7c-232

3M COMPANY

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6 July 1965

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials Branch

Re: License SNM-764 - Additional Information, Application dated 14 April 1965 for Out-of-Plant Air Sampling

Gentlemen:

Included herein are additional information as requested in your letter of 16 June 1965.

1. Reasonable Effort (of 3M Company) to Minimize Discharged Radioactivity

A. Exhaust Ducts

1. There are approximately thirty-three (33) exhaust ducts which exhaust air from building TCAAP-675. Each unit is equipped with filters so that all air exhausted through hoods, dry-boxes or other plant equipment is filtered before discharge to the atmosphere.

2. The standard filter system is one composed of one-or-two prefilters followed by a high efficiency (absolute) filter. Some operations which cause severe dusting are equipped with (torit) dust collectors in advance of the filter boxes.

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3. Air operation may be operated without the absolute filter only if (a) the nature of the operation is such that particulates which are gumming or sticky rapidly plug the high efficiency filters; (b) alternate filtration is provided such as water-scrubbers, electrostatic precipitates, etc.; and (c) air sampling within such ducts shows that the limits of the license are not being exceeded.

   At present, there is only one duct in this category which does not have the absolute filter. This is at location 6-2 (incinerator) This unit is equipped with water-scrubber and pre-filter. Tar formation in this operation results in gummy deposits which would rapidly plug an absolute type filter.

4. Indications of need for change of filters are the result of (a) draft gauge readings and/or (b) air face velocity readings and/or (c) exhaust air sampling.

B. Doors or Windows

Some doors or windows in the plant areas may be open during the summer months; air which may escape from the building through doors or windows is of course not filtered. Since the MPC for in-plant air is a factor of 25 greater than for air in unrestricted areas, there may, on occasion, be concentrations which are instantaneously greater than Table II concentrations, which are released through doors or windows.

Air monitoring at such locations is at the same frequency specified for other exhaust points; the frequency is based on past results or expected values as listed in our letter of 14 April 1965.

II Information on Flow and Concentrations

A. Flow Rates and Total Volume

Each filter unit exhausts an average of 1200 cubic feet per minute. This amounts to a total of 17,860,000 cubic meters per year per unit. The plant total (@ 53 units) would be a maximum of 589,380,000 cubic meters per year. Since all units are not operating all of the time, the actual total would be something less, probably 75% of the values given.

B. Radionuclides

With the exception of a minor amount of normal or depleted uranium almost all of the radioactivity released from the building to unrestricted areas would be due to fully-enriched uranium, which has an approximate specific activity of one gram uranium equal to 75 microcuries (alpha). The Table II limit for all of the radionuclides in high enriched uranium mixtures is $4 \times 10^{-12}$ microcurie per cc. The activity of the mixture is principally due to the isotope U-234.

C. Average Concentrations at Stacks

The average concentrations at each exhaust point follow. These are time-weighted concentrations expressed as percent of Table II MPC limits (unrestricted areas).

| Area and Exhaust Unit No. | Actual Average, Four Months, Jan-Apr 1965 | Maximum Expected Future Averages One Year Basis | Maximum Quantity Release, gU(93.5) Per year |
|---|---|---|---|
| 1 | 1.5% | 5% | 0.05 |
| 6-1 | 24.2 | 50 | 0.50 |
| 6-2 | 58.6 | 150 | 1.50 |
| 6-3 | 77.0 | 150 | 1.50 |
| 7-1 | 4.7 | 10 | 0.10 |
| 7-2 | 15.0 | 20 | 0.20 |
| 9-1 | 0.8 | 5 | 0.05 |
| 9-2 | 11.0 | 20 | 0.20 |
| 10 | 5.3 | 20 | 0.20 |
| 11-1 | 2.3 | 10 | 0.10 |
| 11-2 | 0.0 | 10 | 0.10 |
| 12-1 | 3.0 | 10 | 0.10 |
| 12-2 | 0.0 | 5 | 0.05 |
| 13-1 | 9.2 | 20 | 0.20 |
| 14 | 1.5 | 20 | 0.20 |
| 15 | 8.3 | 25 | 0.25 |
| 16-1 | 2.0 | 25 | 0.25 |
| 16-2 | 5.0 | 25 | 0.25 |
| 17-1 | 4.3 | 50 | 0.50 |
| 17-2 | 5.0 | 25 | 0.25 |
| 18-1 | 5.0 | 25 | 0.25 |
| 18-2 | 5.0 | 25 | 0.25 |
| 19 | 21.6 | 50 | 0.50 |

| Area and Exhaust Unit No. | Actual Avg., Four Months Jan.-Apr 1965 | Maximum Expected Future Averages; One Year Basis | Maximum Quantity Release, Gram U (93.5) per Year |
|---|---|---|---|
| 20-2 | 9.8% | 25% | 0.25 |
| 21-1 | 78.0 | 150 | 1.50 |
| 22 | 4.0 | 25 | 0.25 |
| 23 | 3.0 | 50 | 0.50 |
| 24 | 9.0 | 150 | 1.50 |
| 30 | 5.0 | 50 | 0.50 |
| 31 | 7.0 | 20 | 0.20 |
| 25 | 0.0 | 5 | 0.05 |
| 53 | 0.0 | 10 | 0.10 |
| Open Doors or Windows | | 150 | 1.50 |
| | 17.0% Average | 40% Average | 15.4 grams U per year Total |

D. Peak Concentrations at Stacks

Peak concentrations are presented below. These limiting concentrations can be expected to prevail for fractions of a day (few hours to several hours). At any one exhaust unit, such peak concentrations have been observed only a few times per year. The peak concentrations are averaged into the average concentrations reported in C. above.

| | Table II Basis | | | |
|---|---|---|---|---|
| | | Anticipated Future Peak Concentration | | Released Grams U (93%) |
| Exhaust Unit No. | Act. Recorded Peak Concentr'n Jan-Apr, 1965 | Unrestricted Air | Restricted Air | Per Day at Peak Concentration |
| 1 | 13% | 250% | 10% | 0.0065 |
| 6-1 | 1276 | 1250 | 50 | 0.0325 |
| 6-2 | 2099 | 3750 | 150 | 0.0970 |
| 6-3 | 3930 | 3750 | 150 | 0.0970 |
| 7-1 | 6 | 125 | 5 | 0.0032 |
| 7-2 | 15 | 125 | 5 | 0.0032 |
| 9-1 | 2 | 125 | 5 | 0.0032 |
| 9-2 | 11 | 125 | 5 | 0.0032 |
| 10 | 6 | 125 | 5 | 0.0032 |
| 11-1 | 7 | 125 | 5 | 0.0032 |
| 11-2 | 0 | 125 | 5 | 0.0032 |
| 12-1 | 4 | 125 | 5 | 0.0 |
| 12-2 | 0 | 125 | 5 | 0. |

| Exhaust Unit No. | Actual Recorded Peak Concentration Jan - Apr 1965 | Projected Future Peak Concentration Unrestricted Air | Restricted Air | Releases Grams U (93%) Per Day at Peak Concentration |
|---|---|---|---|---|
| 13-1 | 13% | 125% | 5% | 0.0032 |
| 14 | 3 | 250 | 10 | 0.0065 |
| 15 | 22 | 625 | 25 | 0.0163 |
| 16-1 | 4 | 2500 | 100 | 0.0650 |
| 16-2 | 20 | 2500 | 100 | 0.0650 |
| 17-1 | 13 | 1250 | 50 | 0.0325 |
| 17-2 | 20 | 1250 | 50 | 0.0325 |
| 18-1 | 20 | 2500 | 100 | 0.0650 |
| 18-2 | 20 | 2500 | 100 | 0.0650 |
| 19 | 154 | 2500 | 100 | 0.0650 |
| 20-1 | 3700 | 2500 | 100 | 0.0650 |
| 20-2 | 390 | 625 | 25 | 0.0163 |
| 21-1 | 3740 | 2500 | 100 | 0.0650 |
| 22 | 440 | 1250 | 50 | 0.0325 |
| 23 | 180 | 1250 | 50 | 0.0650 |
| 24 | 22 | 2500 | 100 | 0.0650 |
| 25 | 5 | 125 | 5 | 0.0032 |
| 30 | 110 | 2500 | 100 | 0.0650 |
| 31 | 7 | 625 | 25 | 0.0163 |
| 53 | 5 | 250 | 10 | 0.0065 |

III Human Occupancy At Points of Highest Concentrations

A. The points of highest concentrations in unrestricted areas during inversion conditions are the locations close to the building, TCAAP-675. Human occupancy close to the building within 150 feet is negligible with respect to a yearly basis.

B. Principal occupancy in the region within 150 feet of the building is by persons who are employed by the 3M Company and are under health physics control.

C. Although there is not a fence around the building, prolonged occupancy in this region is limited:

1. After-hours and holidays, the reservation is patrolled by TCAAP guard personnel, precluding loitering or unauthorized occupancy during these periods.

2. During regular hours unauthorized occupancy for prolonged periods is not anticipated and would be prohibited by building 675 supervision. We do not

consider that a few hours in this area is unauthorized nor is this considered as a prolonged period.

D. Regular authorized occupancy in the unrestricted areas within 150 feet of the building include:

| Nature of Occupancy | Expected Max. Hours Per Week For Any Individual |
|---|---|
| Deliveries | 2 |
| Train Switching | 1 |
| Drivers on Road ways | 1 |
| Power and Transformer Repair * | 8 |
| Grass cutting * | 8 |
| Steam line repair * | 16 |

* These jobs which give rise to occupancy times of more than two hours are less than "once a year" type jobs.

E. During normal or average conditions, the points of maximum concentrations in the unrestricted areas are located 150 feet to 250 feet away in the direction of prevailing wind. This region happens also to include the locations at which maximum human occupancy occurs, as described in the following section.

IV Peak and Average Concentrations At Points of Human Occupancy

The principal points of human occupancy in the unrestricted areas are:

| Bldg. No. | 157 | 115 | 151 | 108 | 112 |
|---|---|---|---|---|---|
| Distance from bldg 675 (ft) | 270 | 200 | 200 | 200 | 160 |
| Employer | FCC | FCC | Mark-Lee Lab | FCC | FCC |
| No. of Occupants | 15 | 12 | 5 | 2 | 4 |
| Hours per Week | 40 | 40 | 40 | 5 | 5 |
| Function | Fire House | Steam Plant | Chemical Lab | Storage | Tool Storage |

| Bldg. No. | 157 | 115 | 151 | 108 | 112 |
|---|---|---|---|---|---|
| Direction of Prevailing Winds? | Yes | No | No | Yes | No |
| Air Sampler Installed? | Yes | No | No | Yes | No |
| Expected Year Average Concentration; Table II Basis | <10% | <10% | <10% | <10% | <10% |
| Expected 168 Hour Peak Concentrations Table II Basis | 100% | 100% | 100% | 100% | 100% |

## V Procedures and Calculations to Determine Concentrations in Unrestricted Areas

### A. Procedures

The actual concentrations of the alpha radioactivity in the air in the unrestricted areas will be continuously monitored by air samplers installed at nearest points of possible significant and continuous human occupancy, and in the directions of prevailing annual winds. These locations are at buildings 157 and 108, as described previously.

### B. Calculations

Calculations based on stack sampling will not be used to record concentrations in the unrestricted areas. For purposes of estimating the magnitude of expected concentrations, results of calculations are presented.

1. Maximum Concentrations - Reference: Section 22-28, "Radiation Hygiene Handbook," H. Blatz, ed.

   The simplified Sutton equation is:

   $$X_{max} = \frac{Q}{4.26\ \bar{u}\ h^2}$$

   $X_{max}$ = maximum concentration in the unrestricted areas

Q = Emission rate, microcuries per second

$\bar{u}$ = Mean wind velocity, meters per second

h = stack height, meters

Average Q = $(1.6 \times 10^{-6} \mu c/M^3)(19.0\ M^3/sec)$

= $3.0 \times 10^{-5} \mu c/sec.$

u = 2.3 m/sec

h = 9.6 m

Calculated X max = $\frac{3.0 \times 10^{-5}}{(4.26)(2.3)(9.6)^2}$

= $3.3 \times 10^{-8}\ \mu c/M^3$

or % MPC = $\frac{3.3 \times 10^{-14}}{4 \times 10^{-12}} \times 100$

= 1% MPC (Table II basis)

dilution ratio = $\frac{40\%}{1\%}$ = 40::1

Expected maximum peak concentration in unrestricted areas

= $\frac{3750\%}{40}$ = 95% MPC (Table II basis)

2. Location of Maximum Concentrations in unrestricted areas - Reference: Figure 22-20, "Radiation Hygiene Handbook," Blatz, ed.

X max = distance to point of maximum ground level concentration, feet

where X max = $\frac{h}{2p}$

p = diffusion coefficient

@ stack height = 30 feet

| Condition | p | X max, feet |
|---|---|---|
| Low turbulence | 0.02 | 500 feet |
| Average turbulence | 0.05 | 250 feet |
| Moderate turbulence | 0.10 | 150 feet |

If there are any questions relative to this additional information, do not hesitate to contact us.

Very truly yours,

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TCAAP-675