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S.F. APPLIANCES LIMITED
105 STATE STREET, • PATERSON 17, NEW JERSEY, U.S.A.
Telephone: ARmory 1-1658
Address all correspondence to
EXPORT and EXECUTIVE OFFICE
50 Broad Street, New York 4,
New York, U.S.A.
Phone: WHitehall 3-8241-2-3-4
Cables: SUFLACO

May 16, 1961

Atomic Energy Commission,
Washington 25, D. C.

Attention: Mr. Doulos
Div. of Licensing and
Regulation

Re: Source Material License
D-170

Gentlemen:

We hereby apply for renewal of our Source Material License D-170, to receive, possess and use Thorium Nitrate.

Thorium Nitrate is used in the manufacture of Incandescent Mantles at our plant at 613 W. Washington Ave. Morris, Illinois. Completed Incandescent Mantles are stored at our warehouse at 105 State St. Paterson, N. J. in small quantities never exceeding 50,000 mantles.

Thorium Nitrate is received in 120 lb drums and the maximum quantity held at Morris is 360 lbs at any one time.

A survey of the plant was made in April 1958 and although the original was sent to you at that time we have attached a copy for your convenience. We also attach a copy of a letter referring to an inspection made in April 1960.

We have followed the following proceedures to protect our employees:

Signs have been posted reading CAUTION
RADIOACTIVE MATERIAL
in positions plainly visable in the impregnation room where the Thorium Nitrate is used.

The tubs of Thorium Nitrate are labled with radioactivity-caution labels.

Personnel have been instructed that radioactive material must not be ingested and therefore must refrain from putting in the mouth:

Cigarettes
Impregnated thread
Any other material containing
Thorium Nitrate

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USAEC
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Division of
Licensing & Regulation
Docket Officer

A-19

(Continued) (19)

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Spillage of Thorium impregnating solution is to be avoided.

Each new employee is advised of the above and signs a statement that she is aware that radioactive material is present in the plant and will take the necessary precautions.

There is no waste in the use of the Thorium.

We trust that is information is sufficient to enable you to issue the renewal of our Source Material License.

Yours very truly,

S. F. APPLIANCES LIMITED

A. Dellmann

Asst. Treas.

AD/hrm

40-215

S. F. Appliances Limited and
S. F. Products Corporation
105 State Street
Paterson 17, New Jersey

Attention: Mr. W. M. Qualey
Assistant Treasurer

Gentlemen:

This refers to the inspection conducted on April 21, 1960, of your activities authorized under AEC Source Material License No. D-170.

There were no items of noncompliance noted as a result of this inspection.

We appreciate the cooperation given the AEC representative.

Very truly yours,

Lyell Johnson, Chief
Licensing Branch
Division of Licensing
and Regulation

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INSPECTION OF S. F. APPLIANCES LTD. MANTLE PLANT AT MORRIS, ILLINOIS FOR COMPLIANCE WITH "STANDARDS FOR PROTECTION AGAINST RADIATION," 10 CFR PART 20

R. S. Landauer, Consultant on Radiation, Graemere Hotel, 3400 W. Washington Blvd., Chicago 34, Illinois

H. E. Kremers, Lindsay Chemical Company, West Chicago, Illinois

April 22, 1958

(1) INTRODUCTION

An inspection of the Morris, Illinois, mantle plant was made on April 11, 1958. At the time of the inspection, the plant was operating normally. Fourteen people were employed at the time of the inspection.

The plant is housed in a three story brick building. Housekeeping was acceptable.

In this plant, the only radioactive material used is thorium nitrate. This is obtained in 200 lb. fiber drums from the Lindsay Chemical Company at West Chicago, Illinois. Recent usage has been on the order of 200 to 500 pounds of thorium nitrate monthly resulting in an average production of about 30,000 mantles weekly (1.5 million mantles yearly).

In determining compliance with 10 CFR Part 20, attention was, therefore, given only to those limits specified for thorium. Determination of compliance was made by measuring gamma radiation levels and air-borne alpha activity levels. Measurements of beta activity were not required since beta emission from natural thorium is small compared to gamma activity, and compliance with maximum permissible gamma radiation levels automatically indicates compliance with beta permissible levels.

Most of the actual measurements were made by Mr. Edward Maryniw, radiation technician for Lindsay Chemical Company.

(2) PROCESS RESUME

The process for making mantles consists essentially of the following steps:

1. Rayon thread is knitted into a continuous open mesh seamless hollow webbing by automatic knitting machines.

2. Lighting solution is prepared by dissolving thorium nitrate in water in the ratio 72 pounds thorium nitrate in 9 gallons water. This is done in a 30-gallon stainless steel tub equipped for mechanical agitation with

a stainless steel propeller type mixer. The tub is covered during mixing.

3. Webbing packed in knit open mesh nylon bags is soaked in the lighting solution in the tub, drained, and excess solution removed by centrifugation in a covered standard laundry type suspended basket centrifuge. The centrifuge liquor is returned to the tub. In handling the wet impregnated webbing, the operator wears rubber gloves and an apron.

4. The impregnated webbing is air dried overnight by draping it on a stainless steel rack.

5. The dried webbing, still on the drying rack, is placed in a closed chamber and partially denitrated by fumigating it with pyridine vapor in a steam atmosphere.

6. The partially denitrated webbing is packed in open mesh nylon bags and denitrated completely by soaking in dilute monoethanolamine-water solution. The excess solution is removed by centrifugation in the laundry centrifuge, and the webbing is washed three times in distilled water. After each wash, the webbing is centrifuged.

7. The denitrated webbing is then dried on racks at room temperature, pressed, and if of a very loose knit, is stiffened with a weak cellulose nitrate lacquer solution.

8. The webbing is spooled, and is then sewed on a sewing machine which automatically gathers, sews, and cuts the webbing into short pieces with one end sewed shut. Rayon thread impregnated with thorium nitrate and denitrated is used for sewing.

9. The cut, sewed pieces are fastened together by the sewing thread, and these are cut apart.

10. The sewed mantles are turned inside out by hand and cardboard forms inserted. They are then pressed in a standard laundry steam heated clothes press.

11. "Hand hardening" solution (a mixture of aluminum nitrate salts and red dye in water) is applied by hand dipping to the open end of "hand" of the mantle.

12. The "hand" end is turned by hand and sewed shut with thread sewn into the hem.

13. The finished mantle is stamped with a trademark and packed in polyethylene bags for shipment.

14. Mantles are shipped in corrugated fiber board cartons containing 5,000 or 10,000 mantles each.

(5) RADIATION LEVELS

(a) GAMMA RADIATION. Measurements gave the data in the following table:

Gamma Radiation Levels

Item	Description	mr/hr
1	200 lb. drum of thorium nitrate, reading at drum surface	28
2	Thorium nitrate impregnating solution, reading at outside surface of tub	10
3	Washed impregnated webbing on drying rack	1
4	Slaing webbing with lanyer	0.06
5	Wet, washed impregnated webbing	0.04-0.05
6	Loose mantles in stack	2
7	Aisle in mantle storeroom	1
8	Mantles packed for shipment:	
	(a) Fiberboard carton approx. 1.5 x 1.5 x 2 Ft. cube containing 5,000 mantles	
	..... at surface	2
	..... at 1 meter from surface	0.1*
	(b) Fiberboard carton approx. 2 x 2 x 2 Ft. cube	
	..... at surface	2
	..... at 1 meter from surface	0.15*
	(c) Stack of 10 cartons of 5,000 mantles each, reading in center of cubical stack	4
9	Hand operations on mantles	
	..... at surface of mantles	2
	..... in working area	0.5
10	Hand of Mrs. Lois Nelson after 2 hours work sorting mantles	0.03**
11	Average in area where impregnation done	0.5

*Background at testing site was 0.04 mr/hr.

**No observable increase in background with hand probe grasped in worker's hand.

The highest average gamma radiation level observed in the general area where sewing and the subsequent hand finishing steps were done in making the mantles was about 0.3 to 0.4 mr/hr. For a 40 hour week, this would indicate a dose of 12-16 mr, or 12 to 16 per cent of the permissible limit of 100 mr per week for total body radiation.

Gamma activity in the area where impregnation is done was about 0.5 mr/hr, and the average occupying time in this area is about 2 hours daily.

The highest gamma activity was at the [illegible] thorium nitrate (20 mr/hr). Regardless of the quantity of material stored, self shielding limits the activity at the surface to about 20 mr/hr. Occupation time for the area in which thorium nitrate is stored is less than 1 hour per week, and this could contribute an additional 2 mr to the [illegible] average exposure of 12 to 16 mr per week.

(b) AIR-BORNE ALPHA [illegible] Observations give the data in the following table. The type of sample is indicated by BZ for breathing zone and GA for general air sample. Data is expressed as the fraction of the maximum permissable dose for natural thorium (XML); for example, XML = 0.02 means 2 per cent of the maximum dose.

AIR [illegible] LEVELS

Library Sample Number	Type Sample	Description	Kel.
2130	BZ	Impregnated webbing [illegible] being taken out of cylinder [illegible] chamber	0
2131	BZ	Webbing being [illegible]	0.02
2132	BZ	Hand wand for [illegible] working with Hanger	0
2133	BZ	Cutting [illegible]	0
2134	BZ	Pressing [illegible]	0
2135	GA	Pressing machine	0
2136	BZ	Centrifuging excess [illegible] solution from impregnated machine	0
2137	GA	Exhaust air from decontamination chambers ..	0.02
2138	BZ	Centrifuge loading with wet impregnated machine	0
2139	BZ	Turning and ironing machine	0
2140	BZ	Centrifuge being loaded with impregnated webbing	0
2141	BZ	Applying hand [illegible] to machine	0
2142	GA	Bathing room	0

(4) COMPLIANCE WITH 10 CFR PART 20.

(a) General requirements. The average individual exposure to gamma radiation is probably less than 25 mr per week, [illegible] exposure dose is 300 mr per week, and this will [illegible] 100 mr per week. Therefore, the gamma ray exposure may not [illegible] exceeds [illegible] indicated by [illegible] a [illegible]

(b) [illegible] well below the [illegible] 2 per cent of the [illegible]

(c) [illegible] data show that radiation levels are [illegible] greater of the [illegible] that is rarely [illegible] be made of [illegible] a [illegible] record of gamma exposure. [illegible] be run for a 13 week period once a year.

(d) Radiation area. Radiation areas may even accessible to personnel in [illegible] 5 mr/hr or more could be received by a major portion of the body of an individual in any one hour, or a dose of 100 mr in any 5 consecutive days. In the plant, it is [illegible] unlikely that such a dose could be obtained, so the plant does not need to be classed as a radiation area, and no posting of such is necessary.

(e) Airborne radioactivity area. Since the levels measured were below [illegible] the plant is not classed as an airborne radioactivity area [illegible]

(f) [illegible] such area, [illegible] must [illegible]

[illegible]

[illegible] Therefore, it [illegible] 200 mr. [illegible] [illegible] the [illegible] and posting [illegible]

[illegible] (g) [illegible] Surveys to [illegible] [illegible] must [illegible] be performed [illegible]

12,000 mantles (at 0.5 gram thorium oxide per mantle) or 29 pounds thorium nitrate. Since the largest package of mantles in the plant contains 10,000 mantles, labeling is not required on containers of mantles. Impregnating solutions will contain more than 29 pounds thorium nitrate when made up, so they must be labeled with the radioactive material caution sign.

(g) Instruction of personnel. Paragraph 20.206 requires that personnel working with, or in an area containing radioactive material, be informed of the occurrence of radioactive material, and they must be instructed in the hazards of excessive exposure to such radioactivity and in precautions to minimize exposures. Such instruction is not done, and it is recommended that employees be informed that (1) they are working with materials containing radioactivity in very low amounts, (2) under normal conditions of operation and on the basis of currently accepted permissable doses of radiation, there is no occupational health hazard, (3) radioactive materials should not be ingested; ingestion may be avoided by refraining from putting in the mouth cigarettes, impregnated thread, or other materials containing thorium, and (4) good housekeeping be maintained, for example, in avoiding spillage of thorium nitrate impregnating solutions.

(h) Waste disposal. There is no direct disposal of thorium nitrate impregnation solution into the sewer. The only disposal of thorium materials into the sewer would be the result of clean up operations, and the quantity of thorium thus released to the sewer was unmeasurable, but would be expected to be considerably less than the maximum limits specified.

(i) Records. Permanent records should be kept of radiation surveys and of personnel monitoring data obtained by film badge surveys for each employee.

(7) SUMMARY

General conditions are good in the plant. Gamma and airborne radioactivity levels are low.

The following minor changes should be done to fully comply with with the regulations:

(a) Make yearly 13 week film badge surveys.

(b) Signs. If more than 290 lbs. thorium nitrate isotopes or used in the webbing impregnation room, the room must be posted with the radioactive material sign.

(c) Labels. Tubs of thorium nitrate impregnating solution must be labeled with radioactivity caution signs. These may be self sticking labels. Labels and signs appropriate for your use may be obtained from Atomic Accessories, Inc., 244-02 Jamaica Avenue, Bellerose 26, New York.

(d) Personnel instruction should be given to present employees and to new employees at the time of hiring. The degree of hazard in working with mantles is small and does not warrant any increase in wage rates.

(e) Records should be kept of surveys made and of personnel monitoring.