LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO: : Distribution

DATE: July 22, 1963

FROM : Dale E. Hankins, H-1 Health Physicist

SUBJECT: RADIOACTIVE GAS CONCENTRATIONS IN OLD TRAILER COURT AREA ORIGINATING FROM THE OMEGA STACK

SYMBOL: H-1

090
TA-8

The concentration of radioactive gases that could be expected to be present in the old trailer court area as a result of the routine release of gases from the Omega Stack are calculated in this memo. The concentrations of the released gases vs time of release from the stack were taken from the report "Radioactive Gaseous Effluents from a Homogeneous Reactor" by Dale E. Hankins.

Information concerning the average wind speed and direction was obtained from the H-6 Weather Section and are shown in Table I. The wind information is for 9:00 p.m. and the wind direction is from the south. Wind directions are available from eight directions, each containing a 45 degree section. Also shown is the percent of time the wind blows at a particular velocity from the south.

In the following calculations it is assumed that the Water Boiler reactor was operated for about 150 kwh each day for five days. No consideration was given to the build-up of Xe^{133} and Xe^{135} which would occur under these conditions. However, it can be shown that this build-up is not a major factor in increasing the biological hazard, which is predominately due to the Kr^{88} and Rb^{88} components.

Using the information given in the report mentioned above the average concentration of each isotope in the stack gas was determined for each one hour interval. These concentrations were then divided by 2000 which is the dilution factor that would be expected at a wind velocity of 2 MPH and at a distance of 500 meters (approximate distance to the trailer court area). The dilution factor was determined from information supplied at our request by Orin W. Stopinski of H-6. The corrected concentrations were then totaled and divided by the Radiation Concentration Guild (RCG) value times 168 hours.

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The RCG values for the isotopes used are presented in Table II. These RCG's are for a 168 hour nonoccupational exposure. The concentration in terms of multiples of RCG for each of the gases is given in Table III. The build-up of Xe^{133} and Xe^{135} activity which results from high power reactor operation on consecutive days would increase the multiples of RCG to about 12 for the Xe^{133} and the Xe^{135} by an insignificant amount. This increase is not a significant amount when totaled with the other activities, particularly Kr^{88} and Rb^{88}. Unfortunately no consideration could be given to the periods of time during which inversion weather conditions exist or the wind velocity was less than 3 MPH. Both of these conditions could result in high concentrations in the trailer court area.

Using the wind information shown in Table I it is possible to determine the concentration in terms of multiples of RCG that would exist in the trailer court for a 168 hour period.

Based on the information given in Table IV, the average concentration of these gases in the trailer court area (excluding inversion periods and periods of winds less than 3 MPH), would exceed the RCG by a factor of slightly greater than three. Since the past operation of the reactor has indicated only one third of the available run time is utilized we can say the concentration in the trailer court over long periods of time have probably been at or slightly above one RCG. The number of assumptions and variables present in these calculations made the results subject to large error.

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TABLE I

Occurrence in Percent of South Winds at 9:00 PM

Wind Velocity in MPH

	3 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	All
January	4.24	9.26	4.67	1.64	0.69		20.50
February	5.53	6.80	1.36	.34	.34		14.37
March	3.33	12.02	5.09	1.05		0.70	22.19
April	0.61	6.16	7.38	3.82	0.26		18.23
May	4.39	5.53	5.35	2.63	0.35		18.25
June	3.37	13.67	4.68	2.15			23.87
July	5.00	13.27	5.82	1.09			25.18
August	2.48	9.35	2.67	1.05			15.55
September	4.10	12.70	2.70	2.40			21.90
October	5.17	12.24	2.53	0.74	0.42	0.42	21.52
November	4.62	5.07	5.52	2.14			17.35
December	5.13	5.70	3.75	0.57	0.32		15.48
						Average	19.5 %
South Wind at Velocity Indicated Above in Percent	20.6 %	47.9 %	21.6 %	8.4 %	1.0 %	.5 %	

TABLE II

Nonoccupational RCG Values for a 163 Hour Week in μc/cc

Isotope	Half Life	RCG in μc/cc
Kr^{85m}	4.36 hours	1×10^{-7}
Kr^{87}	78 minutes	2×10^{-8}
Xe^{133}	5.27 days	3×10^{-7}
Xe^{135}	9.13 hours	1×10^{-7}
Kr^{88}	2.77 hours	1×10^{-8}
Rb^{88}	17.8 minutes	3×10^{-8}
A^{41}	110 minutes	4×10^{-8}

TABLE III

Times RCG for Wind Velocity of 2 MPH and 500 Meter Distance

Isotope	Multiples of RCG (168 hours nonoccupational)
Kr^{85m}	3
Kr^{87}	~5
Xe^{133}	1
Xe^{135}	10
Kr^{88}	27
Rb^{88}	13
A^{41}	1
Total Multiples of RCG	~60*

*The RCG's for the isotopes listed are whole body immersion doses and should be added to obtain the total multiples of RCG.

TABLE IV

Multiples of RCG for Various Wind Velocities

Wind Velocity MPH	Frequency of Occurrence of South Wind at Velocity Indicated - %	Multiples RCG	Hours per 168 Hour Week at Multiples of RCG Indicated	Percent of 168 hours at Multiples of RCG Indicated
3-5	20.6%	30	7	4%
6-10	47.9%	15	17	10%
11-15	21.6%	10	7	4%
16-up	~10 %	~6	3	2%