NOTICE

**CERTAIN DATA
CONTAINED IN THIS
DOCUMENT MAY BE
DIFFICULT TO READ
IN MICROFICHE
PRODUCTS.**

~~SECRET~~

efined
transmittal
manner to

- #1 L. Squires - 808 Area File
- #2 J. B. Willard
- #3 W. H. Sullivan
- #4 J. Bugbee - P.W. Crane - 700 Area
- #5 S.F. Cantrell - H.M. Parker
- #6 W.C. Kay - H.W. Millett
- #7 M. P. Ackum
- #8 Pink Copy
- #9 Yellow Copy

17270

~~SECURITY INFORMATION~~

CLASSIFICATION CANCELLED
DATE 2-15-56 <i>TWS</i>
For The Atomic Energy Commission
<i>H.F. Cansell</i>

December 18, 1944

To: L. Squires

From: W. H. Sullivan Chief, Declassification Branch

In Re: Health Hazard From a Long-Lived Rare Gas Activity

In a recent Chicago report (CS-2316) further information was given concerning a long-lived rare gas activity appearing among the fission products. The minimum half-life value, based on two months observation only, is ~2.5 years. The beta ray energy from present measurements is ~0.8 Mev.; the β/γ ratio, ~8000. From the estimated yield of 0.1%, it is calculated that, for 100 days operation and 60 days cooling, the long-lived gaseous activity will be about ten times greater than the 5.5 day Xe activity.

In considering the health hazard of this complication of the stack gas problem at H.E.B., one must evaluate two physical-physiological conditions.

- 1) The body is subjected to external radiation from an infinite cloud of activity.

From the relation $M = 4.15 \times 10^{-6}/E$, where M = curies/cc air (at tolerance concentration) and E = average energy of the beta ray in ev (CI-697, XII, A, 3.6) one finds that, for an 0.8 Mev. beta ray having no gamma ray (judging from the ratio $\beta/\gamma = 8000$), the tolerance concentration of the gas is 1.3×10^{-11} curies/cc.

If the long-lived gaseous activity is ~20 times more intense than the 5.5 day xenon activity at 60 days and the tolerance ratio is $T_{2.5yr}/T_{5.5d} = 1.5 \times 10^{-11}/5 \times 10^{-11} = 0.26$, then the required stack gas dilution factor, as calculated from Figure 2 of the memorandum, J. L. Dreher to L. Squires, September 29, 1944, must be increased from 1.3 to $\sim 10/0.26 \times 1.3 = 49.4$. Since the stack gas dilution factor is not expected to fall below 200, even for short periods of time, no health hazard would arise for normal conditions of operation.

- 2) The gaseous activity is respired and its daughter product is deposited in the lungs.

From the considerations above, respiration of gaseous activity would be an additional hazard only if the daughter product were active. There is no evidence thus far to show that this rare gas has a daughter activity but, if one wishes to place an upper limit on the amount of such activity, it may be assumed from the β/γ ratio of 8000 that the daughter, if it is a gamma ray emitter, is $< 1/80$ as intense as the parent (half-life, >200 yrs.)

MASTER

DISTRIBUTION RESTRICTED TO U.S. ONLY

~~SECRET~~

EB

L. Squires

-2-

12-16-46

Even if there were a daughter activity present, the amount of deposition would be small. At an average respiration rate of 20/minute and 600cc/respiration, one would breathe 14,400 liters/24 hour period. At tolerance level, a total of $1.44 \times 10^7 \times 1.3 \times 10^{-11} = 1.8 \times 10^{-4}$ curies of activity could be inhaled, but only a small fraction of this amount would decay and be deposited in the lungs. For the simplest assumption that one lungful is held to decay over a 24 hour period, one finds that $(1 - e^{-\frac{0.693 \times 1}{2.5 \times 10^5}}) 100 = 0.76\%$ of the gaseous activity decays in a day and that $5 \times 10^2 \times 1.3 \times 10^{-11} \times 7.6 \times 10^{-3} \times 1/60 = 8.2 \times 10^{-13}$ curies of the daughter activity could be deposited in the lungs and blood stream each day (assuming 100% deposition). Since the daughter product is Rb or Cs, elimination of this activity would be sufficiently rapid to present no hazard relative to the accumulation of a ~200 year activity over a period of years.

In summary, it may be stated that no additional hazard is to be expected from the long-lived gaseous activity.

W H Sullivan

W. H. Sullivan, Sr. Supervisor
Technical-Separations Eng. Div.

WAS:jd

DATE

FILMED

5/20/94

END