radii are constant, then $(r_e^{KBr}-r_e^{KCl})$[4,6] should be equal to $(r_e^{CsBr}-r_e^{CsCl})$, and each quantity should represent the difference between the Br and the Cl ionic bonding radii. From the measured values, $(r_e^{KBr}-r_e^{KCl})=0.1541$A, and $(r_e^{CsBr}-r_e^{CsCl})=0.1658$A. Hence the ionic bonding radii vary by about $\frac{1}{2}$ percent in the group of molecules we have considered here.

Work on the microwave spectra of the alkali halides is continuing, and a more detailed article summarizing the results for most of the alkali halides is planned.

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Decay of Rh^{106}†

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The gamma radiations from 30-sec Rh^{106} have been examined using a NaI(Tl) gamma-ray spectrometer. These consist of: 0.516 Mev (20.5 percent), 0.619 Mev (10.4 percent), 0.88 Mev (0.3 percent), 1.04 Mev (1.7 percent), 1.14 Mev (0.4 percent), 1.54 Mev (0.2 percent), and several gamma rays of higher energies with intensities of less than 0.1 percent.

THE gamma radiations from 30-sec Rh^{106}, in equilibrium with 1-year Ru^{106}, have been examined with a NaI(Tl) spectrometer (Fig. 1). Ru^{106} decays to Rh^{106} by emitting a 39-kev beta group.[1] The Rh^{106} decay has been reported to be complex, and energy levels for excited states of Pd^{106} have been suggested by Hayward[2] and Alburger.[3]

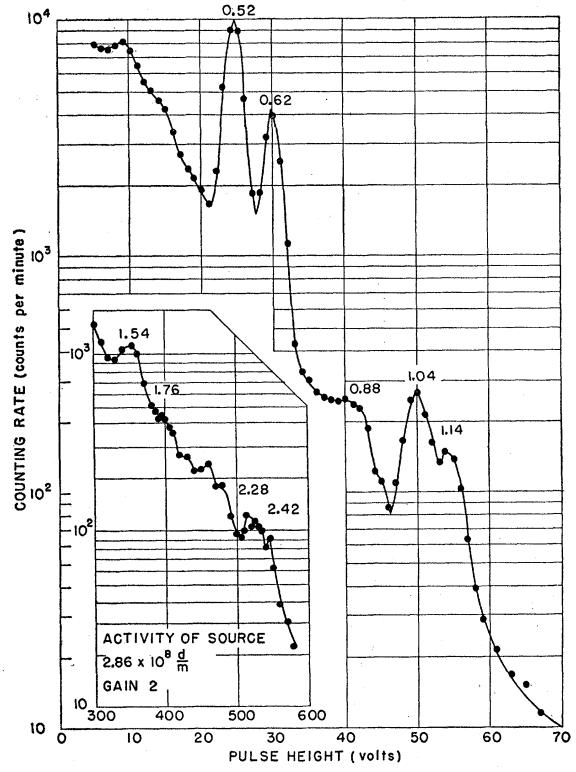

FIG. 1. Pulse-height spectrum of Rh^{106} between 50 kev and 2.50 Mev on NaI(Tl) scintillation spectrometer. Distance from crystal 2.45 cm; activity 1.11×10^7 disintegrations/min; gain 4.

The Ru, in the form of $RuCl_3$, was separated from 4 year old fission products by the Operations Division, Oak Ridge National Laboratory. The activity of the Rh^{106} was determined by 4π counting and by 4π-coincidence counting, the sample being evaporated on an aluminum foil 4 mg/cm² thick and covered with another foil of the same thickness in order to absorb the Ru^{106} beta particles. The activity determined by the two methods was identical, and was in agreement with the activity determined by absolute beta counting with G-M counters and by coincidence counting of an external source. The external source was placed between a NaI gamma counter (shielded with sufficient aluminum to absorb all beta particles) and a proportional beta counter. A large amount of weak continuous radiation was detected by the NaI counter, hence the counter was biased to detect only radiation in excess of 0.30 Mev.

TABLE I. γ radiation from Rh^{106}.

Energy (Mev)	Percent of beta activity
0.516	20.5%
0.619	10.4
0.88	0.3
1.04	1.7
1.14	0.4
1.54	0.2
1.76 2.28 2.42	<0.1 each

The energies and intensities of the gamma rays observed on the NaI spectrometer are given in Table I.

The counting rate was taken to be the area under the

† Based on work performed under contract to the U. S. Atomic Energy Commission.
[1] H. M. Agnew, Phys. Rev. 77, 655 (1950).
[2] R. H. Hayward, Phys. Rev. 85, 760 (1952).
[3] D. E. Alburger, Phys. Rev. 88, 339 (1952).

photoelectric peak in Fig. 1. The spectrometer—having a cylindrical crystal 1 in. in length and $1\frac{1}{2}$ in. in diameter—was calibrated for gamma counting efficiency by using gamma-emitting radioisotopes of known activities. The average deviation of the values in repeated determinations is less than 5 percent. The ratios of the 1.55-, 1.04-, 0.88-, and 0.619-Mev gamma rays to the 0.516-Mev gamma ray are in agreement with the values given

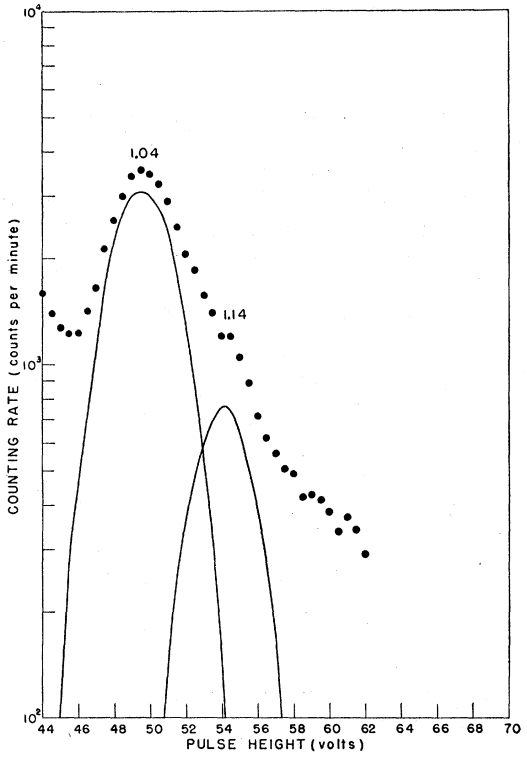

FIG. 2. Pulse-height spectrum of Rh^{106} between 0.90 and 1.30 Mev on NaI(Tl) scintillation spectrometer. Distance from crystal 27.5 cm; activity 1.13×10^{10} disintegrations/min; gain 4.

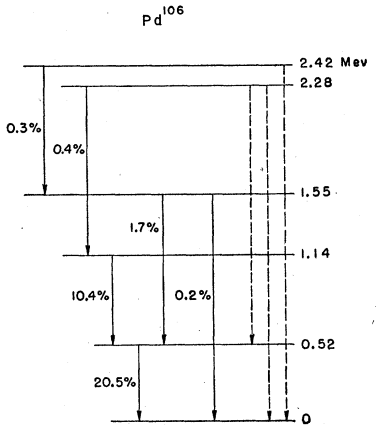

FIG. 3. Gamma rays in the decay of Rh^{106}.

by Kraushaar and Goldhaber.[4] The efficiency of a high-pressure ion chamber for measuring Rh^{106} was calculated with the data of Table I using the method of Jones and Overman.[5] The efficiency determined experimentally was within 1 percent of this calculated value.

The existence of the 1.14-Mev gamma ray was checked by counting sources of increasing intensity at source-to-crystal distances between 2.45 cm (Fig. 1) and 27.5 cm (Fig. 2). A 1.14-Mev peak resulting from a gamma ray of that energy would decrease approximately as the square of this distance, while a peak resulting from 0.516–0.619-Mev coincidences would decrease as the fourth power of the distance. The ratio of the 1.14–1.04-Mev peaks indicates that the amount of the 1.14-Mev γ listed in Table I cannot be ascribed to γ-γ coincidences. The occurrence of small peaks at 2.28 Mev and 1.76 Mev suggests that a 2.28-Mev level exists, and that the 1.14-Mev γ originates at this level. (See Fig. 3.)

[4] J. J. Kraushaar and M. Goldhaber, Phys. Rev. **89**, 1081 (1953).

[5] J. W. Jones and R. T. Overman, U. S. Atomic Energy Commission Report AECD 2367, March 20, 1948 (unpublished).