.22 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

SEGMENT 3

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE NEGATIVE PRESSURE PV DUCT IN VESTIBULE OUTSIDE OF HVAC EQUIPMENT ROOM.

6.3.1 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.3.2 VERIFY VISQUEEN TENT IS BUILT AROUND THE RETURN DUCTING IN CORRIDOR ON THE 617' LEVEL OUTSIDE OF THE HVAC EQUIPMENT ROOM. _____

6.3.3 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.3.4 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.3.5 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST _____

6.3.6 RECORD PV SYSTEM TRAIN THAT IS RUNNING. _____ _____

6.3.7 SECURE ONE TRAIN ON THE OV SYSTEM. _____ OP

6.3.8 START OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.3.9 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.3.10 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.3.13 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 5) IS CORRECT. _____ TS

6.3.12 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 5 FOR THE DUCT IN THE VESTIBULE OUTSIDE OF HVAC EQUIPMENT ROOM. _____

6.3.13 WHEN TESTS IS FINISHED ON THE RUNNING PV TRAIN THEN, START THE PV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.3.14 SECURE THE PV SYSTEM TRAIN THAT WAS JUST TESTED (RECORDED IN STEP 6.3.6). _____ OP

6.3.15 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.3.16 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.3.17 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 6) IS CORRECT. _____ TS

6.3.18 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 6 FOR THE DUCT IN THE VESTIBULE OUTSIDE OF HVAC EQUIPMENT ROOM. _____

6.3.19 WHEN TESTING IS FINISHED ON THE RUNNING PV TRAIN THEN, START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.3.20 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.3.21 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.3.22 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

SEGMENT 4

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE NEGATIVE PRESSURE PV DUCT IN THE HVAC EQUIPMENT ROOM.

6.4.1 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.4.2 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.4.3 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.4.4 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST _____

6.4.5 PNUEMATICALLY BYPASS 0SV-PV43, IN 0LP19, TO FAIL OPEN THE 0B PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV43. _____ IM

6.4.6 VERIFY BYPASS IS INSTALLED CORRECTLY. _____ TS

6.4.7 START OR VERIFY 0B PV TRAIN RUNNING. _____ OP

6.4.8 SECURE OR VERIFY 0A PV TRAIN IS SECURED. _____ OP

6.4.9 SECURE OF VERIFY SECURED ONE TRAIN ON THE OV SYSTEM. _____ OP

6.4.10 START OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.4.11 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.4.12 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.4.13 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 7) IS CORRECT. _____ OP

6.4.14 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 7 FOR THE NEGATIVE PRESSURE PV DUCT IN HVAC EQUIPMENT ROOM. _____

6.4.15 WHEN TESTING IS COMPLETE ON 0B PV TRAIN THEN, REMOVE PNUEMATIC BYPASS ON 0SV-PV43, IN 0LP19, TO CLOSE THE 0B PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV43. _____ IM

6.4.16 INDEPENDENTLY VERIFY PNUEMATIC BYPASS IS REMOVED. _____ TS

6.4.17 PNUEMATICALLY BYPASS 0SV-PV42, IN 0LP18, TO FAIL OPEN THE 0A PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV42. _____ IM

6.4.18 VERIFY BYPASS IS INSTALLED CORRECTLY. _____ TS

6.4.19 START 0A PV TRAIN. _____ OP

6.4.20 SECURE 0B PV TRAIN. _____ OP

6.4.21 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.4.22 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

! NOTE: !
! THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY . !

6.4.23 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 8) IS CORRECT. _____ TS

6.4.24 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 8 FOR THE NEGATIVE PRESSURE PV DUCT IN HVAC EQUIPMENT ROOM. _____

6.4.25 WHEN TESTING IS COMPLETE ON 0A PV TRAIN THEN, REMOVE PNUEMATIC BYPASS ON 0SV-PV42, IN 0LP19, TO CLOSE THE 0B PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV42. _____ IM

6.4.26 INDEPENDENTLY VERIFY PNUEMATIC BYPASS IS REMOVED. _____ TS

6.4.27 VERIFY 0FCV-PV42 IS CLOSED. _____ TS

6.4.28 VERIFY 0FCV-PV43 IS CLOSED. _____ TS

6.4.29 START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.4.30 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.4.31 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.4.32 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

SEGMENT 5

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE PV/OV NORMAL OUTSIDE AIR INTAKE DUCT.

6.5.1 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.5.2 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.5.3 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.5.4 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST _____

6.5.5 PNUEMATICALLY BYPASS 0SV-PV43, IN 0LP19, TO FAIL OPEN THE OB PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV43. _____ IM

6.5.6 VERIFY BYPASS IS INSTALLED CORRECTLY. _____ TS

6.5.7 START OR VERIFY 0B PV TRAIN RUNNING. _____ OP

6.5.8 SECURE OR VERIFY 0A PV TRAIN IS SECURED. _____ OP

6.5.9 SECURE OR VERIFY SECURED ONE TRAIN ON THE OV SYSTEM. _____ OP

6.5.10 START OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.5.11 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.5.12 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.5.13 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 9) IS CORRECT. _____ OP

6.5.14 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 7 FOR THE NEGATIVE PRESSURE PV DUCT IN HVAC EQUIPMENT ROOM. _____

6.5.15 WHEN TESTING IS COMPLETE ON 0B PV TRAIN THEN, REMOVE PNUEMATIC BYPASS ON 0SV-PV43, IN 0LP19, TO CLOSE THE 0B PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV43. _____ IM

6.5.16 INDEPENDENTLY VERIFY PNUEMATIC BYPASS IS REMOVED. _____ TS

6.5.17 PNUEMATICALLY BYPASS 0SV-PV42, IN 0LP18, TO FAIL OPEN THE 0A PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV42. _____ IM

6.5.18 VERIFY BYPASS IS INSTALLED CORRECTLY. _____ TS

6.5.19 START 0A PV TRAIN. _____ OP

6.5.20 SECURE 0B PV TRAIN. _____ OP

6.5.21 RECORD AUXILIARY BUILDING PRESSURE ON 0PDI-AV93A, AT 0CB05 _____ IN. WC. _____

6.5.22 RECORD CONTROL ROOM PRESSURE ON 0PDI-PV20A, AT 0CB05. _____ IN. WC. _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.5.23 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 10) IS CORRECT. _____ TS

6.5.24 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 8 FOR THE NEGATIVE PRESSURE PV DUCT IN HVAC EQUIPMENT ROOM. _____

6.5.25 WHEN TESTING IS COMPLETE ON 0A PV TRAIN THEN, REMOVE PNUEMATIC BYPASS ON 0SV-PV42, IN 0LP19, TO CLOSE THE 0B PV TRAIN BUBBLE TIGHT DAMPER 0FCV-PV42. _____ IM

6.5.26 INDEPENDENTLY VERIFY PNUEMATIC BYPASS IS REMOVED. _____ TS

6.5.27 VERIFY 0FCV-PV42 IS CLOSED. _____ TS

6.5.28 VERIFY 0FCV-PV43 IS CLOSED. _____ TS

6.5.29 START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.5.30 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.5.31 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.5.32 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

SEGMENT 6

NOTE:
THIS SEGMENT CONSISTS OF TESTING THE OV SYSTEM POSITIVE PRESSURE DUCT IN MAIN CONTROL ROOM.

6.6.1 VERIFY ALL TEST PREREQUISITES ARE MET. _____

6.6.2 VERIFY SAMPLE MANIFOLD IS INSTALLED ON THE OV SYSTEM DUCTING IN CONTROL ROOM. _____

6.6.3 OBTAIN SHIFT ENGINEER'S PERMISSION TO START THE TEST. _____

6.6.4 OBTAIN UNIT 2 SUPERVISOR'S PERMISSION TO START THE TEST. _____

6.6.5 OBTAIN UNIT 2 NSO'S PERMISSION TO START THE TEST _____

6.6.6 SECURE OR VERIFY SECURED ONE TRAIN ON THE OV SYSTEM. _____ OP

6.6.7 START OR VERIFY RUNNING ONE CONTROL ROOM EMERGENCY MAKE-UP FAN. _____ OP

6.6.8 RECORD OV TRAIN THAT IS RUNNING. _____ _____

6.6.9 RECORD AUXILIARY BUILDING PRESSURE AT 0CB05. _____ IN. H2O _____

6.6.10 RECORD CONTROL ROOM PRESSURE AT 0CB05. _____ IN. H2O _____

NOTE:
THE FOLLOWING 2 STEPS SHOULD BE DONE CONCURRENTLY .

6.6.11 VERIFY SYSTEM LINEUP DOCUMENTED ON THE LAT VENTILATION LINEUP SHEET(APPENDIX B OF ATTACHMENT 11) IS CORRECT. _____ TS

6.6.12 INFORM LAT TO PERFORM TRACER GAS TEST PER ATTACHMENT 11 ON THE OV SYSTEM POSITIVE PRESSURE DUCT IN MAIN CONTROL ROOM. _____

6.6.13 START OV SYSTEM TRAIN THAT IS SECURED. _____ OP

6.6.14 NOTIFY UNIT 2 NSO THIS TEST SEGMENT IS COMPLETE. _____

6.6.15 NOTIFY UNIT 2 SUPERVISOR THIS TEST SEGMENT IS COMPLETE. _____

6.6.16 NOTIFY SHIFT ENGINEER THIS TEST SEGMENT IS COMPLETE. _____

7.0 ACCEPTANCE CRITERIA:

There is no acceptance criteria for this test. The purpose of this test was to perform an air in-leakage tracer gas test to quantify air in-leakage into the control room envelope. The quantified air in-leakage into the control room will then be used by Sargent & Lundy for control room habitability studies.

8.0 EVALUATION OF RESULTS:

Performed By:_____
Test Engineer

Approved By:_____
Thermal Group Leader

Approved By:_____
Technical Staff Supervisor
or Designee

ATTACHMENT 1
SEGMENT 1
NEGATIVE PRESSURE PV DUCT IN VERTICAL CHASE UP TO AND INCLUDING DUCT IN CEILING OF OLD TSC

ISSP 002 91
RFU 0
2/7/91

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time ____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time ____.

___ 32. For a non-continuous injection test, inject into location D and record time ____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

FEB 07 1991

ATTACHMENT 2
SEGMENT 1

NEGATIVE PRESSURE PU DUCT IN VERTICAL CHASE UP TO AND INCLUDING DUCT IN CEILING OF OLD TSC

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

REV 0

FEB 07 1991

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

FEB 0 7 1991

ATTACHMENT 3
SEGMENT 2
NEGATIVE PRESSURE PU. DUCT LOCATED IN
CABLE SPREADING ROOM CRISER

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number _____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

ATTACHMENT 4
SEGMENT Z
NEGATIVE PRESSURE PV DUCT LOCATED
IN CABLE SPREADING ROOM (RISER)

FEB 07 1991

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 15. Set metering valve for trace B to _____ turns.

___ 16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV0[illegible]	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

TSSP-Z-91
REV 0

FEB 07 1991

ATTACHMENT 5
SEGMENT 3
NEGATIVE PRESSURE PV DUCT IN VESTIBULE
OUTSIDE OF HVAC EQUIPMENT ROOM

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

FEB 07 1991

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test., inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

TSSA-2-11
REV 0

FEB 07 1991

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

APPENDIX B CONTINUED
VENTILATION LINEUP

REVO

FEB 07 1991

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

IDX-27
REV 0

FEB 07 1991

ATTACHMENT C
SEGMENT 3
NEGATIVE PRESSURE PU DUCT IN VESTIBULE
OUTSIDE OF HVAC EQUIPMENT ROOM

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

ISM-2-4
REV 0

FEB 07 1991

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

TSR-2-91
REV 0
FEB [illegible] 199[illegible]

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

APPENDIX B CONTINUED
VENTILATION LINEUP

FEB 07 1991

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

FEB 07 199

ATTACHMENT 7
SEGMENT 4
NEGATIVE PRESSURE PV DUCT IN
THE HVAC EQUIPMENT ROOM

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however; activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number _____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN	OFF	
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER	CLOSED	
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER	CLOSED	
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN	OFF	
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER	CLOSED	
0PV-015	0A CR MAKEUP FAN	OFF	
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER	CLOSED	
0PV010	0B CR SUPPLY FAN	RUNNING	
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV31A	0B CR HOT DECK DAMPER	THROTTLING	
0FCV-PV31B	0B CR COLD DECK DAMPER	THROTTLING	
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER	OPEN	
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER	OPEN	
0FCV-PV38	0B AIR HANDLER RETURN DAMPER	OPEN	
0PV-012	0B CR RETURN FAN	RUNNING	
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER	OPEN	
0PV-016	0B CR MAKEUP FAN	RUNNING	

APPENDIX B CONTINUED
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	OPEN	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

FEB [illegible] 199[illegible]

ATTACHMENT 8
SEGMENT 4
NEGATIVE PRESSURE PV. DUCT IN THE
HVAC EQUIPMENT ROOM

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number _____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

REV 0

FEB [illegible]

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN	RUNNING	
0FCV-PV23A	0A CR HOT DECK DAMPER	THROTTLING	
0FCV-PV23B	0A CR COLD DECK DAMPER	THROTTLING	
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER	OPEN	
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER	OPEN	
0FCV-PV24	0A AIR HANDLER RETURN DAMPER	OPEN	
0PV-011	0A CR RETURN FAN	RUNNING	
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER	OPEN	
0PV-015	0A CR MAKEUP FAN	RUNNING	
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER	OPEN	
0PV010	0B CR SUPPLY FAN	OFF	
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER	CLOSED	
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER	CLOSED	
0FCV-PV[illegible]	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN	OFF	
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER	CLOSED	
0PV-016	0B CR MAKEUP FAN	OFF	

REV 0

FEB 07 1991

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04[illegible]	0B CR MAKEUP FAN DISCHARGE DAMPER	CLOSED	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

T55R2-9L
REV0
SEP 07 1991

ATTACHMENT 9
SEGMENT 5
PV1OV NORMAL OUTSIDE AIR INTAKE DUCT

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number _____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

TSR 2-91
REV 0

FEB 07 1991

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN	OFF	
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER	CLOSED	
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER	CLOSED	
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN	OFF	
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER	CLOSED	
0PV-015	0A CR MAKEUP FAN	OFF	
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER	CLOSED	
0PV010	0B CR SUPPLY FAN	RUNNING	
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV31A	0B CR HOT DECK DAMPER	THROTTLING	
0FCV-PV31B	0B CR COLD DECK DAMPER	THROTTLING	
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER	OPEN	
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER	OPEN	
0FCV-PV38	0B AIR HANDLER RETURN DAMPER	OPEN	
0PV-012	0B CR RETURN FAN	RUNNING	
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER	OPEN	
0PV-016	0B CR MAKEUP FAN	RUNNING	

APPENDIX B CONTINUED
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	OPEN	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

REV 0

FEB 07 1991

ATTACHMENT 10
SEGMENT 5
PV/OU NORMAL OUTSIDE AIR INTAKE DUCT

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number ____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

15. Set metering valve for trace B to _____ turns.

16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

TSK-2-4
REVO

FEB 9 '99

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN	RUNNING	
0FCV-PV23A	0A CR HOT DECK DAMPER	THROTTLING	
0FCV-PV23B	0A CR COLD DECK DAMPER	THROTTLING	
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER	OPEN	
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER	OPEN	
0FCV-PV24	0A AIR HANDLER RETURN DAMPER	OPEN	
0PV-011	0A CR RETURN FAN	RUNNING	
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER	OPEN	
0PV-015	0A CR MAKEUP FAN	RUNNING	
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER	OPEN	
0PV010	0B CR SUPPLY FAN	OFF	
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	CLOSED	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER	CLOSED	
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER	CLOSED	
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN	OFF	
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER	CLOSED	
0PV-016	0B CR MAKEUP FAN	OFF	

APPENDIX B CONTINUED
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	CLOSED	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

ISSUED
REV 0
FEB 07 1991

ATTACHMENT II
SEGMENT G
OU SYSTEM POSITIVE PRESSURE DUCT
IN MAIN CONTROL ROOM

GENERIC TRACER VENTILATION TEST PROCEDURES

December 1990

Lagus Applied Technology, Inc.
11760 Sorrento Valley Road, Suite M
San Diego, CA 92121

Telephone: (619) 792-9277

DETAILED PROCEDURES

NOTE: Each test will be performed as a separate procedure. The tests may be performed in any order, at the discretion of the Test Director, depending on system availability or operational considerations.

It is generally intended that the steps of this procedure are performed in sequence, however, activities may be performed in parallel or out of sequence at the discretion of the Test Director.

Test Number _____

___ 1. Establish appropriate ventilation lineup in the building and note in Appendix B.

___ 2. As directed by the Test Engineer and the Test Director, establish the location of the tracer source injection points in the building. Record the locations below:

Source A _____

Source B _____

Source C _____

Source D _____

___ 3. Record Tracer gas type and injection concentration for each location:

Points	Gas	Concentration
A	_____	_____
B	_____	_____
C	_____	_____
D	_____	_____

___ 4. Identify and describe tracer sampling locations in Appendix A.

___ 5. Turn on 4 channel analyzer and wait 30 minutes for warm up.

___ 6. Perform calibration check on each channel and enter calibration check response on chromatograph log sheet.

___ 7. Install regulator/valve assembly on each source bottle.

___ 8. If a continuous injection test is planned, place tracer source near the center of each injection location.

___ 9. For a non-continuous injection test indicate amount of tracer to be injected into each source location.

Source A _____

Source B _____

Source C _____

Source D _____

___ 10. Provide auxiliary mixing fan ventilation as required.

___ 11. For a continuous injection test tracer using source A, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 12. Set metering valve for tracer A to _____ turns.

___ 13. Take a background sample near the tracer A cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 14. For a continuous injection test using tracer source B, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 15. Set metering valve for trace B to _____ turns.

___ 16. Take a background sample near the tracer B cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 17. For a continuous injection test using tracer source C, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 18. Set metering valve for tracer C to _____ turns.

___ 19. Take a background sample near the tracer C cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 20. For a continuous injection test using tracer source D, close shutoff valve on regulator, open cylinder valve, set regulator to _____ psig.

___ 21. Set metering valve for tracer D to _____ turns.

___ 22. Take a background sample near the tracer D cylinder, if background sample indicates a leak, identify and repair leaks and take another sample.

___ 23. Prepare and label sample syringes for sample points in Appendix A.

___ 24. Take a background sample at selected sample points.

___ 25. Analyze samples for tracer gas. If background is free of tracer gases, begin test. If background samples show appreciable tracer gas(es), contact the Test Director and Test Engineer for further direction.

___ 26. For a non-continuous injection test, inject into location A and record time _____.

___ 27. For a continuous injection test, open the shutoff valve for tracer cylinder A and record time _____.

___ 28. For a non-continuous injection test, inject into location B and record time _____.

___ 29. For a continuous injection test, open the shutoff valve for tracer cylinder B, and record time _____.

___ 30. For a non-continuous injection test, inject into location C and record time _____.

___ 31. For a continuous injection test, open the shutoff valve for tracer cylinder C, and record time _____.

___ 32. For a non-continuous injection test, inject into location D and record time _____.

___ 33. For a continuous injection test, open the shutoff valve for tracer cylinder D, and record time _____.

___ 34. For a continuous injection test, take samples from the identified sample areas every 20 minutes for the first hour, then 30 minutes, then 60 minutes, and then at an hour and a half. Test duration and sample times may be adjusted as required by the Test Director.

___ 35. For a non-continuous injection test, wait 30 minutes for mixing and then take samples every _____ minutes for a period of _____.

___ 36. After the last sample has been taken during a continuous injection test shut off the tracer gas bottles and record time _____.

Cylinder A _____

Cylinder B _____

Cylinder C _____

Cylinder D _____

___ 37. Analyze samples and record on chromatograph log sheet.

___ 38. Disassemble the test assemblies and relocate to the next locations as required.

___ 39. Attach a copy of all the log sheets for this test.

___ 40. Notify Shift Supervisor that testing is completed.

TSR 2-94
REV 0

FEB 07 '95

APPENDIX A
SAMPLE LOCATIONS

SAMPLE NUMBER	LOCATION

APPENDIX B
VENTILATION LINEUP

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0PV009	0A CR SUPPLY FAN		
0FCV-PV23A	0A CR HOT DECK DAMPER		
0FCV-PV23B	0A CR COLD DECK DAMPER		
0FCV-PV28A	0A AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV28B	0A AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV22	0A AIR HANDLER DISCHARGE DAMPER		
0FCV-PV42	0A OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV24	0A AIR HANDLER RETURN DAMPER		
0PV-011	0A CR RETURN FAN		
0FCV-PV05A	0A CR RETURN FAN DISCHARGE DAMPER		
0PV-015	0A CR MAKEUP FAN		
0FCV-PV03A	0A CR MAKEUP FAN DISCHARGE DAMPER		
0PV010	0B CR SUPPLY FAN		
0FCV-PV32A	0B AIR HANDLER SMOKE FILTER BYPASS DAMPER	OPEN	
0FCV-PV32B	0B AIR HANDLER SMOKE FILTER INLET DAMPER	OPEN	
0FCV-PV31A	0B CR HOT DECK DAMPER		
0FCV-PV31B	0B CR COLD DECK DAMPER		
0FCV-PV35	0B AIR HANDLER DISCHARGE DAMPER		
0FCV-PV43	0B OUTSIDE AIR ISOLATION DAMPER		
0FCV-PV38	0B AIR HANDLER RETURN DAMPER		
0PV-012	0B CR RETURN FAN		
0FCV-PV06A	0B CR RETURN FAN DISCHARGE DAMPER		
0PV-016	0B CR MAKEUP FAN		

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FEB 07 1991

EQUIPMENT #	EQUIPMENT NAME	TEST STATUS	VERIFIED
0FCV-PV04A	0B CR MAKEUP FAN DISCHARGE DAMPER	_____	_____
0FCV-PV13A	MAKEUP FILTER DISCHAGE DAMPER	OPEN	_____
0FCV-PV13B	MAKEUP FILTER SUPPLY DAMPER	OPEN	_____
0FCV-PV39	OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
0FCV-PV44	OV OUTSIDE AIR ISOLATION DAMPER	CLOSED	_____
N/A	0A OV TRAIN	_____	_____
N/A	0B OV TRAIN	_____	_____

ATTACHMENT 12

TSSR-2-91
REV 0

FEB 07 1991

SARGENT & LUNDY
ENGINEERS
FOUNDED 1891
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
(312) 269-2000
TWX 910-221-2807

December 26, 1990
Project No. 8747-19
File No. 13.11
(DHF-21)

Commonwealth Edison Company
Zion Station - Units 1 and 2

Control Room Habitability-
Tracer Gas Testing

Mr. D. B. Wozniak
Project Manager
Zion Station
101 Shiloh Boulevard
Zion, IL 60099

Dear Mr. Wozniak:

Enclosed, please find a summary of the discussions held with Dr. P. Lagus of Lagus Applied Technologies, Inc. concerning PV System Tracer Gas Testing.

By copy of this letter, Sargent & Lundy (S&L) is forwarding a copy of the requested drawings to Dr. Lagus.

The requested room volumes have been previously transmitted to Dr. Lagus by L. DuBois of Station Technical Staff.

If you have any questions, please call either W. J. Adams at (312)269-6619 or myself at (312)269-3901.

Yours very truly,

D. H. Flens
Senior HVAC Project Engineer

DHF:tmk
Attachment
See next page for distribution

TSR 2-91
REV 0

FEB

K. Ainger	(1/1)
S. Berczynski	(1/1)
L. Bush	(1/1)
L. DuBois	(1/1)
W. Mammoser	(1/1)
T. Peterson	(1/1)
J. Reiss	(1/1)
T. Rieck	(1/1)
S. Szumski	(1/1)
R. Hameetman	(1/0)
R. Skowzgird	(1/0)

SARGENT & LUNDY
ENGINEERS
CHICAGO

TSS-2
REV 0

FEB 07 1991

December 26, 1990

Summary of Discussions with LAT, Inc.
on Tracer Gas Testing

Purpose: To discuss Tracer Gas Testing methodology and scope with Dr. P. Lagus of LAT, Inc.

Participants:

P. Lagus	- Lagus Applied Technologies, Inc.
K. Fleming	- Nuclear Consulting Services
W. C. Mammoser	- CECo-ENC
S. Berczynski	- CECo-Tech. Staff
L. DuBois	- CECo-Tech. Staff
W. J. Adams	- Sargent & Lundy
D. H. Flens	- Sargent & Lundy

Date: November 28, 1990 at Zion Station

SUMMARY OF DISCUSSIONS:

The purpose of this meeting was to familiarize Dr. P. Lagus of Lagus Applied Technologies, Inc. with the scope of the tracer gas testing to be performed at Zion. After initial review of the HVAC physical plan drawings, a walkdown of the ductwork which is to be tested was performed. Based on this walkdown, the number of actual test set-ups was determined as well as any special test requirements. The agreed upon tests and test provisions are as follows:

TEST 1 Negative Pressure PV Duct in HVAC Equipment Room

Test Segment 4

Tracer gas will be released in HVAC Equipment Room in multiple locations. Portable fans will be used to establish a homogenous concentration in the room. Tracer gas concentration will be measured in PV supply duct outside of Equipment Room.

Special provisions - need to use portable fans and obtain airflow measurement in PV supply duct.

PER PHONE W/D. FLENS 12/27/90 DO SINGLE FAN ONE ALSO a.

TEST 2 Negative Pressure PV Duct in Vestibule Outside of HVAC Equipment Room

Test Segment 3

A temporary visqueen will be placed around ductwork. Tracer gas will be injected into tent and sampled in PV system return air door upstream of EMAFU.

Special Provisions - visqueen tent around PV return duct.

TEST 3 Negative Pressure PV Duct in Vertical Chase Up to and Including Duct in Ceiling of Old TSC.

Test Segment 1

Tracer gas will be released within a temporary visqueen tent which surrounds the affected ductwork and seals the top of the vertical chase. Due to the huge volume above the ceiling of the old TSC, it was not deemed practical and could lead to erroneous readings due to recirculation airflows if a homogenous tracer gas mixture was established in this area. Tracer gas will be sampled in PV system return air duct upstream of EMAFU. (Emergency Makeup Air Filter Unit)

Special provisions - Install visqueen tent around affected ductwork and enclose top of vertical duct chase. Provide temporary scaffolding in hallways/room beneath suspended ceiling as required.

TEST 4 OV System Positive Pressure Duct in Main Control Room.

Test Segment 6

Tracer gas will be injected into OV supply duct in HVAC Equipment Room. To minimize impact to Control Room operations, a manifold sampling system made of lightweight plastic pipe and assisted by a vacuum pump will be used to collect air samples. The manifold will be arranged for complete sampling on all relatively inaccessible sides of the OV ductwork. If the initial tracer gas test indicates no leakage, testing will be considered complete. If leakage is detected, portable fans will be brought in to achieve a homogenous mixture in the Control Room for accurate leakage measurements.

Special Provisions - This test will require the fabrication of lightweight sapling manifolds to be temporarily installed around the OV supply duct above the Control Room ceiling. Portable fans may also be required to obtain accurate measurements during subsequent testing. Testing will need to be coordinated to minimize impact on Control Room operations. Finally, OV supply duct airflow will need to be measured.

TEST 5 Negative Pressure PV Duct Located in Cable Spreading Room (Riser).

Test Segment 2

This ductwork is completely covered by a concrete like fire proofing material (most likely pyrocrete) except for two fire damper access doors. Leak testing of the

entire duct segment would require the fabrication of a temporary walled enclosure within the cable spreading room in order to achieve acceptable tracer gas concentrations. Since the entire duct is encased by pyrocrete, inleakage is thought to be extremely minimal if existent at all. Thus, for initial testing, only the access door portion of the duct will be leak tested.

Special Provisions - A temporary VISQUEEN enclosure will be installed over the existing access door. Tracer gas will be injected into the enclosure and concentration measured in the HVAC equipment room.

TEST 6 PV/OV Normal Outside Air Intake Duct.

Two Segments

This test is being conducted for informational purposes. In the event of a single failure of bubble tight dampers OFCV-PV042 and OFCV-PV043, PV system isolation to the outside air will be achieved by redundant bubble tight damper located in the Unit 2 purge duct room. Under this condition, the normal make-up air duct will be under negative pressure up to damper OFCV-PV039. Any inleakage to this duct will result in unfiltered inleakage to the control room.

To perform this test, a homogenous tracer gas mixture will be formed in the purge duct room with sampling taking place in the PV supply housing upstream of the return air duct.

Special Provisions - Need to fail-open damper OFCV-PV042 and OFCV-PV043 independent of OFCV-PV039 to perform test.

The following additional items were also agreed upon.

- Auxiliary Building HVAC (AV) System would be operated in its design accident mode to minimize pressure influences on tracer gas testing.

- All temporary fans, sampling manifolds and vacuum pumps required for testing would be supplied by LAT and left with CECo.

- All tracer gas testing would be performed on second or third shifts to minimize room pressure disturbances caused by personnel ingress/egress and to minimize impact on plant operations.

- LAT will write test procedures and submit to CECo for comment. Technical staff will embody these procedures into the station test procedures.

- The first test is scheduled to be performed in February 1991 and subsequent retesting in May. Test duration is expected to be 1 - 2 weeks. Actual test dates will be based upon completion of security badging.

Dr. Lagus also requested copies of the following items:

- HVAC Physical Drawing for Purge Room
- HVAC Diagram for OV System
- Room Volumes for Areas Served by OV System During Accident Mode.

ATTACHMENT 15

T99-Z-97
REVD

MATHESON GAS PRODUCTS
MATERIAL SAFETY DATA SHEET

081

FEB 0 [illegible] 99

1-76-81

PRODUCT IDENTIFICATION

MSDS081: SULFUR HEXAFLUORIDE

SYNONYM(S): Sulfur (VI) Fluoride

CHEMICAL FORMULA: SF_6

C.A.S. NUMBER: 2551-62-4

D.O.T. SHIPPING NAME: Sulfur Hexafluoride

D.O.T. I.D. NUMBER: UN1080

D.O.T. HAZARD CLASS: Nonflammable Gas

D.O.T. LABEL(S): Nonflammable Gas

PHYSICAL DATA

MOLECULAR WEIGHT: 146.054

SUBLIMATION POINT @ 1 atm.: -63.7°C; -82.7°F

VAPOR PRESSURE @ 21.1°C: 2,210 kPa (gauge); 320 psig

SPECIFIC VOLUME @ 1 ATM, 21.1°C: 0.156 m^3/kg; 2.5 ft^3/lb

RELATIVE DENSITY, (AIR=1): 5.114 @ 1 atm, 20°C

SOLUBILITY IN WATER @ 1 ATM, 25°C: 5.4 cm^3/ kg water

DESCRIPTION: At room temperature and atmospheric pressure, sulfur hexafluoride is a colorless, odorless, nontoxic gas. It is shipped as a liquefied gas under its own vapor pressure.

FIRE AND EXPLOSION HAZARD DATA

FLAMMABLE LIMITS IN AIR:

FIRE FIGHTING PROCEDURES: [illegible] does not create a fire hazard. However, cylinders [illegible] may rupture with violent force. Extinguish surrounding fire and keep cylinders cool [illegible] water spray applied from the maximum possible distance.

HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMITS: [illegible] TWA [illegible] 1000 mg/m³

[illegible] (1000 mg/m³)

[illegible] 1000 mg/m³

ACUTE EFFECTS OF OVEREXPOSURE: [illegible] is considered to be nontoxic. It can act as a simple asphyxiant by displacing [illegible] of asphyxia include rapid respirations, dizziness and fatigue. Contact may cause [illegible]

CHRONIC EFFECTS OF OVEREXPOSURE: [illegible]

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Move victim to fresh air. [illegible] respiration, preferably mouth to mouth. If breathing is difficult, [illegible]

CONTACT: Treat for frostbite.

REACTIVITY DATA

STABILITY: (X) STABLE ( ) UNSTABLE

INCOMPATIBILITY: May react violently with organometallics and chemically active metals such as sodium, potassium, and barium, powdered magnesium, powdered aluminum. Reacts vigorously, perhaps explosively, with disilane.

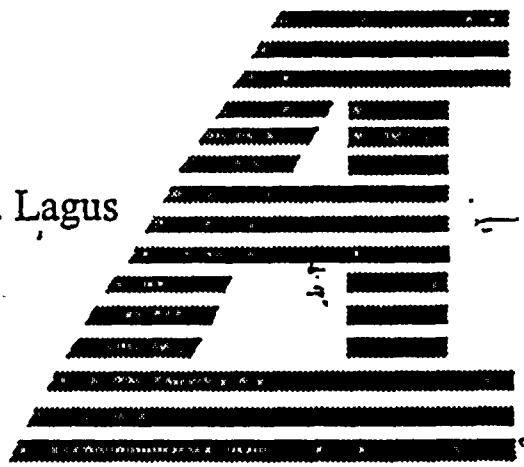
HAZARDOUS DECOMPOSITION/OXIDATION PRODUCTS: When heated to decomposition or exposed to electric arcs, toxic fluorine and sulfur compounds are released.

POLYMERIZATION: (X) WILL NOT OCCUR ( ) MAY OCCUR

LAGUS APPLIED TECHNOLOGY,INC.

Tracer Gas Ventilation Characterization Services

P. L. Lagus



January 1987

Corporate:
11760 Sorrento Valley Rd., Suite M
San Diego, California 92121
Phone: (619) 792-9277 Fax: (619) 792-9133
East Coast:
18159 Village Mart Dr., Suite 242
Olney, Maryland 20832
Phone: (301) 774-4012 Fax: (301) 774-4473

Determination of the ventilation characteristics of residential, industrial, and commercial structures has developed into a relatively well-known technology over the preceding ten years. Concerns of health, safety, and energy conservation have largely been responsible for driving this development. Within the last five years, attention has been focused on the utilization of single and multiple tracer gases as they apply to the characterization of various ventilation-related problems specific to industrial/chemical process and hazardous containment situations. Tracer gas characterization of ventilation systems has become widely accepted within the building engineering community. In fact, ASTM Standard E-741 has been promulgated to provide for a standard method for measuring air-leakage (ventilation) rates within structures.

Tracer gas characterization of ventilation as it relates to industrial buildings encompasses a number of readily-recognizable experimental scenarios; six which come to mind are:

- Control room habitability studies,
- Containment leak-rate testing,
- Airflow pattern identification,
- Monitor location verification,
- Overall ventilation/flow characterization, and
- Hazardous event impact studies.

Utilizing a unique, single and multiple tracer approach, complex ventilation flows can be characterized quickly and accurately for substantially less cost than with conventional techniques. The remainder of this brochure briefly outlines a number of experimental procedures utilizing tracer gas that solve problems which may occur within a ventilated industrial plant. These procedures are by no means meant to be exhaustive, but merely illustrate the broad range of technical possibilities which are made available by using single and multiple tracer gases to unambiguously tag and trace ventilation flows within complex structures.

Figure 1 depicts one of the most familiar uses for tracer technology, especially to those involved in conventional power plant operations. Often there is interest in the pollutant impact of the generator stack on the surrounding countryside. A common technique for doing this is by means of an analytical or a numerical model describing the pollutant transport from the effluent stack. In order to have confidence that the model is describing reality, often times tracer gas is injected into the stack and monitored downwind as a function of distance, elevation, and azimuth. The analytical or numerical model is used to predict measured concentrations to within a specified error percentage. The plot shown here has actual experimental data taken at an Arizona power plant which are compared to a calculation from a numerical pollutant plume dispersion model.

The most common tracer gas, sulfur hexafluoride (SF_6), has been used in a variety of tracer applications for over thirty years. Its properties are enumerated in Table 1.

FIGURE 1. PLUME MODEL VALIDATION EXAMPLE SHOWING SF_6 CONCENTRATIONS

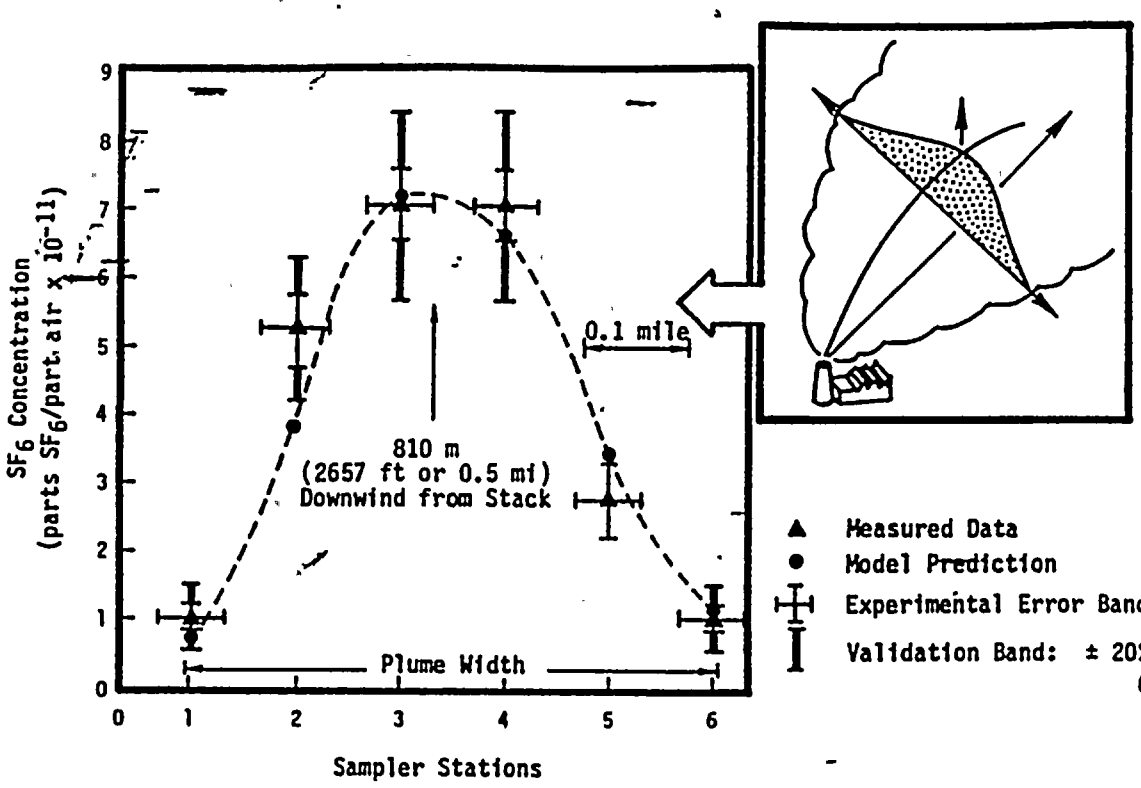
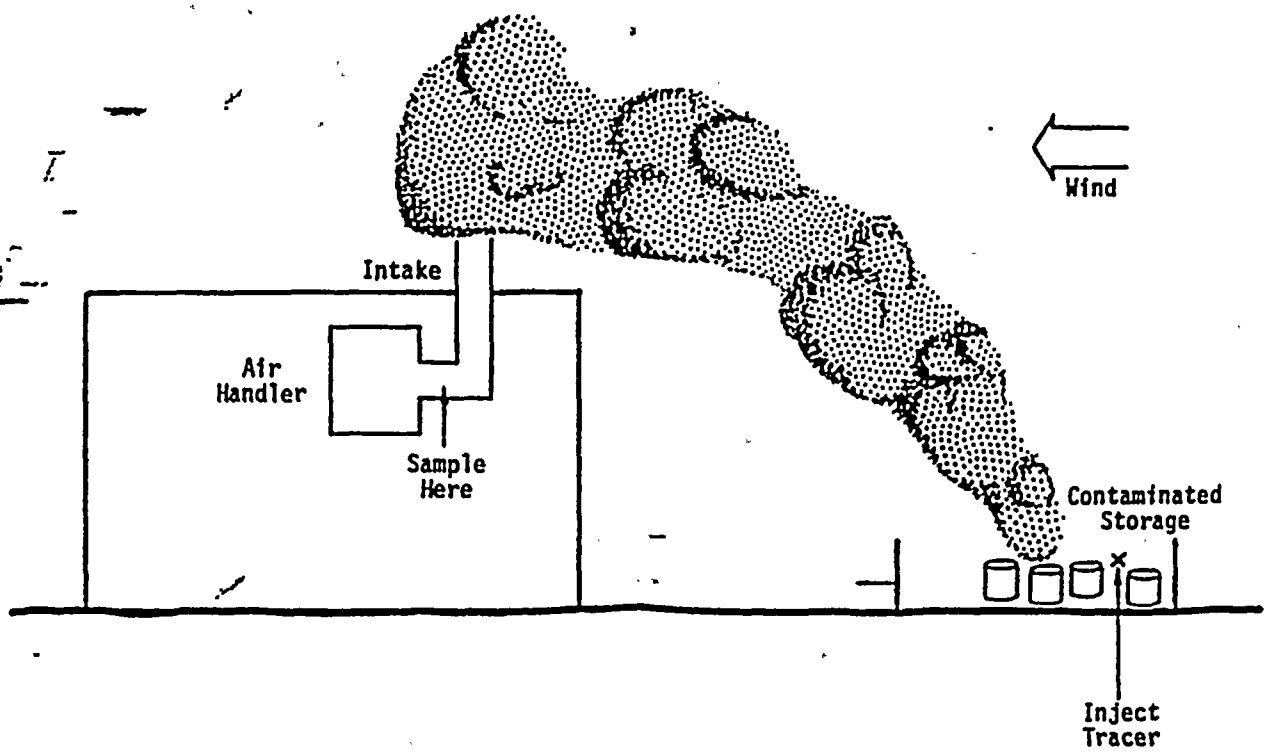


TABLE 1. SULFUR HEXAFLUORIDE (SF_6)

- Non-Toxic and Non-Allergenic
- Chemically Inert, Odorless, and Tasteless
- Non-Flammable and Non-Explosive
- Transported and Dispersed as Other Atmospheric Gases
- Easily and Economically Measured with High Reliability
- Measurable by an Established Experimental Technique which Precludes Interference with Air
- Measurable at Very Low Concentrations, i.e., 10^{-6} (microgram) to 10^{-12} (picogram)
- Not a Normal Constituent of Air; Non-Existent to Negligible Background Concentration
- Commercially-Available

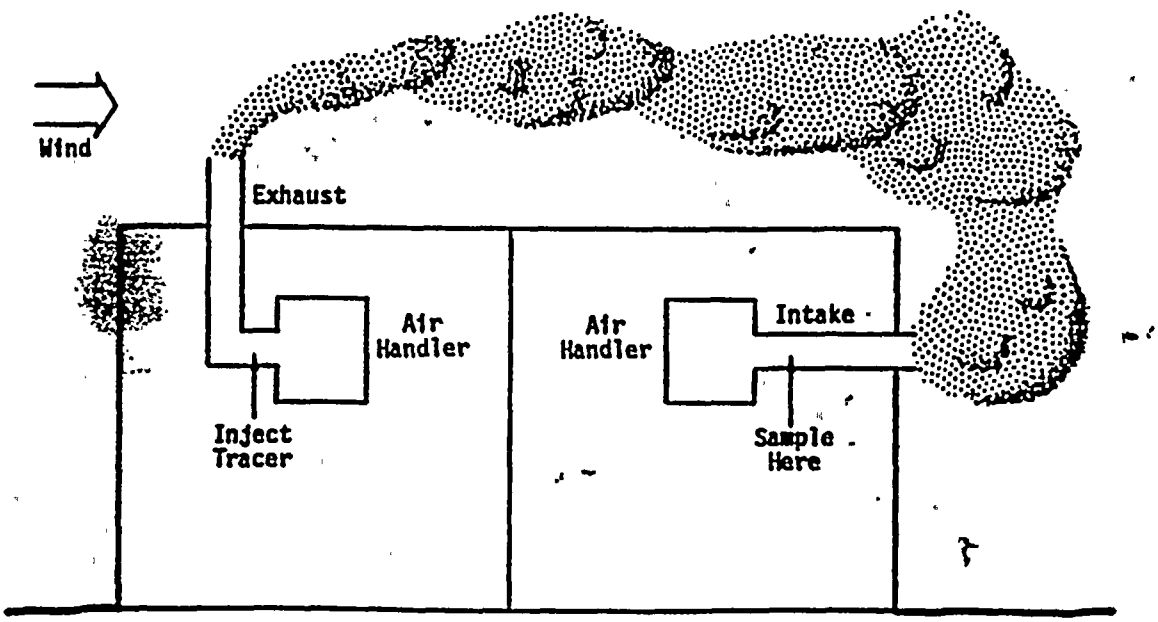
Figure 2 presents a simple example of the use of tracers to locate or document the effect of external pollution on internal air. Situations exist where contaminated storage, such as solvents, may be located upstream of the air intake for a control room or other critical area within a plant. Release of tracer within a contaminated storage, with subsequent measuring at the intake to the air-handling unit, will disclose the existence and the magnitude of external pollution recirculation.

FIGURE 2. RECIRCULATION TEST (External Pollution)



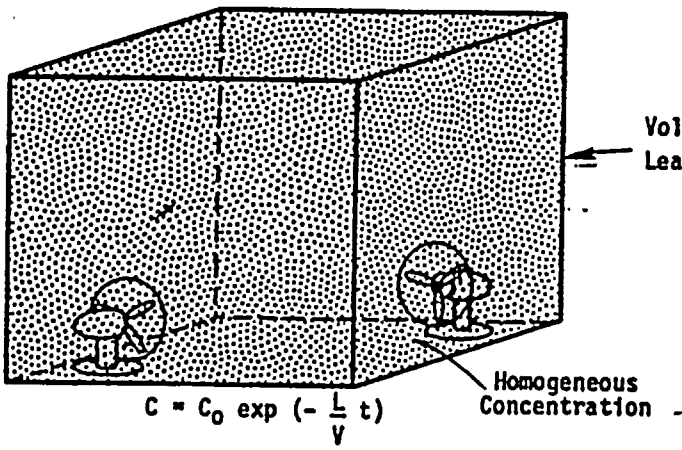
It is also possible, as shown on Figure 3, to utilize the above-mentioned technique to document recirculation of internal pollution by injection of the tracer into a potentially objectionable exhaust stream with subsequent monitoring at a corresponding intake. This test will disclose the existence and the magnitude of internal pollution recirculation.

FIGURE 3. RECIRCULATION TEST (Internal Pollution)

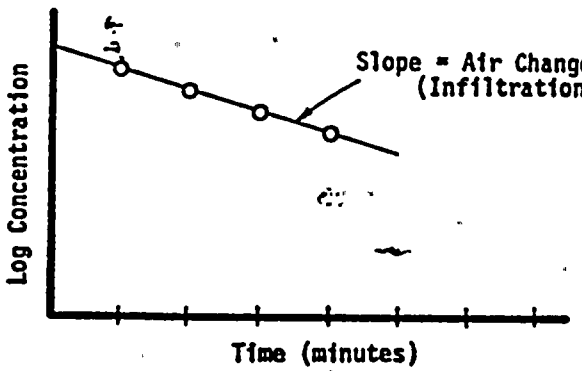


In many applications, it is desirable to quantitatively measure ventilation characteristics within an individual room, or within a ventilated system as a whole. There exist two relatively-straightforward techniques by which these measurements can be performed. Figure 4 shows the basics for performance of air-leakage tests by concentration decay. This is the basis for ASTM Standard E-741. The structure to be tested is filled with a more or less homogeneous concentration of tracer gas at very low concentration (on the order of 1 part in 10^9). The concentration is then monitored as a function of time; when concentraion decay as a function of time is plotted on a semi-log plot, a straight line is often the result. The slope of that line is the volume-normalized leakage rate, called the air change (or infiltration) rate.

FIGURE 4. AIR LEAKAGE BY CONCENTRATION DECAY

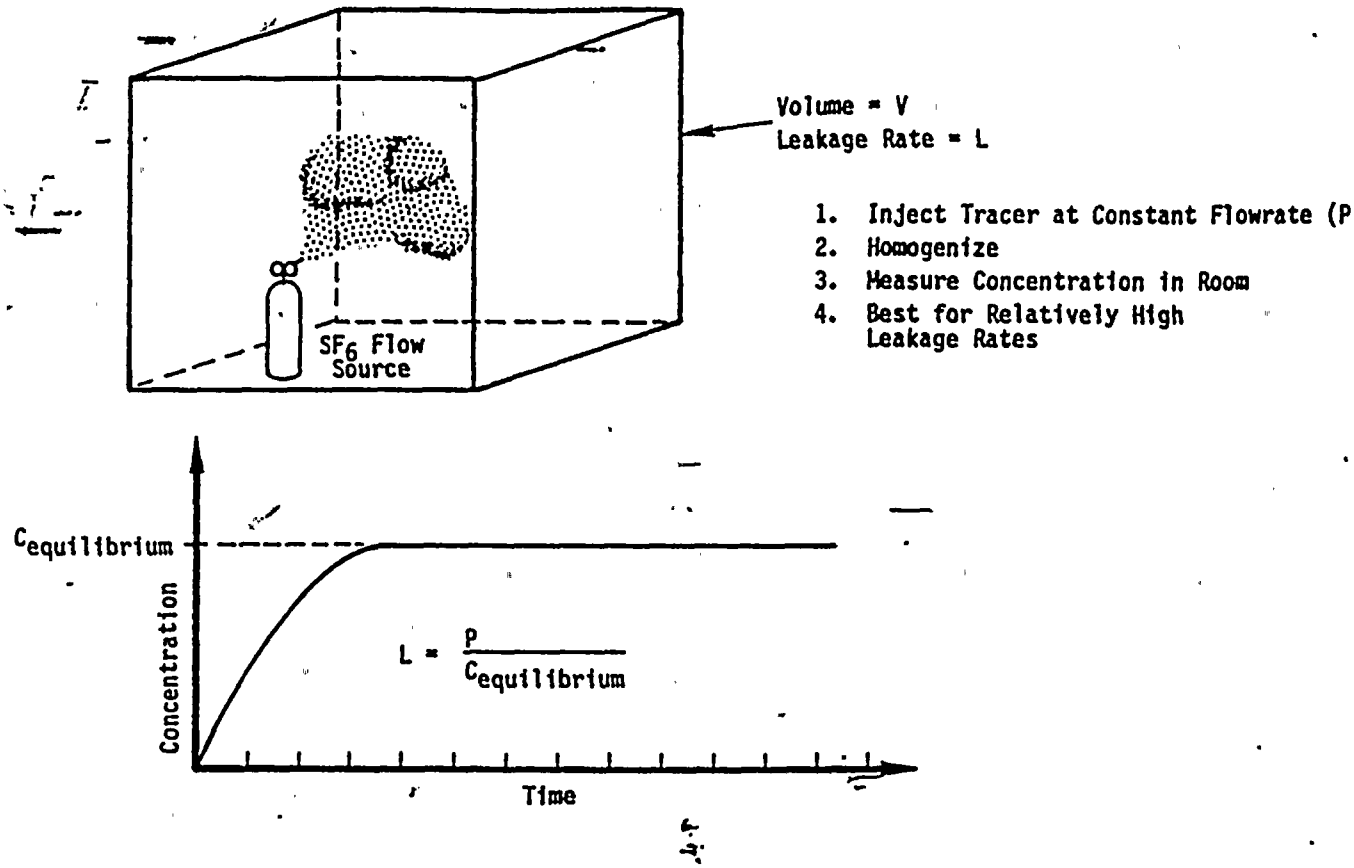


Concentration	Time
C_0	0
C_1	10
C_2	20
C_3	30
•	•
•	•
•	•



A second technique, especially used for areas of high ventilation rate, is the so-called constant flow test which is illustrated on Figure 5. For this method, a constant flow of tracer is released into a ventilated area. The concentration within the structure is monitored as a function of time. A plot of the concentration as a function of time discloses that the concentration of tracer within a ventilated structure becomes constant after some time. (This can also be demonstrated mathematically.) This constant value is proportional to the leakage rate; in fact, the leakage or ventilation rate is equal to the input rate of tracer divided by the equilibrium concentration value.

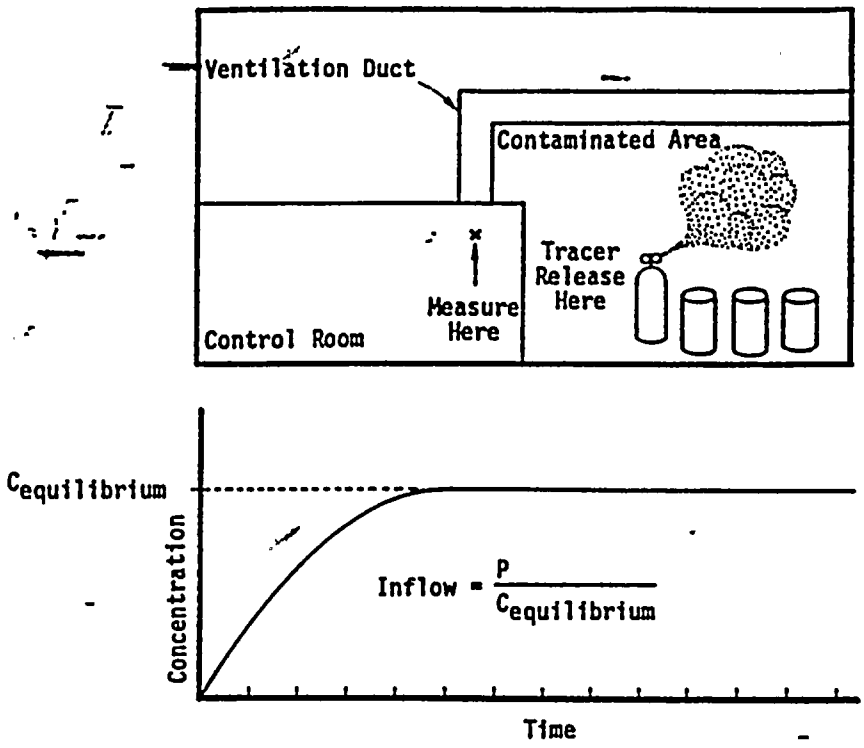
FIGURE 5. CONSTANT FLOW TEST



An interesting use for the concepts outlined above is shown on Figure 6. Within a particular area, often one is interested in leakage of internally-generated contamination into a control room or other ventilation-controlled area. Release of a tracer at a constant flowrate in the particular area, coupled with measurements within the controlled area, results in a plot of the concentration as a function of time. The inflow rate is simply the production rate of the tracer divided by the equilibrium concentration of tracer measured within the control room. A test such as this not only discloses the existence of non-design, inflow leakage from ducting or other features, but also allows one to quantitatively infer this leakage.

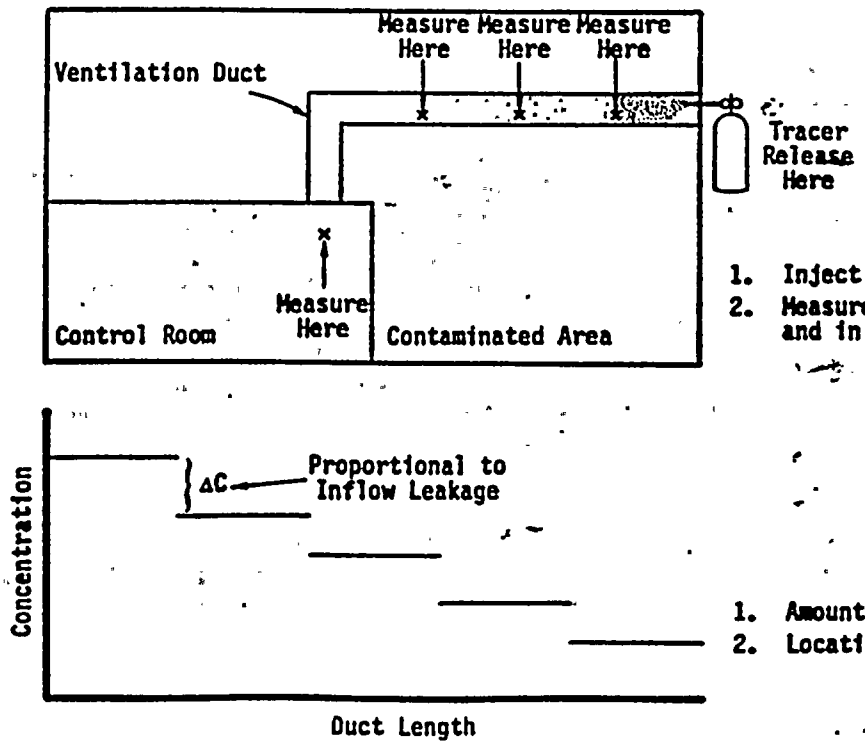
A similar test is shown on Figure 7. Especially in return ducting, inadvertent and non-design leakage can be a problem. Many times one is interested in the actual magnitude of this duct leakage. A constant injection of tracer into the duct, followed by subsequent measurements along the duct, allows measurement of the flowrate through the duct. As shown, it is also possible to discover those areas along the duct where duct leakage or non-design inflow is occurring.

FIGURE 6. NON-DESIGN INFLOW LEAKAGE TEST



1. Inject Tracer
2. Measure Concentration in Control Room

FIGURE 7. DUCT LEAKAGE TEST

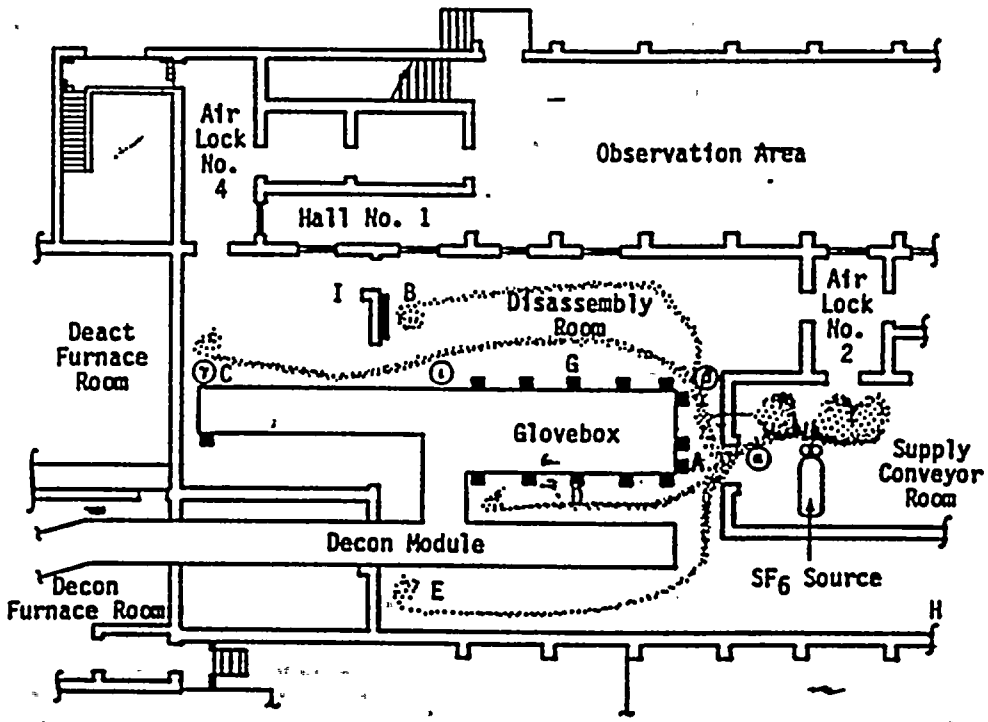


1. Inject Constant Flow of Tracer
2. Measure Concentration along Duct and in Control Room

1. Amount of Duct Leakage
2. Location of Duct Leaks

Figure 8 presents another technique which is adapted from actual measurements performed in a chemical process plant. The entire area to be tested was a high-rate, forced-ventilation area. A constant rate of tracer was released in the supply conveyor room, as this was a source of potentially hazardous gas leakage. Concentrations of tracer as a function of time were monitored at a variety of locations within the plant. Typical flow lines are shown as dotted paths. Measurements like these allow rapid location and quantification of ventilation dead zones within a forced-ventilated area. They are also useful for identifying optimum locations for health and safety monitors. Presently, such monitors are often installed more for the convenience of installer personnel than for the ultimate safety of plant occupants. An additional use for this test is to infer contaminant or pollutant transit times from one area to another. This information is necessary to design safe evacuation routes and also for overall hazardous incident planning.

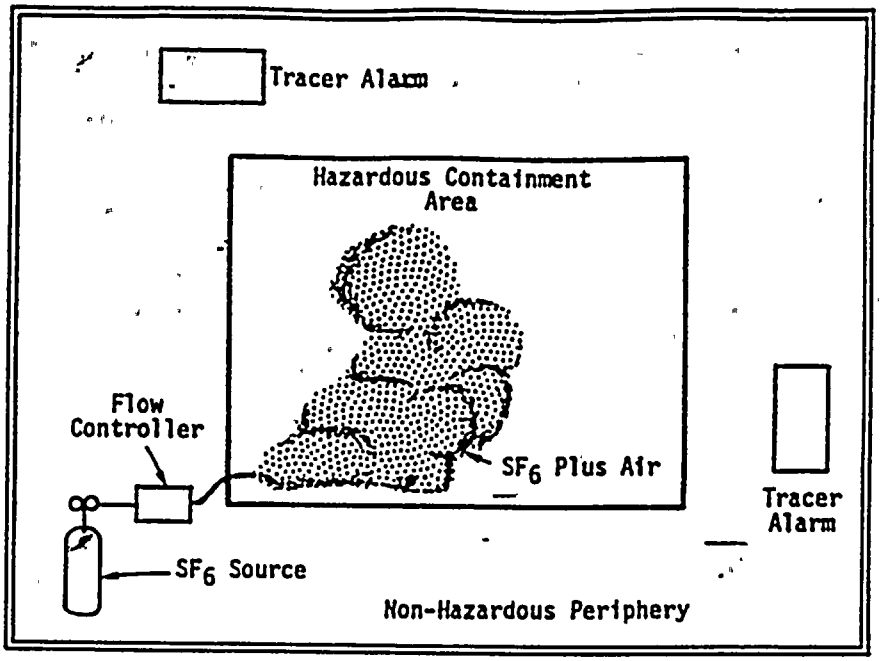
FIGURE 8. AIRFLOW PATTERN TEST



1. Ventilation Dead Zones
2. Health & Safety Monitor Locations
3. Contaminant/Pollutant Transit Times

A variation on the techniques which have been documented so far is the use of integrity breach monitoring (shown on Figure 9). Integrity breach monitoring is implemented by injecting a constant flow of SF_6, or other tracer, into a hazardous containment area and monitoring the periphery for the presence or absence of this tracer. If one finds no tracer within the non-hazardous periphery, one can infer that there is no breach of containment. Conversely, if one does detect tracer within this area, one has unambiguous evidence of a containment breach. Moreover, the magnitude of the tracer concentration yields quantitative information on the magnitude of the integrity breach.

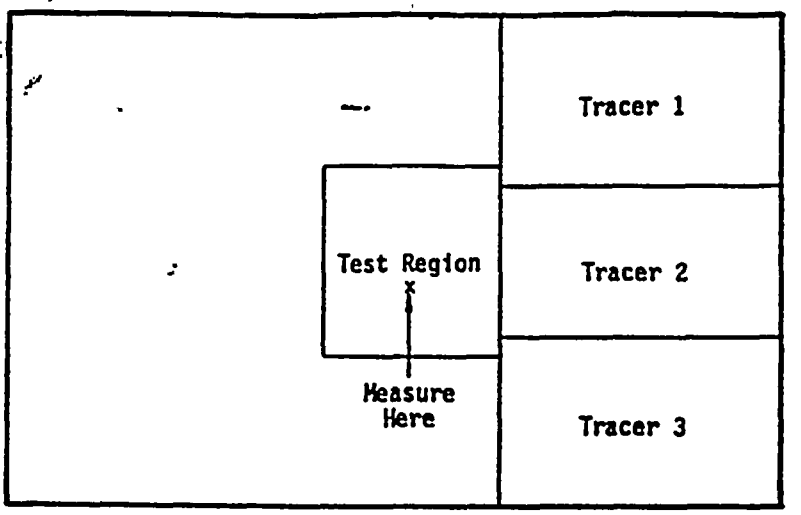
FIGURE 9. INTEGRITY BREACH MONITORING



1. Inject SF_6 into Containment Area
2. Monitor Periphery for SF_6
3. No SF_6 Implies No Breach of Containment

In many applications, information on the actual performance characteristics of a ventilation system is desired. Many forced-ventilation systems do not necessarily perform exactly as designed and, in some instances, the degree of departure from design is a vital piece of information. Figure 10 illustrates a multi-tracer, unintentional-ventilation, flow test wherein three distinct tracers are injected into three areas of interest. The test region--which can be a containment area, a safe area, or the like--is monitored for the presence or absence of any or all of these three tracers. The existence of any of these tracers within the test region immediately implies a ventilation connection between the two. The magnitude of the tracer concentration can give a measure of the inflow leakage rate. Table 2 and Figure 11 present some common electronegative tracers and show an actual multiple tracer separation. Note that all these tracers share the same ideal tracer characteristics as enumerated for SF_6 in Table 1. The primary differences between these tracers and SF_6 are: 1) the separation from air is often times more complex than for SF_6, and 2) the chromatograph may not be as sensitive to these tracer gases as to SF_6. It should be emphasized, however, that all these gases have been used either singly or in combinations of up to six gases simultaneously for the characterization of both intentional and unintentional ventilation flows.

FIGURE 10. UNINTENTIONAL VENTILATION FLOW (Multi-Tracer Test)

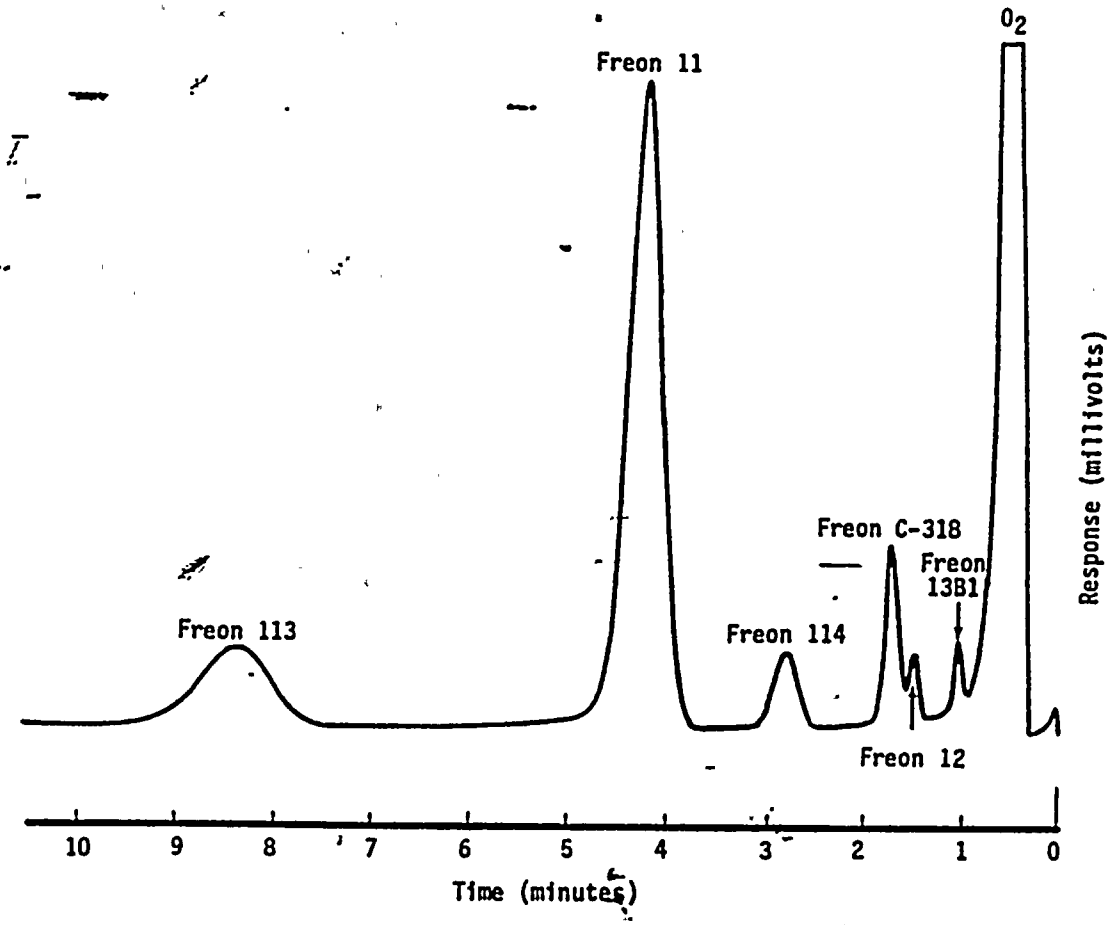


1. Tells which Area is Contaminating Test Region
2. Can give Inflow Leakage Rate

TABLE 2. ADDITIONAL ELECTRONEGATIVE TRACER GASES

Name	Symbol	Trade Name
Dibromodifluoromethane	CF_2Br_2	Freon 12B2
Trichlorofluoromethane	$CFCl_3$	Freon 11
1,1,1-Trichlorotrifluoroethane	$C_2Cl_3F_3$	Freon 113
[illegible]trifluoromethane	CF_3Br	Freon 13B1
[illegible]luorocyclobutane	C_4F_8	Freon C-318
Dichlorodifluoromethane	CCl_2F_2	Freon 12
1,2-Dichlorotetrafluoroethane	$C_2Cl_2F_4$	Freon 114
Chlorodifluoromethane	$CHClF_2$	Freon 22
Chloropentafluoroethane	$CClF_2CF_3$	Freon 115

FIGURE 11. MULTIPLE TRACER GAS CHROMATOGRAPHIC SEPARATION



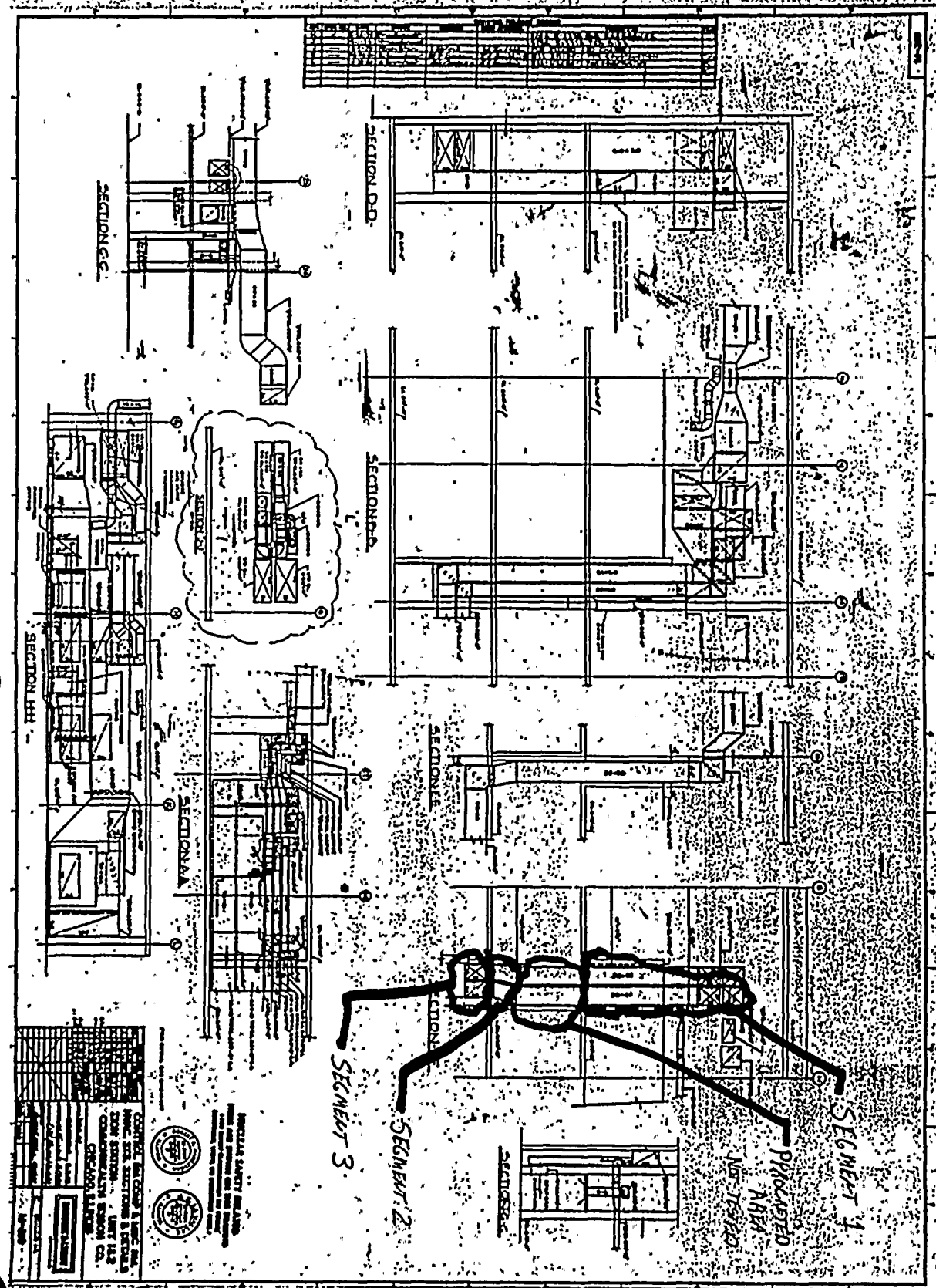
The examples given above are in no way meant to be comprehensive but, instead, are by nature a tutorial in which it is hoped that solutions to specific problems are suggested which can be addressed by techniques similar to those disclosed. Tracer characterization of a ventilation system within an industrial plant affords three significant benefits:

1) Detailed understanding of the actual operating performance of a ventilation system,

2) Enhanced reliability of a ventilation system after tracer-discovered retrofit actions are undertaken, and

3) Increased confidence in the ability of a ventilation system to protect occupants of a control room or otherwise safe area.

For an in-depth discussion of your particular ventilation-related flow problem, or for assistance in designing and implementing a characterization program, please contact P. Lagus.



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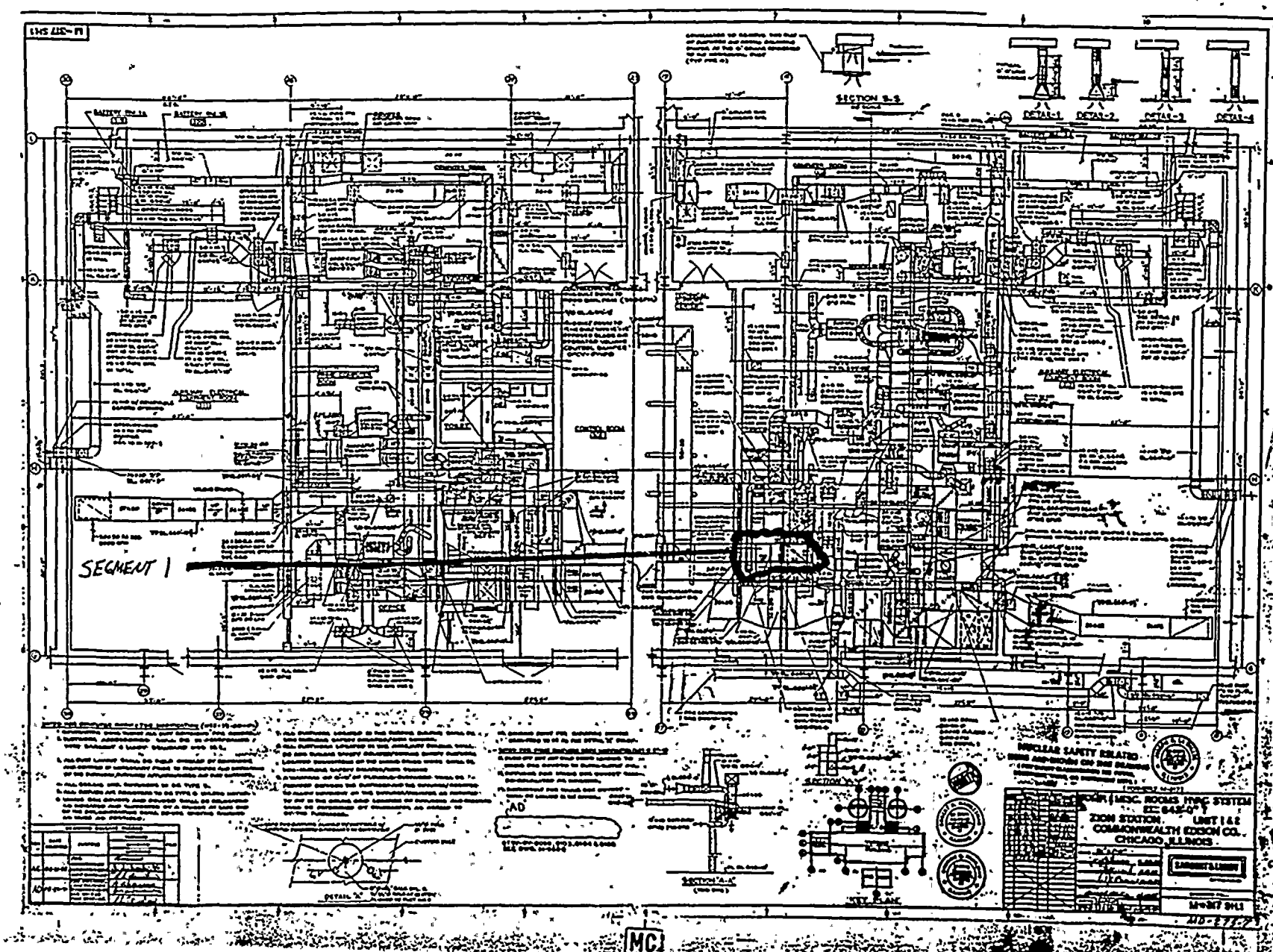

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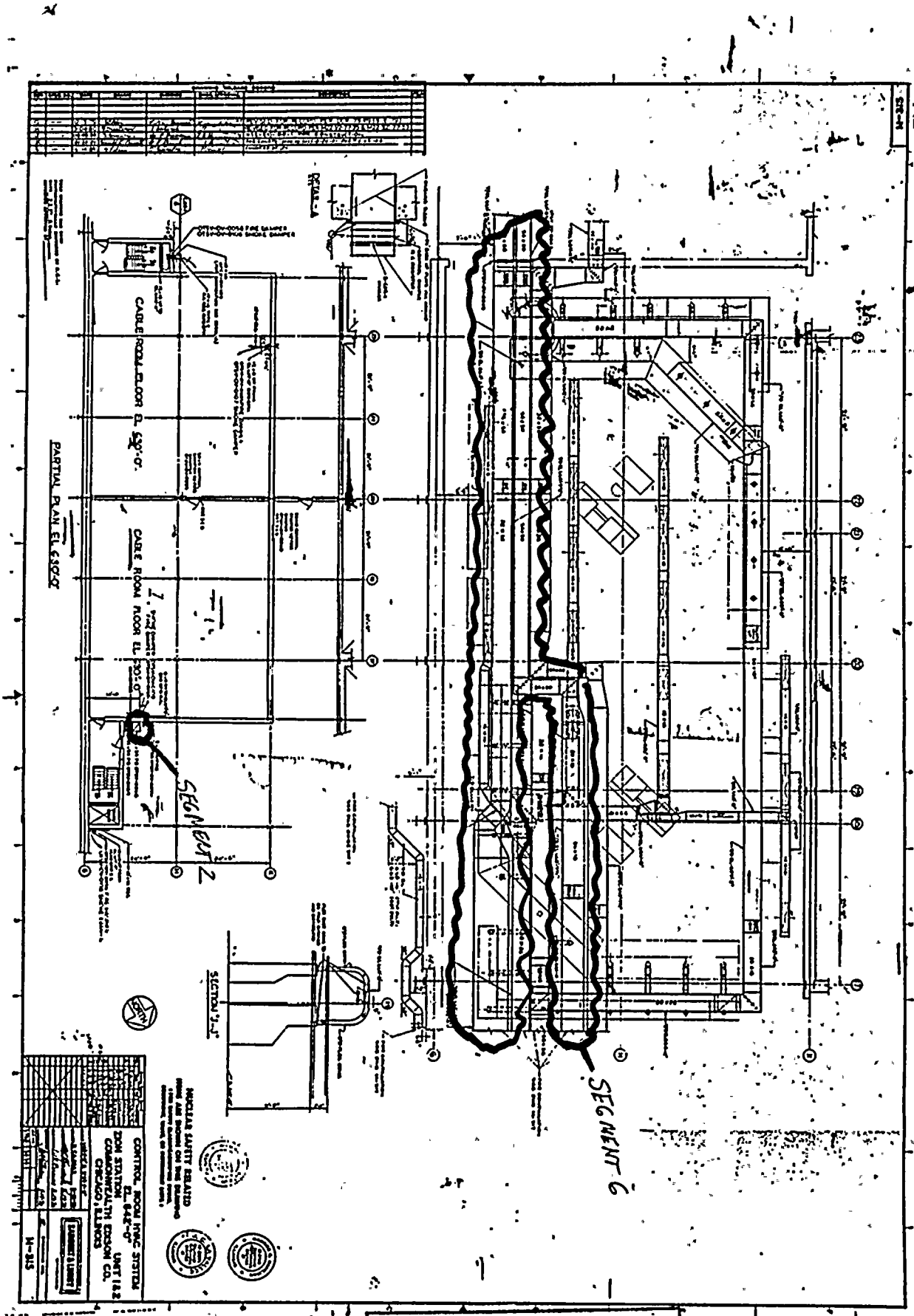

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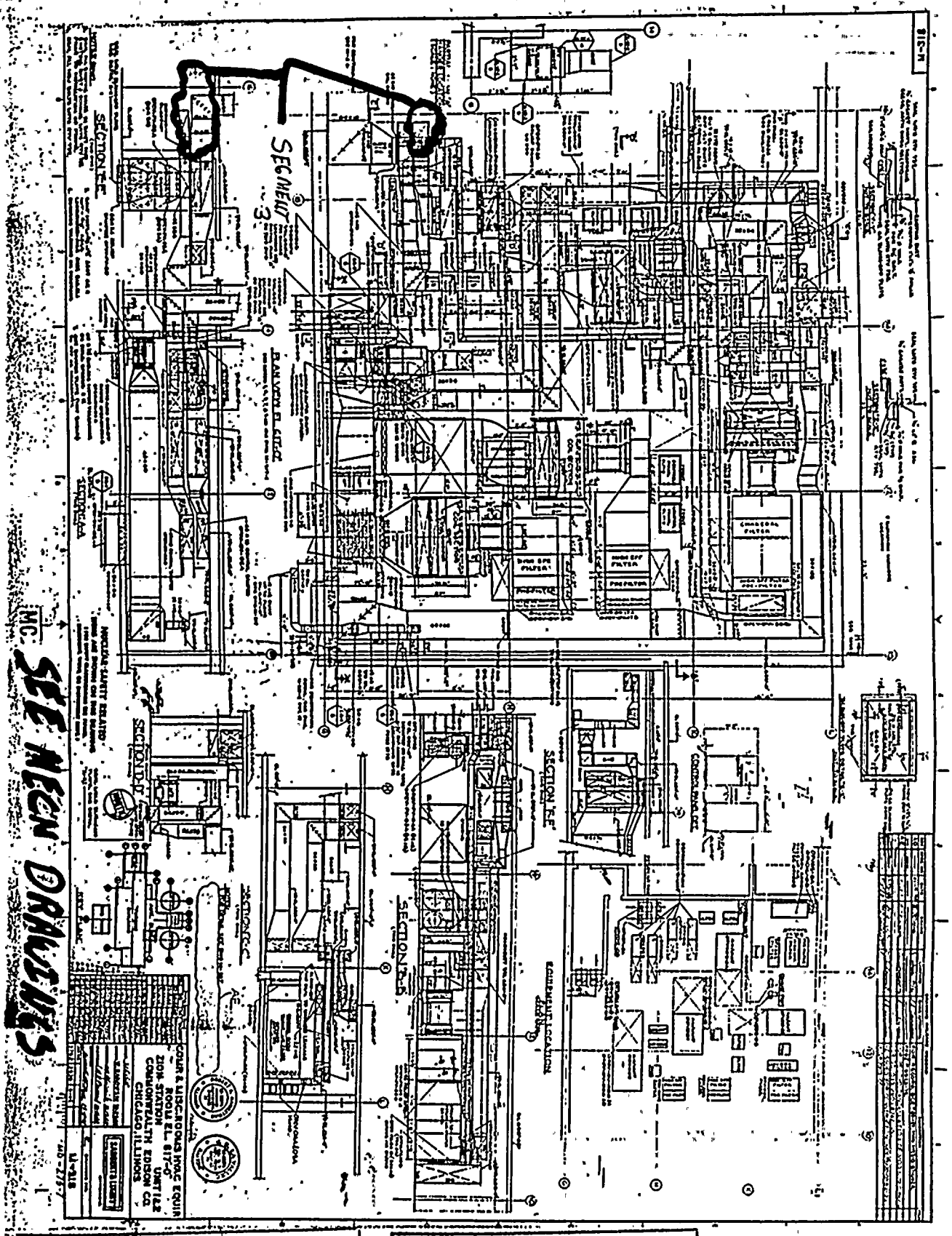

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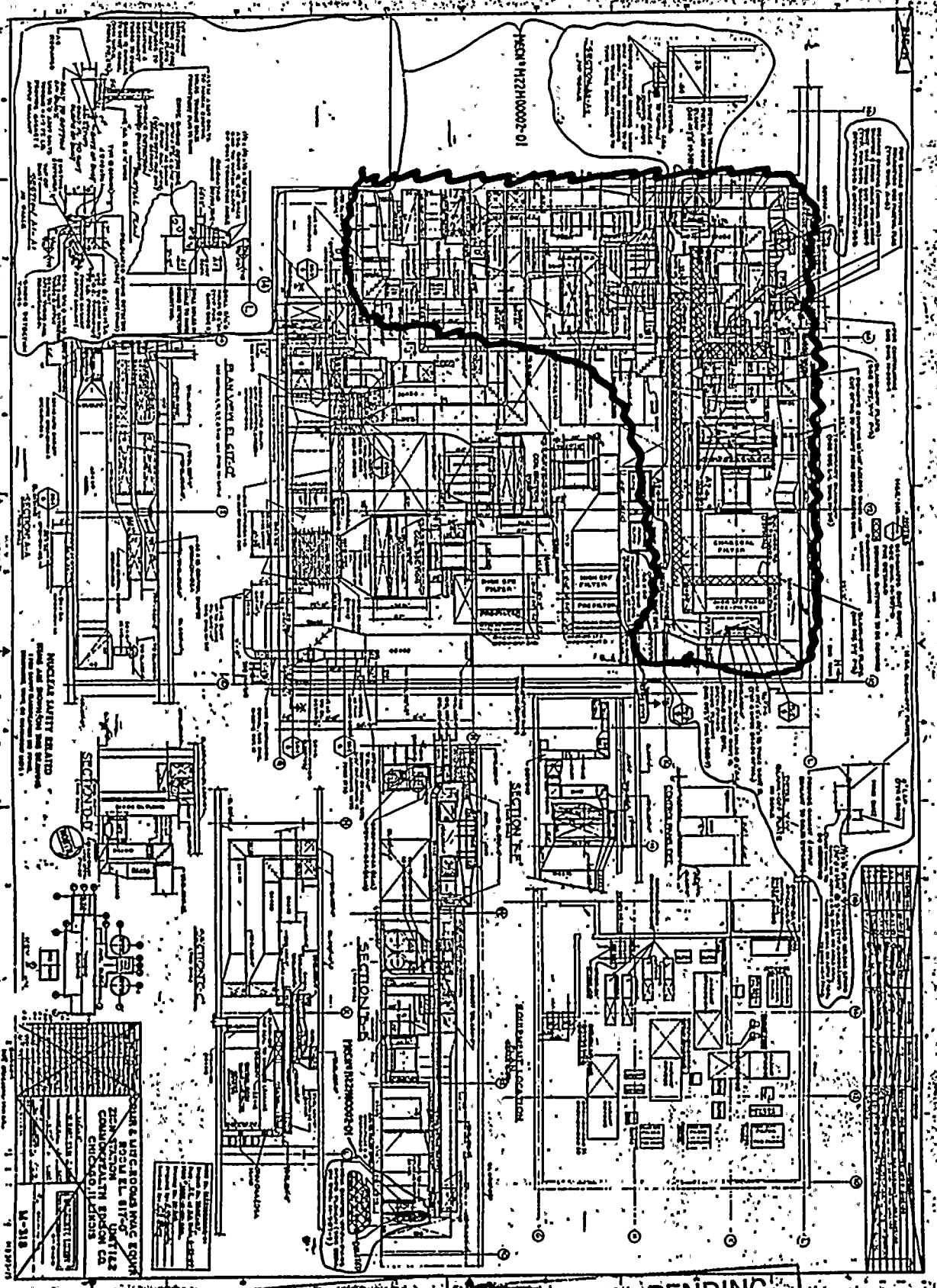

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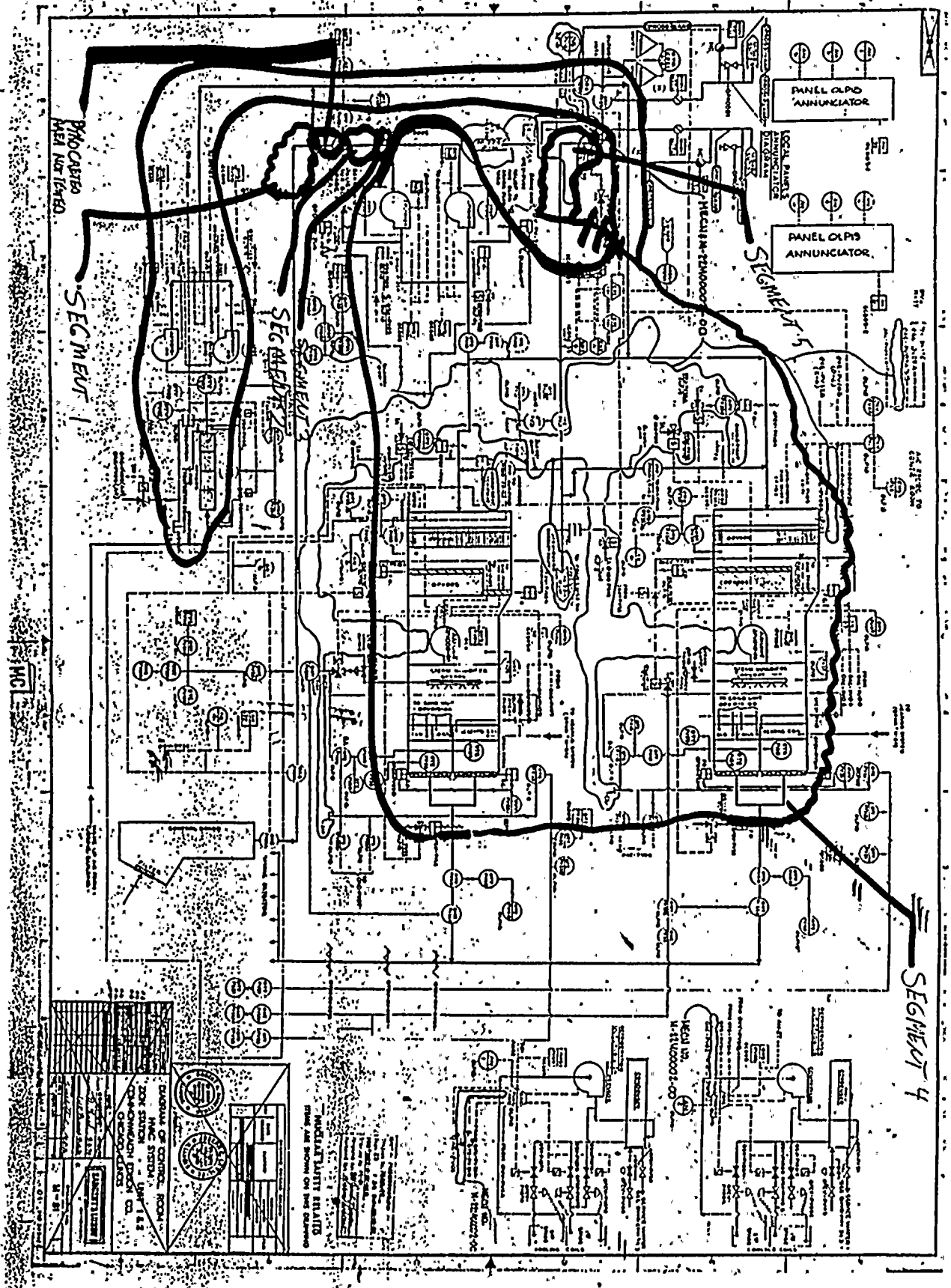

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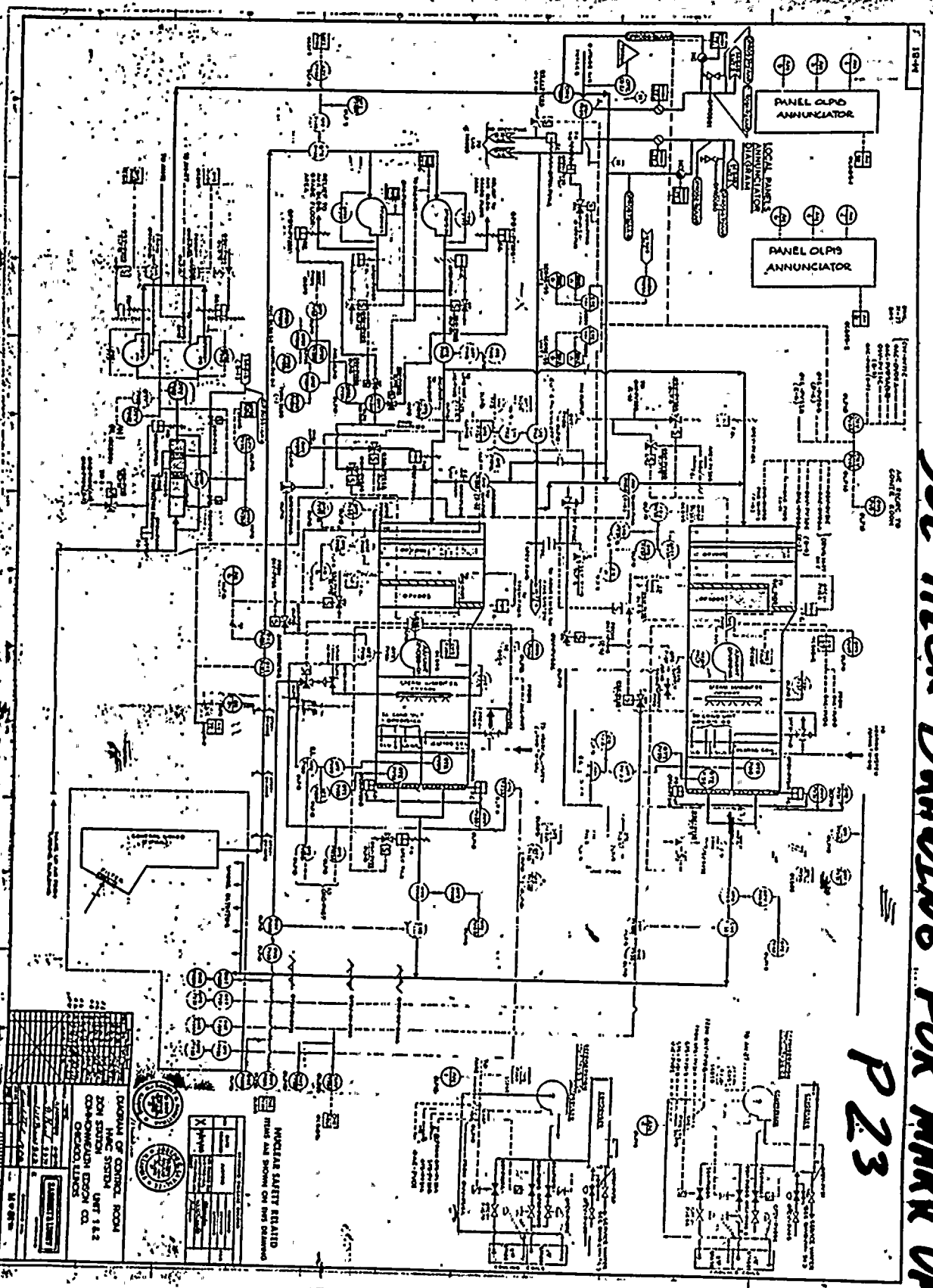

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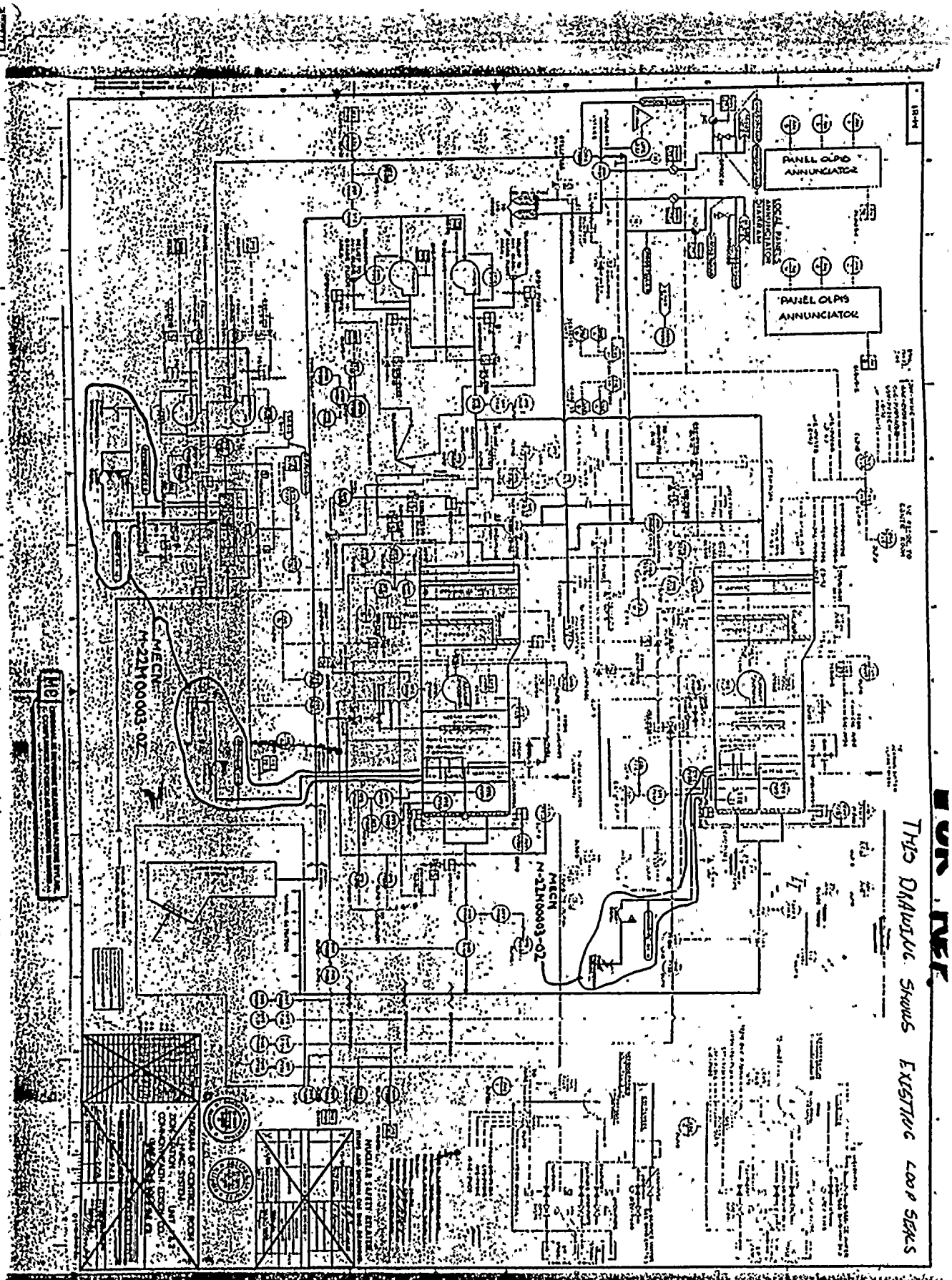

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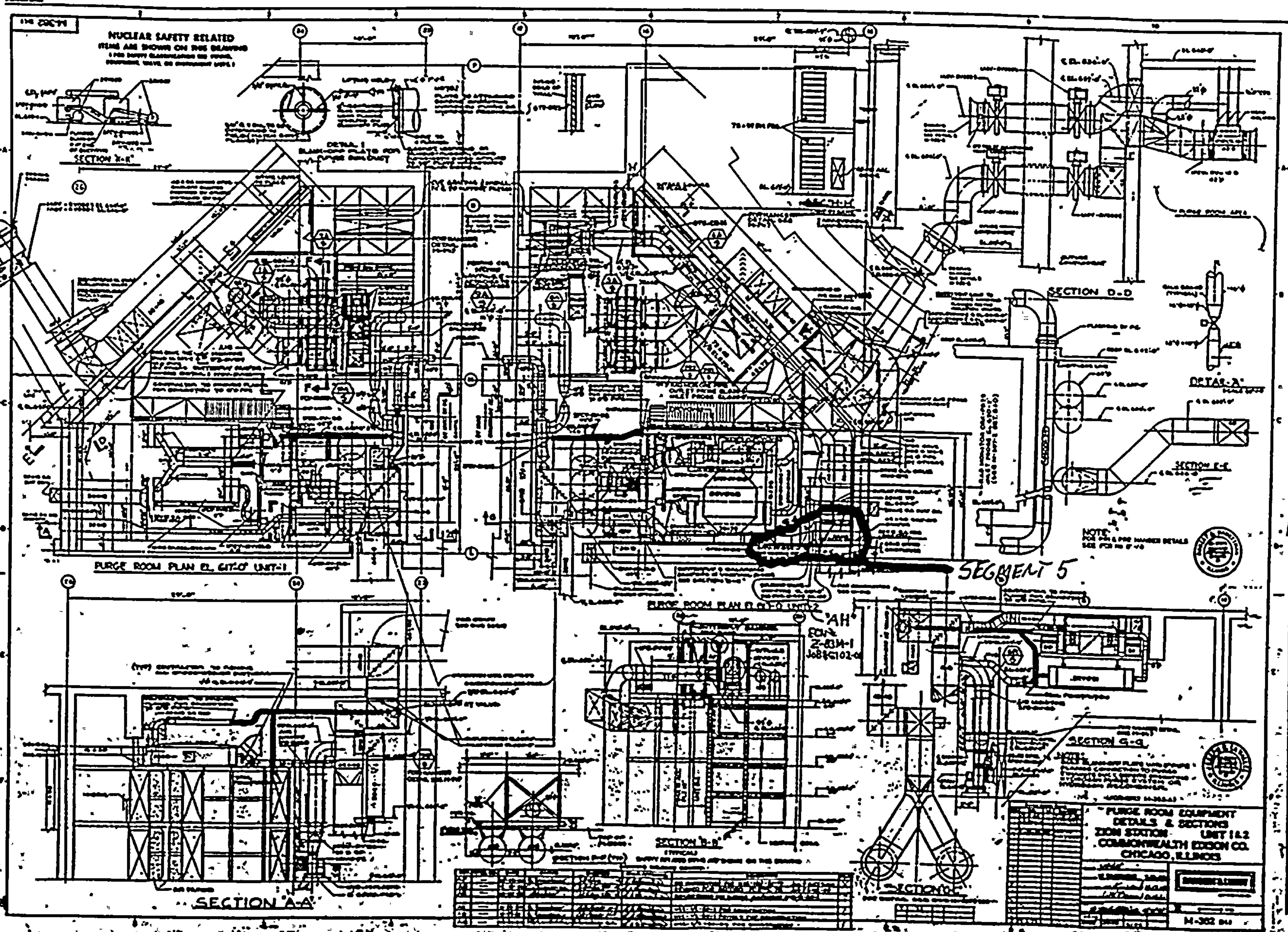

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