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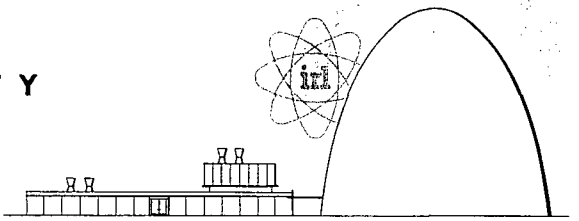
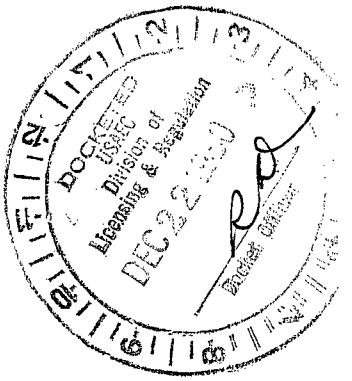
COLUMBIA UNIVERSITY
c/o Industrial Reactor Laboratories, Inc.
Plainsboro, New Jersey

SWinburne 9-1800





1 December, 1960

United States Atomic Energy Commission,
Washington, 25, D. C.

Attention: Mr. H. L. Price, Director
Division of Licensing & Regulation

Subject: Application for Amendment No. 7 to Facility License No. R-46, as amended.

References:
(a) Facility License No. R-46, Amendment No. 6, effective 24 October, 1960.
(b) Letter dated 22 September, 1960, from the Commission to Industrial Reactor Laboratories, Inc., Attention: Mr. Jerald S. Hanks, Treasurer.
(c) Letter dated 18 July, 1960, from Industrial Reactor Laboratories, Inc. and Columbia University to the Commission.
(d) Agreement dated as of 1 October, 1960, between Industrial Reactor Laboratories, Inc. and the Trustees of Columbia University in the City of New York.

Gentlemen:

This letter and the two attachments accompanying it constitute a request to the Commission for an amendment to our Facility License, No. R-46, as amended, Reference (a), in two respects.

First, with respect to item number 1 in the Commission's letter, Reference (b), we are asked to establish a dilution factor for gaseous discharge from our reactor "stack". We request specifically, and in accordance with paragraph 20.106 of 10CFR20 effective January 1, 1961, that our license be amended to permit the discharge from the IRL reactor stack of gaseous isotopes at concentrations not to exceed 5×10^3 times those specified in Appendix B, Table II of 10CFR20. It is demonstrated below and in Attachment I hereto, that it is unlikely that any individual would thereby be exposed to average concentrations in excess of the limits specified in Appendix B, Table II

B-14

Meteorological and other data, as identified in Attachment I to this letter, indicate an average downwind dilution factor of 1.74×10^{-4} at ground levels. Although the temporary existence of large deviations from average conditions may be postulated, since they should appear most prominently within the IRL site previously described to the Commission in Section F of the IRL Hazards Summary Report, we do not feel that this could cause a significant undetected exposure. We presently require all personnel, IRL and outside contractors, to wear film badges outdoors and indoors whenever the reactor is operating. In addition, we have installed an outside area monitoring system at three points 120° apart and on a radius of 800 feet from the reactor, with a lower limit of detection of 0.01 mr/hr corresponding to about 4×10^{-9} uc/cc of Ar^{41}, the principle isotope routinely discharged from the stack.

Secondly, we request, by license amendment, authorization and permission to carry out an experiment to be known as the PTR (Pressure Tube Reactor) Critical Experiment at the IRL site. This critical experiment has been proposed by, and is to be carried out for AMF Atomics, a division of American Machine & Foundry Company, by Columbia (IRL) operating staff personnel under the terms of the agreement, dated 1 October, 1960, between IRL, Inc. and Columbia University, Reference (d), A complete description of the proposed experiment, its objectives and procedures for its execution constitute Attachment II in the form of a document titled "PTR Critical Experiment Hazard Summary Report", prepared by AMF Atomics and dated 10 November, 1960. (See Reports File.

In requesting this amendment to our operating license, it should be pointed out that Columbia (IRL) Operating Staff members have reviewed the proposed experiment in accordance with the Experiment Review procedures outlined in Exhibit I of Reference (c) under the classification of a Complex Experiment and have approved it in accordance with the description given in Attachment II.

As may be determined from the procedures indicated in Attachment II, no change in the provisions of paragraphs 2.B and 2.C of Reference (a), relative to the possession and use of Special Nuclear and By-Product Materials, is deemed necessary. In particular, the total quantity of Special Nuclear Material required for the conduct of the proposed critical experiment, when added to the inventory that will be on hand concurrently, will not exceed the limit set forth in Reference (a).

It is currently proposed that this experiment be carried out early in 1961, but in any case it would undoubtedly be completed before June 1, 1961. We would request, therefore, that this amendment be issued at the earliest possible date.

Should there be additional questions or problems which arise as a result of your review of this application, we would appreciate learning of them at your earliest convenience so that we may expedite matters to a successful conclusion.

Yours very truly,

Laboratory Director

APPROVED:

INDUSTRIAL REACTOR LABORATORIES, Inc.

Treasurer

COLUMBIA UNIVERSITY

Professor and Chairman of the
Advisory Committee on IRL

RWH:DH
Attachments - 2

STATE OF NEW JERSEY)
) SS:
COUNTY OF MIDDLESEX)

On this 1st day of December, 1960, before me personally appeared Jerald S. Hanks, to me known and who, being by me duly sworn, did depose and say: that he is the Treasurer of Industrial Reactor Laboratories, Inc.; that he is duly authorized to execute the foregoing instrument on behalf of said corporation; and that the statements made therein on behalf of said corporation are true, complete and correct to the best of his knowledge and belief and are made in good faith.

Maud R. Spencer
Notary Public

NOTARY PUBLIC OF N. J.
My Commission Expires April 6, 1961

CITY OF NEW YORK)
) SS:
COUNTY OF NEW YORK)

On this 8th day of December, 1960, before me personally appeared Professor Jewell M. Garrelts, to me known and who, being by me duly sworn, did depose and say: that he is Chairman of the Columbia University Advisory Committee on IRL; that he is duly authorized to execute the foregoing instrument on behalf of Columbia University, and that the statements therein made on behalf of the said University are true, complete and correct to the best of his knowledge and belief and are made in good faith.

Margaret K. Jennings
Notary Public

MARGARET K. JENNINGS
Notary Public, State of New York
No. 31-[illegible]775
Qualified in New York County
Commission Expires March 30, 1962

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ATTACHMENT I

IRL STACK DILUTION FACTOR

As has been described in the IRL Hazards Summary Report[1], as amended, and the IRL Research Reactor Start-UP Test Program, Approach to Full Power and Full Power Report[2], the beam tube exhaust, rabbit exhaust and hold-up tank vent discharge from a common "stack", a louvered plenum at the top of the reactor containment dome 87' above ground level. The beam tube and rabbit exhaust air presently passes through AEC type absolute filters. No routine filter or hold-up for gaseous effluent exists, although it is sampled at the plenum and the concentration is detected by a Kanne Chamber and logarithmic electrometer. The measured value is both recorded and, by a variable set point, may be arranged to alarm at any desired point within the range of the electrometer, 10^{-13} to 10^{-7} amp. This corresponds, our calculations indicate, to a concentration of from 10^{-8} to 10^{-2} uc/cc for the 1.25 mev beta-emitting gas Ar^{41}.

It seems appropriate to treat this discharge as a continuous point source, to which Sutton's diffusion equations as contained in standard references such as AECU-3066[3], may be applied. To simplify the analysis, it is proposed to calculate the anticipated dilution at the downwind point of minimum dilution (and therefore maximum concentration) for two meteorological conditions, conservative (Inversion with 2 mph wind) and normal (negative lapse rate with 10 mph wind).

The equation for the distance of the point of highest ground concentration is:

$$(1) \quad d_{max} = \left(\frac{h^2}{C^2}\right)^{\frac{1}{2-n}}$$

and for the concentration at this point, neglecting radioactive decay:

$$(2) \quad X_{max} = \frac{2Q}{e\pi \bar{u} h^2}$$

Where:

- C = Diffusion coefficient, $(\text{meters})^{n/2}$
- d = Distance (meters)
- e = 2.7183
- h = Height of source (meters)
- n = Stability parameter (non-dimensional)
- Q = Concentration at point of discharge (curies/meter^3 or uc/cm^3)
- $\bar{u}$ = Mean wind speed (meters/sec)
- X = Concentration, downwind (same units as Q)

1. Section D, 3. Reactor Building Ventilation
2. IRL Staff Addendum, Page 2
3. Meteorology and Atomic Energy, Chapter 4.

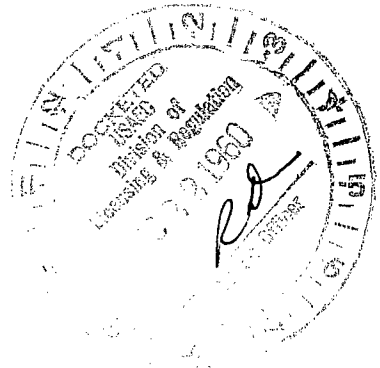

Table 4.3 of the previous reference[4] for conservative conditions, $n = 0.50$ and $C^2 = 0.004$ and for normal conditions $n = 0.20$ and $C^2 = 0.043$.

Substituting in the above equations, and taking $Q = 1$ for purposes of arriving at a dilution factor: under conservative conditions $d = 3,100$ meters $= 10,100$ ft. and $X_{max} = 3.73 \times 10^{-4}$, while under normal conditions $d_{max} = 710$ ft. and $X_{max} = 7.50 \times 10^{-5}$.

If inversion conditions are assumed one-third of the time and normal conditions two-thirds, a weighted downwind dilution factor of 1.74×10^{-4} may be calculated.

Additional "virtual" dilution factors may be applied if the concentration at any one downwind point is considered over a period of time, such as a year, in that:

1. A minimum reactor shut-down of a day a week may be anticipated for experimental changes, maintenance, etc., so that a long term operating factor of .85 is applicable.

2. As indicated in the IRL Hazards Summary Report[5], the prevailing winds do not blow in any one direction (to eight compass points) in any of the velocity groups shown (0-3, 4-8, 9+) more than 10% of the time. Since the location of the downwind point of predicted maximum concentration is a function of both wind direction and velocity, a wind factor of .10 seems reasonable.

In our judgment, these latter factors allow for a suitable margin of error in the "weighted" downwind dilution factor indicated above.

4. Ibid. p. 53
5. op. cit., Appendix B-4 Pollution Climatology of Princeton-Plainsboro area.