In 40-215

S.F. APPLIANCES LIMITED

613 W. Washington Street
MORRIS, Illinois, 60450.
Telephone: 815 942 0864
Telex: 723442
A member of the VALOR GROUP

April 23, 1980

Nathan Bassin
License Management Branch
Division of Fuel Cycle & Material Safety
U.S. N. R. C.
Washington, D.C. 20555

16153

Ref. License # STB_258

Gentlemen:

This is to reply to your letter of June 28, 1979, and to give additional information which you have requested to supplement our timely application for license renewal.

You have asked for information on six points which are covered in the attachments.

We trust these attachments answer your questions. If you have any further inquiries please contact us.

Sincerely,

S. F. APPLIANCES LIMITED

K.G. Calaway

K.G. Calaway
Vice President

KGC:bj
Encl. (3)

FEE EXEMPT

R 59

S & F APPLIANCES

LICENSE # STB-258 RENEWAL

SUPPLEMENTARY INFORMATION

16153

ITEM #1: TRAINING AND EXPERIENCE

1. Mr. Ken Calaway

B.A., University of Akron, Ohio 1928-1932

Formal course work - including mathematics (c - basic to the use and measurement of radioactivity)

M.A. in Management, University of Akron, Ohio 1933-1934

Akron Lamp Manufacturing 1934-1942

On the job training (e - principles and practices of protection against the chemical toxicity of $Th(NO_3)_4$ source material.

Lota served as Supervisor 1942-1946

Sun Flame Appliance Co., Chief Engineer

On the job training in all phases of mantle production including:

(a) Principles and practices of radiation protection necessary for $Th(NO_3)_4$

(b) Radioactivity measurements, standardization, and monitoring instruments and techniques

(c) Biological effects of radiation

(d) Principles and practices of protection against the chemical toxicity of $Th(NO_3)_4$.

Worked with Lindsey Chemical Works problems in the 1950's . Worked with and was taught by the Radiation Safety Engineer - R.K. Anderson - from 1952-1972. Specifically O.T.J. training with

(a) Radioactivity measurements and monitoring techniques

(b) Mathematics and calculations basic to the use and amount of radioactivity.

Sun Flame Appliance Co. - Executive Vice President 1972-1980

In administrative charge of Radiation Safety. Hired consultants, read reports, made appropriate improvements in the plant.

2. Mrs. Ada Fannin

O.T.J. training working with $Th(NO_3)_4$

1955-1980 with Mr. Calaway

Signed up for two-day intensive review course with Health Physics Associates Ltd.

ITEM #2: DESCRIPTION OF FACILITIES AND EQUIPMENT

Let us preface our description of the plant with the comment that in manufacturing of gas lamp mantles the material is in a totally oxidized and relatively diffused form at all times. This then leads to a situation where chemical rapid oxidation is impossible, criticality is impossible, the possibility of terrorist seizure unthinkably remote, and the number of entire insoluble ThO_2 containing lamp mantles to be eaten to achieve a permissible body burden of natural thorium is extremely large. Consequently the description of the plant

which we included was thought to be adequate to insure that health was protected and that danger to life and property was minimal. To expand on our description as suggested in Guide 10.4 Item 11 Part a --

SITE: THE SURROUNDING AREA

The plant is bordered on the south and west by a quater mile strip of unoccupied river bottom land. Beyond the river to the south is a concrete plant and a Department of Public Works vehicle storage area; in other words a low occupancy industrial area. To the west is farm land. To the north is an industrial building occupied occasionally by a plastic molding operation. Beyond is several yards of creek bed followed by a residential area. To the east is mixed business and residential, commencing at greater than 100 yards from the plant.

SITE: STORAGE

There are three items which are stored.

(1) Raw $Th(NO_3)_4$ in 200 pound drums

(2) Package mantles for shipment

(3) Waste (largely trimming from mantles in process).

The raw $Th(NO_3)_4$ is received in cardboard drums. The gamma dose rate on contact approximates 5 mR/hr. In large groups they still, due to self shielding, produce a dose rate near by of approximately 5 mR/hr. There is no criticality or auto combustion problem. Shielding is unnecessary since the access to stored stock is necessary only occasionally to replenish solutions. The storage of this

material is in a remote locked basement area. In so far as security goes this is the only area in the plant which is restricted. It is locked and access to the key for this area is controlled by the Vice President's office.

The mantles awaiting shipment are principally stored on the first floor with overflow storage in the basement and the second floor areas. There is no criticality problem, and the principle hazard in a fire would be the fire itself since the active material inside the cardboard boxes is chemically in a state of complete oxidation. Dose rates near bulk quantities of mantles produced in plant are much lower than near cartons shipped in from Malta awaiting re-shipment. (Per survey of March 1980 shown on attached floor plans.)

The flow of material through the plant is

(a) In 200 # drums.

(b) Stored in locked secure areas. Chemical storage in basement.

(c) Taken to Solution Room where $Th(NO_3)_4$ is dissolved in H_2O in a single 40 gallon stainless tub, covered and mechanically agitated. Eighteen pounds of pre-knitted webbing (knitted in basement area) is soaked for one hour and excess liquid removed by spinning for three minutes. Recovered solution drains back into tub for reuse. Webbing is air dried in Solution Room and washed and dried several times. (See Sup-

plement 9.) Drying racks are ventilated in drying "ovens".

(d) Impregnated webbing is cut to size and has ends sewn in second floor Sewing Room.

(e) Some mantles are pre-burned and strengthened by dipping in lacquer solution in Penthouse. This operation is done under an exhaust hood venting out the roof of the building. Trimming from the sewing and the burn off and mounting operations are stored in the subbasement Hot Storage area. Please note that in general this is the most concentrated radioactivity of the waste materials, loosely packed rayon fabric scraps impregnated with some ThO_2 or $Th(NO_3)_4$.

(f) Packaging of mantles is done either in the Penthouse or the Sewing Room on the second floor.

(g) Preshipment and storage of packaged mantles is primarily on the main or first floor. Some storage is done in the basement or on the second floor.

Note the layout of the plant in cross section in figure 6, and the floor plans in figures 1 to 5.

SITE: GENERAL SAFETY

Protective clothing issued to the person doing the solutioning is rubber gloves and rubber apron to be used when handling solutioned webbing. Personal air samplers and pocket chirpers etc. are not deemed necessary. Waste receptacles

are standard waste baskets. No auxiliary shielding is needed since most radiation fields in the plant are below 2 mR/hr. and none to our knowledge have ever exceeded 10 mR/hr. Fire fighting systems meet Illinois state code and insurance requirement, and no additional fire hazards are posed by the source material. There are no vacuum systems, and safety showers other than the change areas are unnecessary. Other safety considerations are that the women doing the mantle sewing wear aprons and shoes which are changed and left at the plant.

SITE: VENTILATION

The air flow through the plant is shown in the cross section shown in figure 6. Note: the incoming air is supplied by windows, doors, and leakage. The most populated work area is the second floor sewing room where usually five or six women will be working. The windows here are open for incoming fresh air.

There are four primary exhaust squirrel cage vent blowers--the penthouse burn off machine blower, the solutioning room drying cabinet blower, the furnace chimney in the basement, and the supplementary exhaust blower in the basement.

The air flow is in at the second floor windows separating part to the Penthouse and out through the hood, and part down to the first floor--sweeping past the storage the air flow goes down the open stair to the basement through the

Knitting Room (generally unoccupied) through the grill to the subbasement where it flows past the Hot Storage and out the furnace and supplementary blowers through stacks venting above the third floor.

The performance criterion for the blowers in the system is that they operate.

Specific containment scrubbers and effluent monitoring are deemed unnecessary.

SITE: RESPIRATORY PROTECTION

The sweep of air pattern from highly occupied areas through lower level occupancy and storage areas where the thoron is predominately generated finally through the hot waste areas and then out the 50' stack provides working areas with levels of airborne radioactivity which are below permissible levels. This being the case we have not a need for respiratory equipment.

SITE: RADIATION DETECTION INSTRUMENTS USED

The main radiation protection program rests on consulting surveys. Health Physics Associates comes in four times a year for a complete survey. They use Victoreen 440 Air Ion Chambers for gamma dose rates, Eberline PAC 4-G for surface alpha surveys, Staplex Hi Vol. air sampler with Whatman #41 Media and surface wipes for removable alpha contamination. In between major surveys the plant is checked by weekly surveys with our own alpha, beta, gamma

sensitive Geiger Counter.

This GMSM is calibrated twice annually by Health Physics Associates Ltd., 3304 Commercial Avenue, Northbrook, Illinois 60062 (312/564-3330 or 273-2525). Surface wipes taken in plant by our personnel are counted by Health Physics Associates and results returned to us. Their calibration procedures have been filed with the Nuclear Regulatory Commission.

SITE: PERSONNEL MONITORING

Our personnel, including clerical, are monitored by monthly film badges from R.S. Landauer, Jr. and Company. The badges are worn to indicate whole body exposure. Records are kept on file for your inspection. Our worst case exposure has been less than 1/5 M.P.D. over a 13 year period of monitoring.

ITEM #3: SURVEY PROGRAM

Our survey program with our consultants has been increased to 2 times annually, with the inauguration of a weekly systematic check with our in plant G.M.S.M. The records of these weekly surveys will be maintained for your inspection. Guide paragraph 12(a) which you referenced requests information on fire safety.

12(a) All flamable agents are stored in a locked fireproof room with explosive proof light switches and fixtures. Inflamable material drums are grounded for safety. Radioactive material is in the form of completely oxidized $Th(NO_3)_4$ which is totally non flamable.

ITEM #4

You request information which is asked for in Guide 10.4 Paragraph 12(b). This paragraph asks for a copy of safety procedures (see enclosed safety rules issued to all employees and posted on bulletin board). In this company the only people to be notified are the foreman, Mrs. Fannin, and the Vice President, Mr. Calaway. Mr. Calaway has a plant extension phone at home.

The emergency procedures are--

Fire--notification by phone to second and third floors and by voice to first floor. The third floor has automatic sprinkler system. Employees have been instructed to leave by certain exits (the nearest) in case of fire.

Spills are not a major hazard since our most concentrated source $Th(NO_3)_4$ is a diffuse material requiring over 6Kg to make up a millicurie of Th^{232}. Should a spill occur it is not an emergency but an unfortunate accident. The spill is cleaned up and the area scrubbed with "Spartan" cleaning compound for radioactive materials. Supervision of the maximum conceivable accident can be handled by the supervisor on duty.

ITEM #5: SPECIFIC PROCEDURES FOR TRAINING PERSONNEL

All employees are to be given a one day intensive training course on Radiation Safety. New employees are to be trained with a "programmed learning" text and by the Supervisor at

the time of employment and retrained by Health Physics Associates at an annual training session. See attached course outline, "Personnel Training".

ITEM #6: WASTE DISPOSAL PROGRAM

The waste produced in the production of gas mantles consists of clippings from the sewing of thorium impregnated webbing into mantles, wastes from spoiled mantles, and test samples from burn and shock tests. We have no filters, pyrophoric fires, molding, or grinding wastes etc.

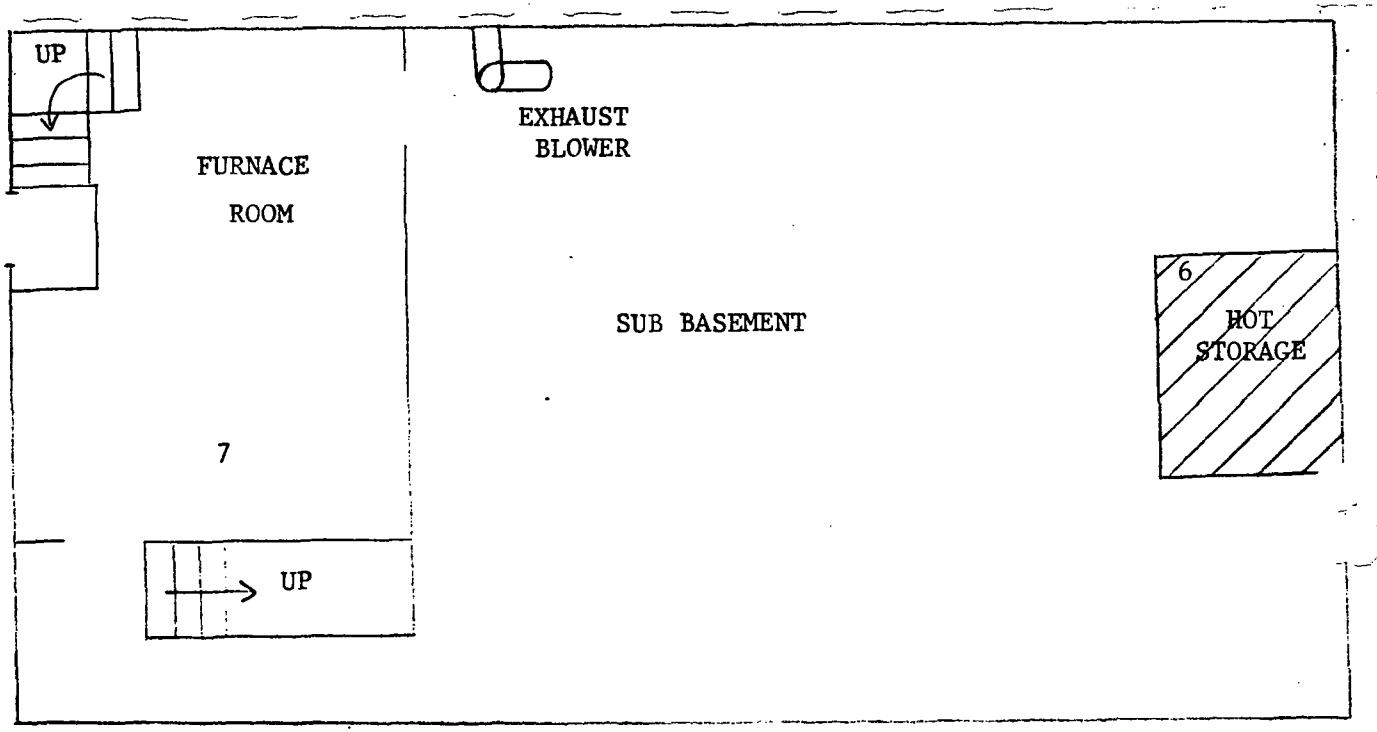
Solid wastes including contaminated equipment are packaged in 55 gallon drums and disposed of through Chemical Nuclear and buried at Barnwell, South Carolina.

Airborne wastes are totally natural thoron gas and daughter products. These products are exhausted with the ventilation waste air over the roof level of the third floor penthouse.

Liquid wastes consist of wash tank drainage to sanitary sewer system. Such waste is sampled periodically to establish radioactivity levels. Most recent analysis attached.

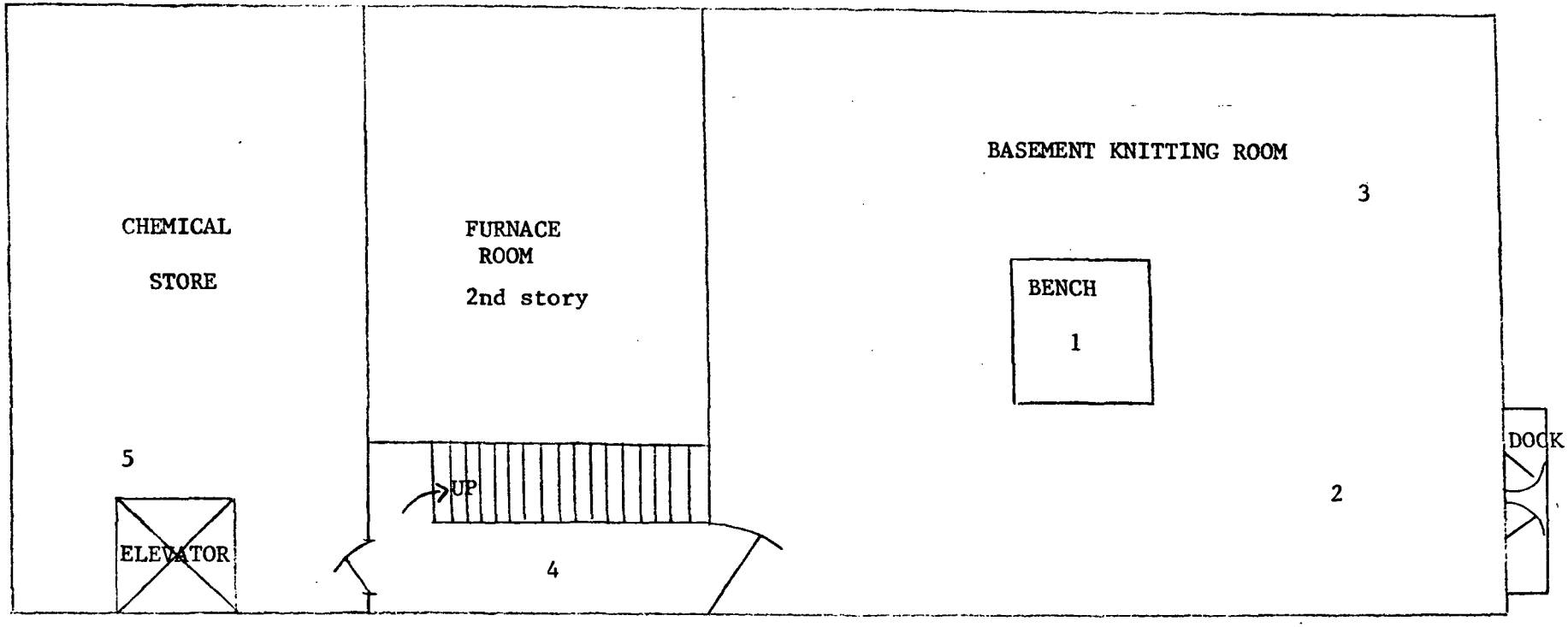
SUB BASEMENT

PLAN



LOCATION	GROSS GAMMA mR/hr	TOTAL SURFACE ALPHA uCi 50 cm^2 in cts/min	REMOVABLE ALPHA d/min/100 cm^2
6. Hot waste area floor	0.7	15,000	1571 $\bar{/}$.000 7 uCi 7
7. Furnace room floor	1.0	350	31

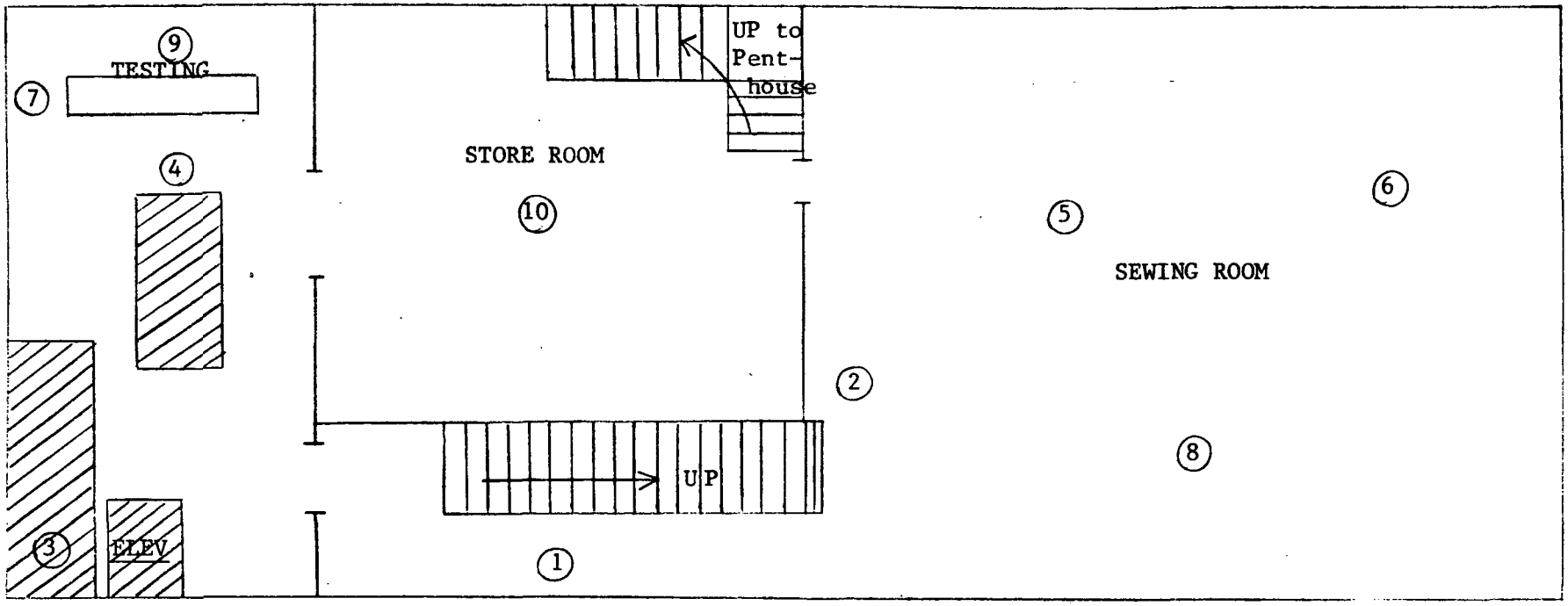
FIGURE 1



BASEMENT PLAN

LOCATION	GROSS GAMMA mR/hr	TOTAL ALPHA 50 cm^2 in cts/min	REMOVABLE ALPHA d/min/100 cm^2
1. Bench	0.7	380	19
2. Floor	0.8	400	17
3. Boxes	1.0	320	39
4. Hall	0.2	430	12
5. Chemical storage	0.15	450	102

FIGURE 2

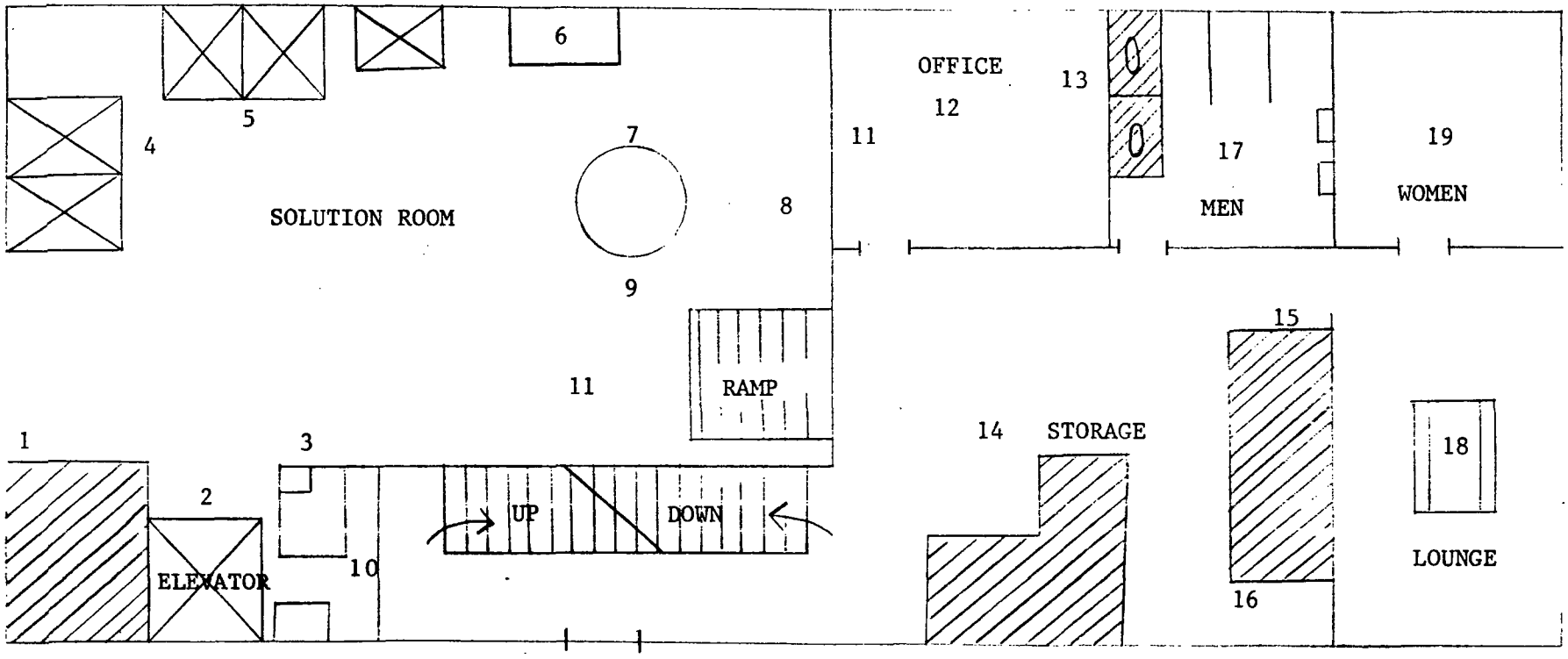


SECOND FLOOR

TABLE III

LOCATION	GROSS GAMMA mR/hr	SURFACE ALPHA 50 cm^2 cts/min	REMOVABLE ALPHA CONTAMINATION d/min/100 cm^2
1. Hall	0.4	450	12
2. Cooler	0.4	300	-
3. Storage boxes	0.15	300	-
4. Storage boxes	1.5	400	377
5. Forming table	1.3	400	12
6. Pressing table	0.3	350	15
7. Bench	1.0	400	m
8. Floor	1.0	410	19
9. Testing bench	0.6	420	-
10. Storage room	1.3	400	156

FIGURE 3



FIRST FLOOR PLAN

TABLE I

SOLUTION ROOM

LOCATION	GROSS GAMMA in mR/hr	TOTAL SURFACE alpha/ct/min/ 50 cm^2	REMOVABLE ALPHA d/min/ 100 cm^2
1. Box storage	.2	8,000	M
2. Elevator door	.3	1,500	52
3. Box storage	.2	7,000	87
4. Oven door	.3	1,300	14
5. Oven door	.5	2,500	69
6. Bench top	.7	550	242
7. Solution drum	1.4	16K	352
8. Rack area	2.5	35K	747
9. Solution tank	1.0	550	52
10. Bench top	.4	350	193
11. Floor	.7		87

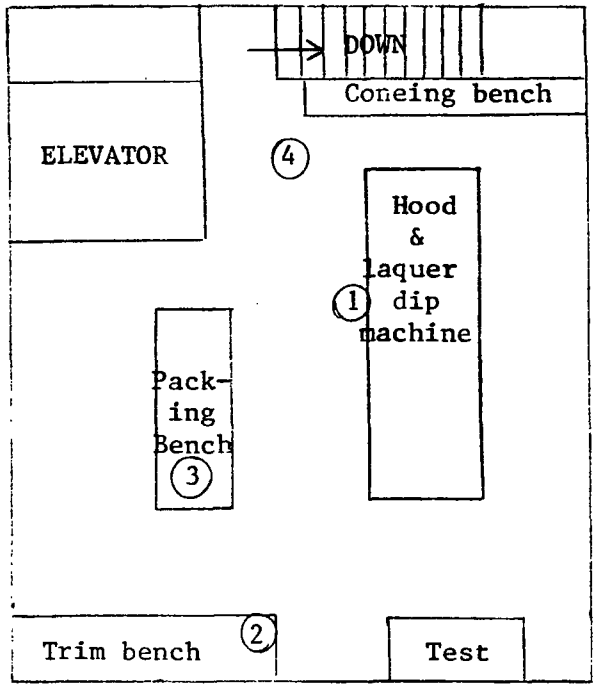
TABLE II

OFFICE AND LOUNGE AREAS

LOCATION	GROSS GAMMA in mR/hr	TOTAL SURFACE alpha/50 cm^2 cts/min	REMOVABLE ALPHA d/min/ 100 cm^2
11. Desk	0.5	360	M
12. Desk	0.6	320	M
13. Floor	0.5	310	52
14. Storage area	1.0	1100	19
15. Hall	0.9	1100	33
16. Storage area boxes	.5	400	173
17. Men's room floor	.7	400	21
18. Lounge table	.5	300	M
19. Ladies' room floor	.6	340	31

FIGURE 4

PENTHOUSE PLAN



LOCATION	GROSS GAMMA in mR/hr	TOTAL SURFACE ALPHA per 50 cm^2 in cts/min	REMOVABLE ALPHA d/min/100 cm^2
1. Hardening machine	0.20	2,000	83
2. Trim bench	0.25	400	-
3. Packing bench	0.40	460	40
4. Floor	0.55	470	117

FIGURE 5

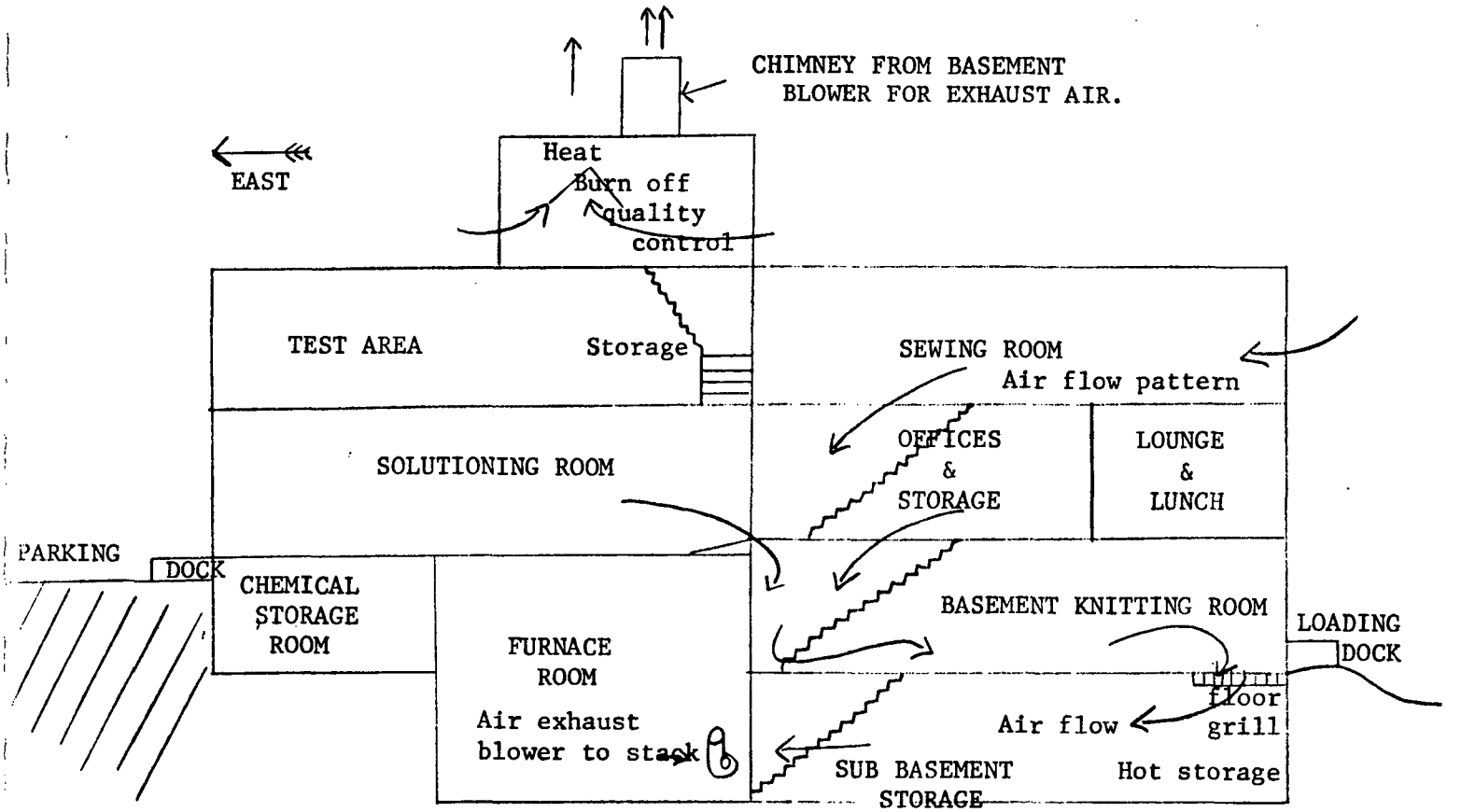

CHIMNEY FROM BASEMENT
BLOWER FOR EXHAUST AIR.
EAST
Heat
Burn off
quality
control
TEST AREA
Storage
SEWING ROOM
Air flow pattern
OFFICES
&
STORAGE
LOUNGE
&
LUNCH
SOLUTIONING ROOM
PARKING
DOCK
CHEMICAL
STORAGE
ROOM
FURNACE
ROOM
Air exhaust
blower to stack
BASEMENT KNITTING ROOM
LOADING
DOCK
floor
grill
Air flow
SUB BASEMENT
STORAGE
Hot storage

FIGURE 6

HEALTH PHYSICS ASSOCIATES LTD. CONSULTANTS IN RADIATION SAFETY

3304 COMMERCIAL AVENUE / NORTHBROOK, IL 60062 / PHONES: 312/564-3330 / CHICAGO #: 273-2525

REPORT OF WASTE WATER

CLIENT: S. & F. Appliance
613 W. Washington
Morris, Illinois 60450

ATTN: Mr. Ken Callaway

TYPE OF ANALYSIS: Determination of Thorium -232 in water samples

SAMPLES RECEIVED: March 5, 1979

SAMPLE IDENTIFICATION	TOTAL VOLUME (ml)	pCi/l
1st Wash	850	400 ± 50
2nd Wash	900	870 ± 80
3rd Wash	925	540 ± 50

Submitted by:

William B. Rivkin
Laboratory Manager

While training is a continuing process, it is convenient to recognize three distinct phases of training: Initial, on-the-job, and periodic. Each is decribed below. This division into these phases should not imply that there should be any relaxation of the requirement to adopt improved methods for controlling radiation exposure as they are developed. As field conditions change, the user, supervisor, and RPS *shall* make the necessary adjustments to equipment, operating procedures, and safety procedures to accomplish the assigned tasks and to continue the protection from unnecessary radiation exposures.

INITIAL TRAINING

Initial training is that training given to all prospective users *before* they are assigne responsibilities. The topics that *should* be included in initial training are:

1. FUNDAMENTALS OF RADIATION AND RADIATION PROTECTION
   - A. Structure of Matter
     1. Elements, molecules, compounds
     2. The atom
        - a. Structure of the atom
        - b. Isotopes and nuclides
   - B. Radioactivity and Radiation
     1. Natural (Background) radiation and man-made radiation
     2. Nuclear reactions
        - a. Nuclear fission
          - (1) Chain reactions
          - (2) Fission products
        - b. Activation of nuclides
     3. Radioactive decay
        - a. Types of decay
        - b. Activity - the curie
        - c. Fundamental decay law
     4. Radiation producing devices
   - C. Nature and Consequesences of Radiation Exposure
     1. Biological effects of radiation
        - a. Types of effects
          - (1) Somatic
          - (2) Genetic
        - b. Radiosensitivity
     2. Dose-effect relationships
        - a. Classification of doses
        - b. Effects of acute irradiation dose
        - c. Chronic doses and late effects
     3. Radiation quantities and units
        - a. Exposure-roentgen
        - b. Absorbed dose-rad
        - c. Dose equivalent-rem
        - d. Quality factor
     4. Nature of radiation health problem
        - a. External radiation
        - b. Internal radiation contamination
     5. Physical examinations
        - a. Preoperational base-line data
        - b. Exposure evaluations
   - D. Radiation Hazard in Proper Perspective
     1. Philosophy of radiation benefits and risks
     2. Personnel exposures
        - a. Background
        - b. Man-made sources
          - (1) Occupational exposure
          - (2) Medical exposure

3. Radiation risk
4. Maximum permissible doses for occupational workers
   a. Quarterly and annual dose limits
   b. Lifetime dose limits

E. Control of Hazards from External Radiation Sources
1. Time as a factor in radiation protection
2. Distance as a factor in radiation protection
3. Radiation attenuation and shielding
   a. Attenuation of alpha and beta particles
   b. Attenuation of electromagnetic radiation attenuation
      (1) Linear attenuation coefficient
      (2) Half-value layers, tenth-value layers
      (3) Reduction factors

F. Control of Hazards from Internal Radiation Sources
1. Control of contamination
   a. Modes of entry into the body: Ingestion, Inhalation, Absorption
   b. Leak-testing of sources
2. Maximum permissible concentrations

G. Measurement of Radiation
1. Basic concepts of radiation dosimetry
   a. Dose
   b. Dose rate
2. Personal monitoring devices
   a. Pocket dosimeters
   b. Badges: Film and TLD
3. Survey meters
   a. Types
      (1) Ion chamber
      (2) Geiger counter
      (3) Solid state detectors
   b. Basic characteristics and limitations
4. Instrument calibration
5. Source standardization calculation
   a. Frequency of calibration
   b. Error analysis

2. FUNDAMENTALS OF H I P PROCESS
A. Introduction
B. Elements of procedures
1. Characteristics of radiation sources
2. Geometric principles
3. The specimen

C. Manufacturing Techniques
1. Calculations
2. Arrangements

3. LICENSING AND REGULATIONS
A. Requirements of Pertinent Federal and State Regulatory Agencies
1. Nuclear Regulatory Commission
2. Agreement states
3. Other bodies (e.g. port authorities, cities, countries, etc.)

B. License for Using Radionuclide Sources
1. Requirements for a specific license to use source materials
   a. Conditions and control
   b. General considerations for protection against radiation
   c. Precautionary procedures and records required
   d. Qualifications and training of personnel
   e. Organizational structure
   f. Operating procedures
   g. Internal inspection system
   h. Record systems

C. Transportation of Sources
   1. Federal and State regulations
   2. International Atomic Energy Agency recommendations

4. RADIATION EMERGENCY PROCEDURES
   A. Types of Emergencies
      1. Personnel overexposure
      2. Equipment malfunctions
      3. Lost sources
      4. Exposures of non-controlled personnel
   B. Emergency Plans and Responses
   C. Reports and Follow-up
   D. Case Histories

5. SUGGESTED LABORATORY EXERCISES
   1. Time and distance factors in radiation protection (inverse square law; time, distance, dose, and dose-rate relationships)
   2. Source calibration
   3. Survey meter calibration
   4. Radiation attenuation
   5. Radiation scattering
   6. Exposure techniques
   7. Leak testing sealed sources

Approximately ____hours of classroom and laboratory time *should* be required of the trainee during this training so that time for study is available outside of the classroom. To become a user, the trainee *shall* be required to demonstrate knowledge of the training material on a comprehensive written examination. Within the company files there *shall* be retained information on initial training examinations that includes:

1. The names of the individuals who took the examination, the date they took it, and the grades scored on the examination.

2. The individual(s) responsible for administering the training course and examination.

3. A copy of the examination given (not necessarily the individual's test papers).

ON-THE-JOB TRAINING

In addition to completing "initial training", and *before* being given independent responsibilities, users *shall* be given instruction in the following topics, as to usage and radiation safety,

A. Introduction-Purpose of On-The-Job training
B. Company Organization
   1. Levels of authority
   2. Degrees of responsibility
C. Operating Procedures
   1. Equipment operating procedures
   2. Safety equipment operating procedures
D. Safety Procedures
   1. Equipment
   2. Personnel monitoring
   3. Survey procedures
   4. Area layout and posting
E. Emergency Procedures
   1. Overexposures
   2. Equipment malfunctions
   3. Source damage
   4. Lost sources
F. Records Relating to Radiation Protection Program
   1. Personnel dose records
   2. Receiving and shipping records
   3. Quarterly inventory
   4. Decay curves
   5. Source utilization log
   6. Leak test records
   7. Source disposal records
   8. Survey meter calibrations
   9. Area layout

The amount of time devoted to on-the-job training will be determined by the complexity of the company's programs and the learning rate. Special attention *shall not* be given to users until they have demonstrated that they can perform effectively and safely under actual field conditions. Examination of the personnel to assure that the user has sufficient knowledge of operating and safety procedures shall include a written examination as well as direct observation of the user under actual working conditions. "Retraining" *shall* be required where deficiencies are ascertained either from the examination results or from observation. Satisfactory completion of the on-the-job training and examination *shall* be documented.

S & F APPLIANCES

INSTRUCTIONS TO PERSONNEL

1. All personnel are to be apprised of the basic principles of Radiation Safety prior to doing any work at S & F.

2. "Controlled Areas" are to be occupied only by Controlled Personnel.

3. Controlled Personnel are to wear film badges, aprons and change their shoes when entering controlled areas.

4. Smoking, eating, drinking or application of makeup is not allowed in controlled areas.

5. Hands are to be washed thoroughly when leaving a controlled area.

6. Smoking is allowed only in lunchroom and washrooms.

7. Film badges are to be left in lead box provided for them when leaving plant.

8. Contact Mrs. Fanning for clarification of any instruction that is not perfectly clear or that has been omitted.