

**A HEALTH PHYSICS PROGRAM FOR THE STARTUP OF AN
ENRICHED URANIUM NAVAL FUEL FACILITY AT THE
SAVANNAH RIVER SITE**

by

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A paper proposed for presentation at the Health Physics
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**A HEALTH PHYSICS PROGRAM
FOR THE STARTUP OF AN ENRICHED
URANIUM NAVAL FUEL FACILITY AT
THE SAVANNAH RIVER SITE**

**CHARLES D. STRAIN
HEALTH PROTECTION DEPARTMENT
WESTINGHOUSE SAVANNAH RIVER COMPANY**

**A HEALTH PHYSICS PROGRAM FOR THE STARTUP OF AN ENRICHED URANIUM
NAVAL FUEL FACILITY AT THE SAVANNAH RIVER SITE**

SLIDE 1 - TITLE SLIDE

SLIDE 2 - PICTURE OF THE FUEL MANUFACTURING FACILITY

IN SEPTEMBER, 1986, RADIOACTIVE MATERIAL WAS FIRST INTRODUCED INTO THE FUEL MANUFACTURING FACILITY (FMF) LOCATED AT THE SAVANNAH RIVER SITE (SRS) IN AIKEN, SOUTH CAROLINA. THIS FACILITY WAS DESIGNED TO CONVERT URANIUM HEXAFLORIDE INTO A USEFUL FUEL PRODUCT FOR THE NAVAL NUCLEAR REACTOR PROGRAM. THIS WAS ALSO THE FIRST MAJOR NEW FACILITY AND PRODUCTION PROCESS TO BEGIN OPERATIONS SINCE THE INITIAL CONSTRUCTION OF THE SRS IN THE 1950's.

THERE WERE SEVERAL MAJOR HURDLES TO OVERCOME DURING STARTUP. THE PROCESS ITSELF WAS UNIQUE TO THE SITE AND WAS THE FIRST ONE ON THE SITE TO BE RUN USING A COMPUTERIZED DISTRIBUTIVE CONTROL SYSTEM. ALSO, A LARGE NUMBER OF THE ENGINEERS AS WELL AS OPERATING PERSONNEL WERE INEXPERIENCED, ESPECIALLY WITH RESPECT TO THE SAFE HANDLING OF RADIOACTIVE MATERIALS. FINALLY, THIS FACILITY WAS THE FIRST AT THE SITE TO OPERATE WITH PERSONNEL ON A TWELVE HOUR ROTATING SHIFT WHICH INITIALLY CREATED ADMINISTRATIVE PROBLEMS.

SLIDE 3 - STAFFING, TRAINING, AND PROCEDURES

INITIAL STAFFING OF THE HEALTH PROTECTION GROUP INCLUDED SEVEN PROFESSIONAL/SUPERVISORY PERSONNEL AND TWENTY TWO TECHNICIANS. ALL OF THESE PERSONNEL WERE ASSIGNED DIRECTLY TO THE FACILITY EITHER ON SHIFTS OR STRAIGHT DAYS. THIS GROUP SUPPORTED A STARTUP PRODUCTION CONTINGENT OF APPROXIMATELY 600 PERSONNEL

PRIOR TO INTRODUCTION OF RADIOACTIVE MATERIAL, A MAJOR TRAINING EFFORT WAS UNDERTAKEN TO PREPARE PRODUCTION PERSONNEL (ENGINEERS AND OPERATORS) TO BE ABLE TO SAFELY WORK WITH RADIOACTIVE MATERIALS AS WELL AS SAFELY HANDLE HAZARDOUS CHEMICALS.

OVER 50 HOURS OF TRAINING WAS PROVIDED IN SMALL CLASSES ON SUBJECTS THAT INCLUDED: UNDERSTANDING THE PRINCIPALS OF RADIOACTIVITY, CONTAMINATION MEASUREMENT AND CONTROL, HEALTH PHYSICS INSTRUMENTATION, POSTING REQUIREMENTS, INTERNAL AND EXTERNAL DOSIMETRY, EMERGENCY PROCEDURES, AND CHEMICAL HANDLING TECHNIQUES. TRAINING WAS BEGUN SEVERAL MONTHS PRIOR TO STARTUP AND REQUIRED TRAINERS WORKING ON ALL SHIFTS TO COMPLETE THE TASK. ADDITIONALLY, THE HP ASSIGNED STAFF REVIEWED AND COMMENTED ON OVER 1,000 OPERATING PROCEDURES FOR THE FACILITY. OCCUPATIONAL HEALTH FACTORS WERE EMPHASIZED IN THE REVIEW.

FACILITY DESIGN CONSIDERATIONS

SLIDE 4 - LOW VOLUME SAMPLING HEAD

DESIGN OF THE FMF INCLUDED EXTENSIVE MONITORING OF THE WORKER ENVIRONMENT. WITHIN THE FACILITY ARE APPROXIMATELY 300 LOW VOLUME (3 CFM) PARTICULATE AIR SAMPLERS THAT ARE THE SAMPLE OF RECORD FOR OCCUPATIONAL EXPOSURE TO AIRBORNE RADIOACTIVE CONTAMINANTS. BY HAVING SO MANY SAMPLERS, IT IS POSSIBLE TO CHARACTERIZE THE AIRBORNE ACTIVITY PATTERNS AT EACH WORK STATION AND ALSO TO PINPOINT PROBLEM AREAS WHEN THEY OCCUR. EACH UNIT IS EQUIPPED WITH A CALIBRATED ROTAMETER AND VACUUM IS MAINTAINED BY A CENTRAL PUMP WHICH IS EQUIPPED WITH A BACKUP. (POINT OUT THE IDENTIFICATION SYSTEM USING NUMBERS GLUED TO EACH HEAD.)

SLIDE 5 - TENNELEC AUTOMATIC COUNTER

AFTER SAMPLES ARE CHANGED OUT, THEY ARE ANALYZED ON A TENNELEC LB 5100 GAS PROPORTIONAL AUTOMATIC COUNTER. THE SAMPLES ARE COUNTED THREE TIMES OVER A 24 HOUR PERIOD AND THE DATA IS STORED ON FLOPPY DISK. AFTER THE FINAL COUNT, THE UNIT CALCULATES THE AIR ACTIVITY (COMPENSATING FOR RADON DAUGHTERS), PRINTS THE RESULTS ON HARD COPY FOR RECORDS RETENTION, AND FLAGS ANY SAMPLES THAT ARE ABOVE A PRESET CONCENTRATION LEVEL

RECENTLY, A STUDY WAS DONE PLACING PERSONAL AIR SAMPLERS ON SELECTED OPERATING PERSONNEL AND COMPARING THE RESULTS WITH THE FIXED SAMPLERS. THERE WAS NO SIGNIFICANT DIFFERENCE IN THE CONCENTRATION VALUES MEASURED BY THE TWO METHODS.

SLIDE 6 - HIGH VOLUME AIR SAMPLE ENCLOSURE

A SECOND METHOD OF PARTICULATE AIR SAMPLING LOCATED THROUGHOUT THE FACILITY CONSISTS OF HIGH VOLUME CONSTANT AIR MONITORS. EACH UNIT UTILIZES AN ANNULAR KINETIC IMPACTOR WHICH OPERATES AT APPROXIMATELY 40 CFM. THE UNIT IS DESIGNED TO DEPOSIT URANIUM PARTICLES ON A ZINC SULFATE COATED PLANCHET WHICH IS IN CLOSE PROXIMITY TO A PHOTOMULTIPLIER TUBE.

SLIDE 7 - HIGH VOLUME PANEL BOARD

IMPULSES FROM THE PM TUBE ARE SENT BACK TO AN AMPLIFIER AND A RATE METER LOCATED ON THIS PANEL BOARD IN THE HP OFFICE. WHEN A PRESET ACTIVITY LEVEL IS EXCEEDED, LOCAL AUDIO AND VISUAL ALARMS ARE TRIGGERED AT THE JOB SITE WHICH ALERTS PERSONNEL TO EVACUATE. ALARMS ARE ALSO TRIGGERED IN THE HP OFFICE AS WELL AS THE FACILITY CENTRAL MONITOR ROOM. HP PERSONNEL THEN EVALUATE THE SITUATION AND TAKE APPROPRIATE ACTIONS. THIS SYSTEM IS DESIGNED TO SEE ONE DERIVED AIR CONCENTRATION (DAC) FOR URANIUM IN APPROXIMATELY ONE HOUR.

SLIDE 8 - AREA GAMMA MONITOR

IN ORDER TO WARN PERSONNEL OF POSSIBLE INCREASES (CHRONIC OR SUDDEN) IN AMBIENT RADIATION LEVELS, THE FACILITY WAS PROVIDED WITH A NUMBER OF AREA GAMMA MONITORS. THE UNIT SHOWN IN THIS PHOTO IS A NUCLEAR MEASUREMENTS CORPORATION GA-6. THESE UNITS ARE IN ADDITION TO, AND INDEPENDENT OF, THE FACILITY NUCLEAR INCIDENT MONITORS. TO DATE, RADIATION LEVELS THROUGHOUT THE FACILITY HAVE REMAINED LOW.

FOR CONTAMINATION CONTROL PURPOSES, APPROXIMATELY 250 COUNT RATE METERS (FRISKERS) ARE LOCATED AT ALL WORK LOCATIONS AND AT STRATEGIC CONTROL POINTS THROUGHOUT THE FACILITY. VARIOUS LEVELS OF MONITORING ARE REQUIRED AT EACH STATION DEPENDING ON LOCATION AND WORK BEING PERFORMED.

SLIDE 9 - STACK PROBE

THE PRIMARY EFFLUENT FROM THE FACILITY CONSISTS OF AIR EXHAUSTED FROM THE ACTUAL PROCESS COMPONENTS COMBINED WITH AIR EXHAUSTED FROM THE REST OF THE FACILITY. THE EFFLUENT IS EXHAUSTED THROUGH A 150 FOOT STACK. PARTICULATE SAMPLING IS ACCOMPLISHED THROUGH THE USE OF AN ISOKINETIC SAMPLING PROBE SYSTEM LOCATED NEAR THE TOP OF THE STACK. THIS PROBE MEETS ALL ANSI REQUIREMENTS AND DOE ORDERS FOR STACK EFFLUENT MONITORING.

SLIDE 10 - STACK SAMPLE COLLECTION ENCLOSURE

LOCATED SEVERAL FEET AWAY FROM THE ISOKINETIC SAMPLER IN A MONITORING ROOM BUILT AT THE 100 FEET LEVEL OF THE STACK, ARE THE COLLECTION POINTS FOR THE STACK AIR SAMPLES. THE COLLECTION STREAM IS SPLIT AND TWO SAMPLES ARE COLLECTED ON FILTER PAPER MEDIA. ONE COLLECTION POINT IS EQUIPPED WITH AN ALPHA, BETA-GAMMA SENSITIVE DETECTOR. SIGNALS FROM THE DETECTOR ARE RELAYED TO THE HP OFFICE IN ALMOST THE IDENTICAL METHOD DESCRIBED FOR THE CONSTANT AIR MONITORS. STACK ALARMS, HOWEVER, ARE ALSO RELAYED FROM THE FMF TO THE AREA EMERGENCY COORDINATOR LOCATED IN ANOTHER FACILITY AND FINALLY TO THE SITE EMERGENCY OPERATING CENTER.

THE OTHER COLLECTION ENCLOSURE CONTAINS A FILTER COLLECTION MEDIA AS WELL, BUT NO DETECTOR. IT IS THE SAMPLE OF RECORD AND IS CHANGED AND ANALYZED ONCE PER WEEK.

SLIDE 11- PERSONNEL BIOASSAY REQUIREMENTS

IN ORDER TO EVALUATE POTENTIAL EXPOSURE TO INTERNAL RADIOACTIVE CONTAMINATION, PERSONNEL ROUTINELY SUBMIT BIOASSAY SAMPLES FOR ANALYSIS. SAMPLING FREQUENCY IS DETERMINED BY THE SOLUBILITY CLASS OF THE MATERIAL IN THE PROCESS, AS WELL AS THE

PAGE 5

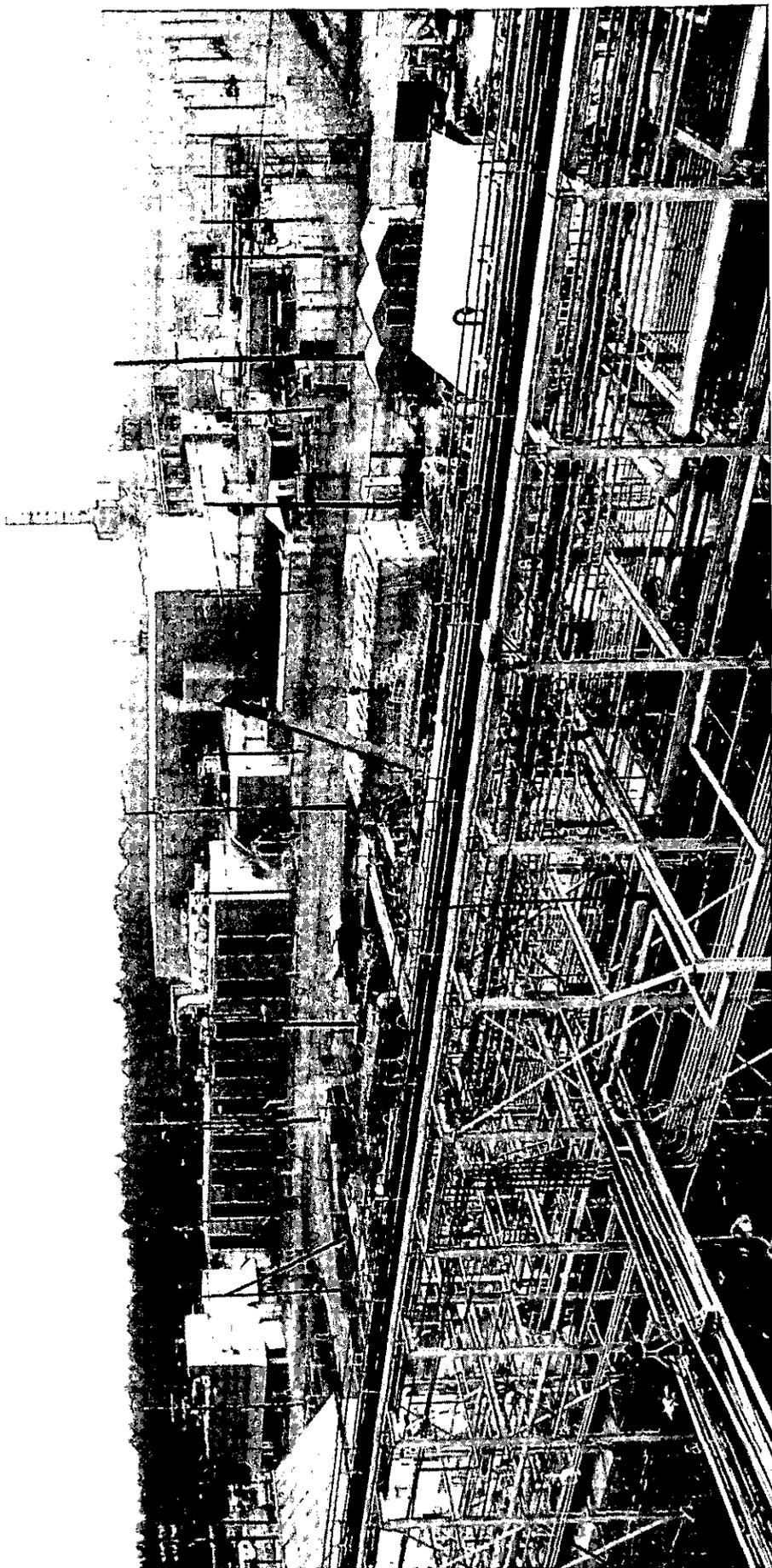
TYPE OF WORK BEING PERFORMED. SAMPLING FREQUENCIES RANGE FROM MONTHLY TO ANNUALLY, AS WELL AS IMMEDIATELY POST ANY RADIOLOGICAL INCIDENT. PERSONNEL ALSO RECEIVE AN ANNUAL LUNG COUNT FOR RADIONUCLIDE DEPOSITION. (EXPLAIN CONFIRMED ASSIMILATION.)

SLIDE 12 - SUMMARY

TO DATE, EXTERNAL DOSES TO PERSONNEL HAVE AVERAGED 10 TO 20 MREM PER MONTH. THERE HAVE BEEN NO CONFIRMED ASSIMILATIONS OF URANIUM BY PERSONNEL. ENVIRONMENTAL RELEASES FROM THE FACILITY HAVE BEEN ESSENTIALLY ZERO.

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WESTINGHOUSE
SAVANNAH RIVER COMPANY**



STAFFING, TRAINING, AND PROCEDURES

STAFFING

- SEVEN PROFESSIONAL/SUPERVISORY
- TWENTY TWO TECHNICIANS

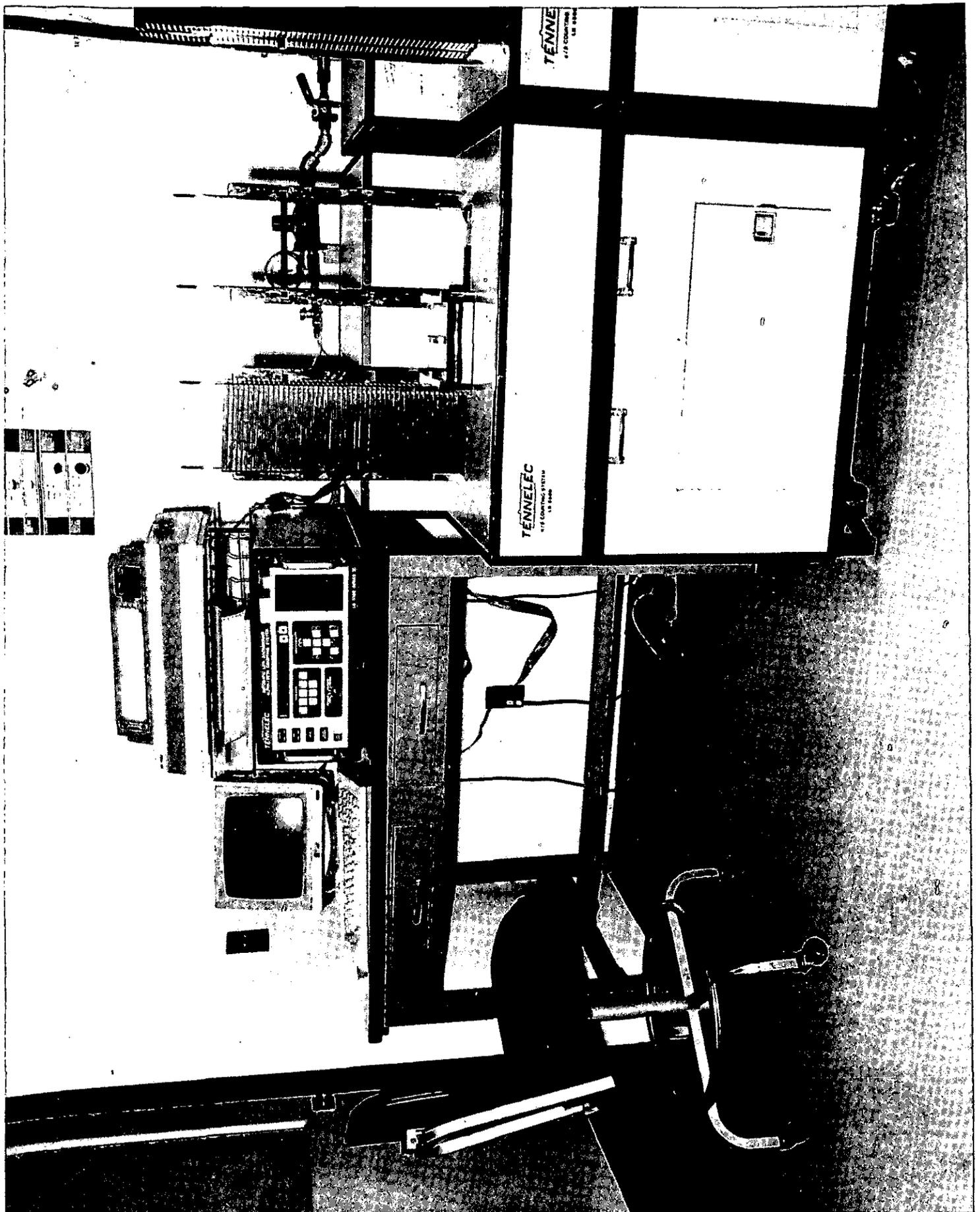
TRAINING

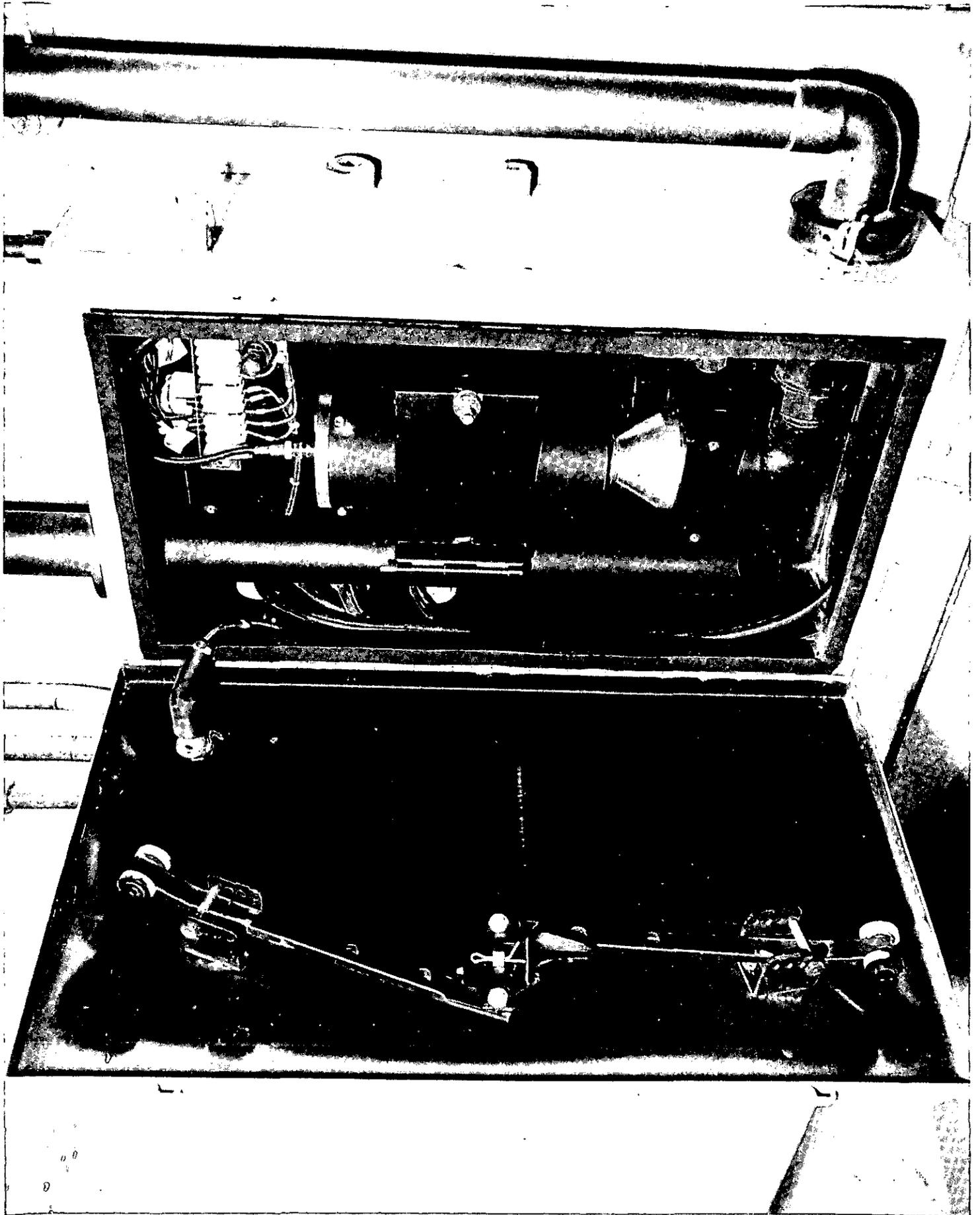
- SIX HUNDRED PRODUCTION PERSONNEL
- FIFTY HOURS TRAINING

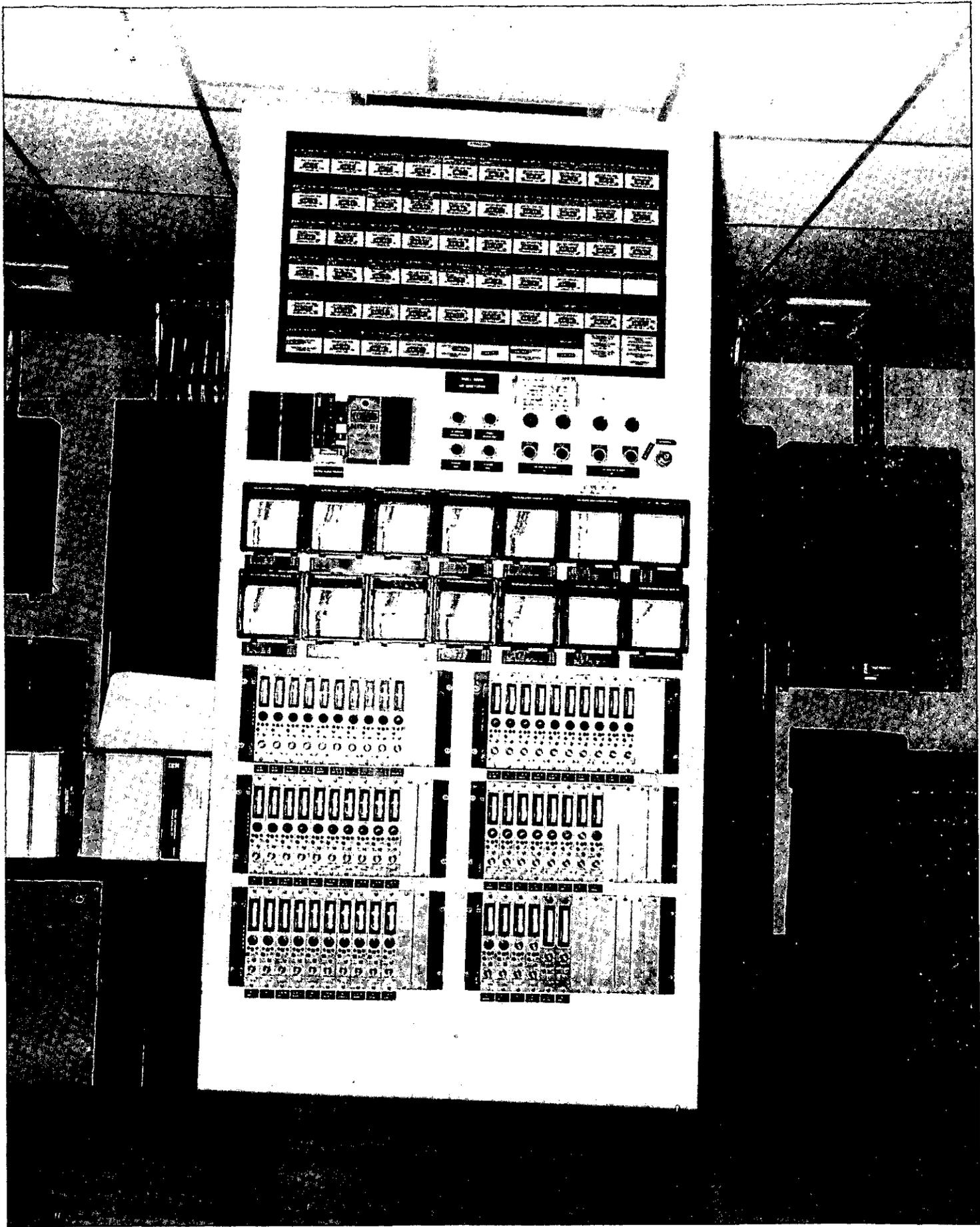
PROCEDURES

- REVIEWED APPROXIMATELY ONE THOUSAND OPERATING PROCEDURES

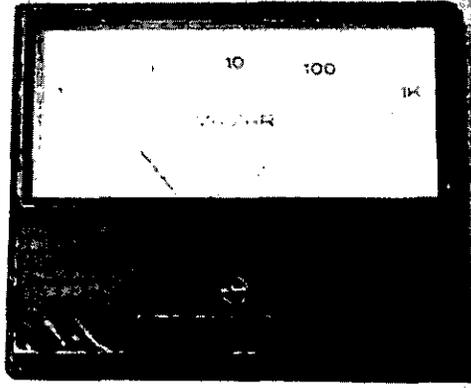








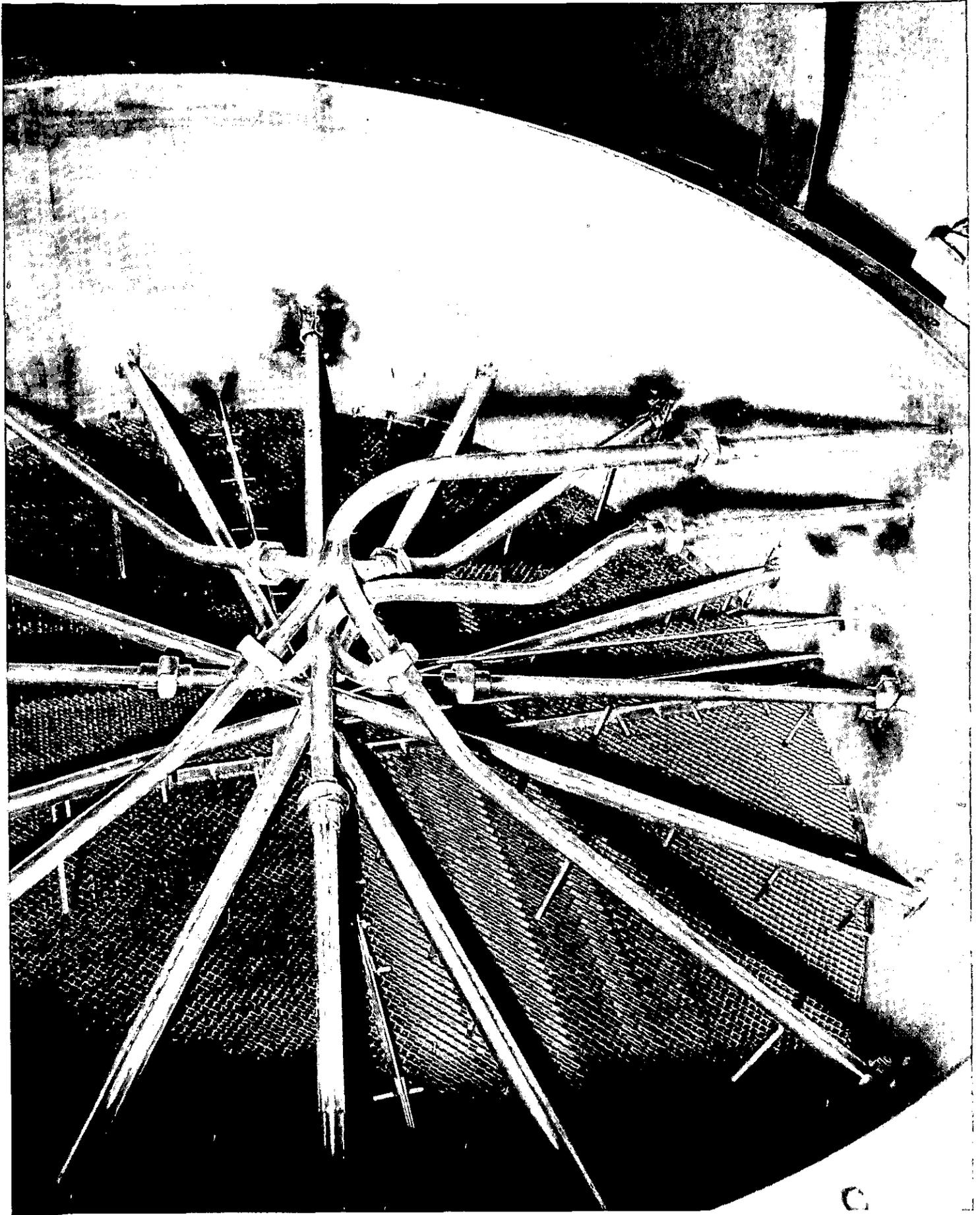
NUCLEAR MEASUREMENTS
CORPORATION
INDIANAPOLIS, IN
GAMMA RADIATION
MODEL GA-C

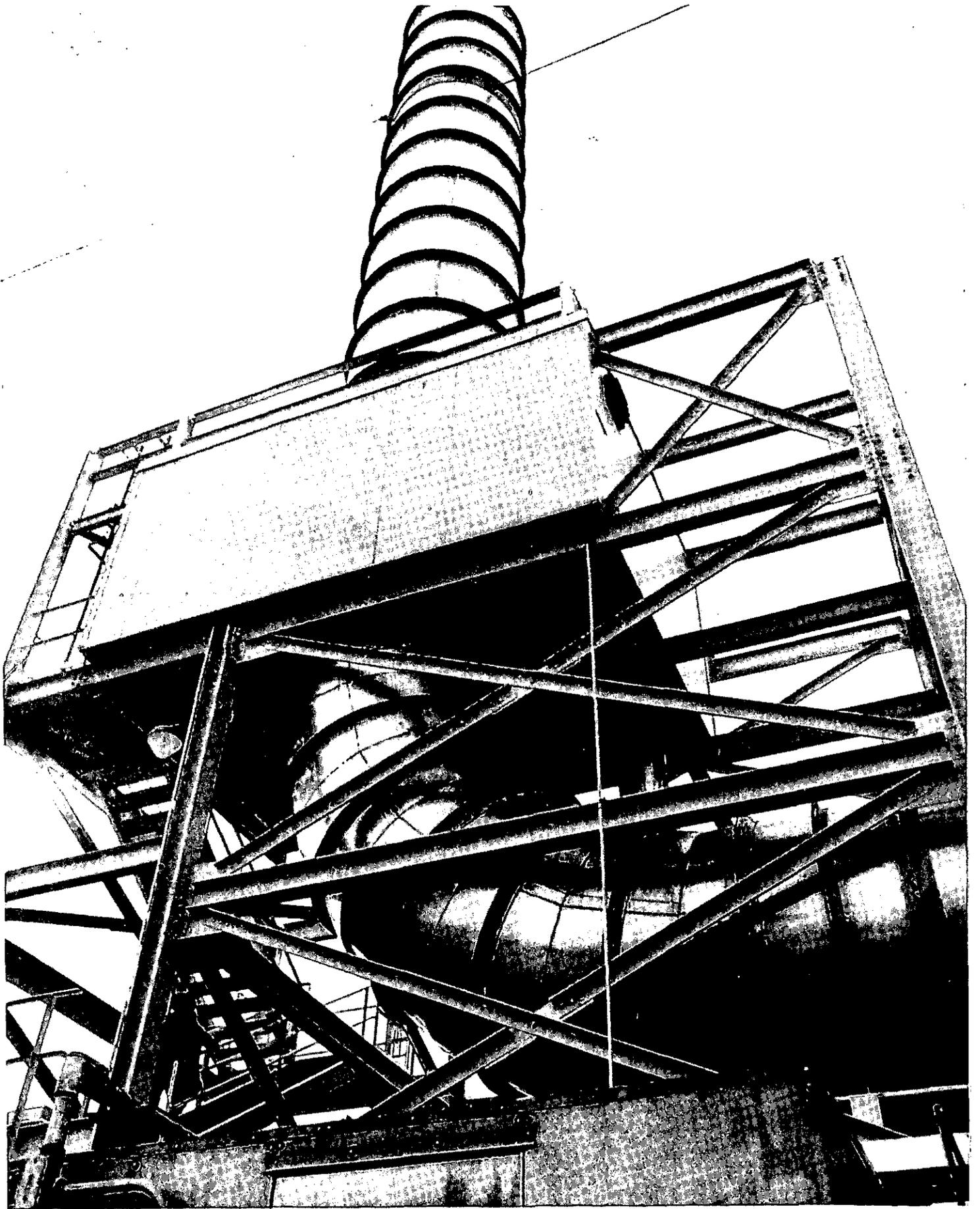


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BIOASSAY PROGRAM

- **FREQUENCY OF SAMPLE COLLECTION IS CLASS AND JOB TASK DEPENDENT**
- **ANNUAL LUNG COUNT**
- **INCIDENTS REQUIRE SPECIAL SAMPLES**

SUMMARY

- **HEALTH PHYSICS PROGRAM SOUND**
- **LOW EXTERNAL PERSONNEL DOSES**
- **MINOR CONTAMINATION CASES**
- **NO PERSONNEL ASSIMILATIONS**
- **NO ENVIRONMENTAL RELEASES**

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6. Type of Document ("x" one)

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b. Conference paper: Name of conference (no abbreviations)

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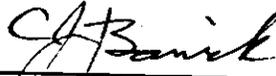
May 9, 1989

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I. DETAILS OF REQUEST FOR RELEASE

WSRC-RP-89-185, "A HEALTH PHYSICS PROGRAM FOR THE STARTUP OF AN ENRICHED URANIUM NAVAL FUEL FACILITY AT THE SAVANNAH RIVER SITE," By C. D. Strain.

A paper proposed for presentation at the meeting at the Health Physics Society Annual Meeting in Albuquerque, NM on June 25-29, 1989.

Technical questions pertaining to the contents of the document should be addressed to the author(s) or

G. Hayes, Manager
Health Protection
Savannah River Site

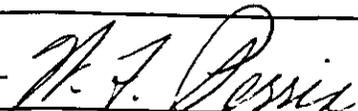
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Date 5-25-89

SAVANNAH RIVER DOCUMENT APPROVAL SHEET

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AUTHOR(S) C. D. Strain PHONE NO. 557-8362
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