[redacted]

UNCLASSIFIED

SAND98-0152

November 13, 1964

To: B. F. Murphey - 5410

Hugh W Church

From: H. W. Church - 5414

Re: Giant Squid Hazard

Assume 1 kt of fission produces 550 Mcuries of gamma-emitting fission products at H + 1 hour, and that one M curie of fission products spread uniformly over one square mile produces a dose rate of 4.7 r/hr. Also, from Knapp 1963 (TID-19266), assume that ratio of picocuries per liter of milk (I_m) to 24 hour post-detonation gamma dose rate r_o (mr/hr) is about 10^5 (actually given is a range of 18,000 to 220,000). So that we get $M = W$ (kt) $Z\ 5.66\times10^9$ [$pc/\ell/kt/mile^2$] for the average milk dose for a fission yield W with fraction Z of bomb produced products in mushroom cloud available for fallout.

For the present case of $W = 0.02$ kt and $Z = 0.9$ (which seems unreasonably high for this underwater shot) $I_m = 1.02\times10^8$ [$pc/_\ell\ mile^2$]. If we take NRDL's quoted area of $4.6 \times 10^4\ mile^2$ for deposition area and spread it uniformly we get a final dose of $2.2\times10^3\ pc/_\ell$ out to their distance of 414 miles. According to FRC report No. 5, a milk concentration of 60-70 $nc/_\ell$ could result in a total intake of 600 nc and a dose to a 2 gram thyroid of 10 rads. Thus, an increase of 30 to the 2.2 $nc/_\ell$ calculated above would be required before any protective action would be considered. However, with the assumption of uniform disposition imposed above, it is not difficult to visualize non-uniformities in deposition patterns where increases of 30 are easily realized.

Comparing this case to the one of a $\frac{1}{2}$ kt surface burst is difficult because of the much lower cloud height (600 m vs. 3200 m). However, the $\frac{1}{2}$ kt case may have had an unrealistic particle size distribution for I^{131} since no fractionation was assumed there.

Another check is to take figures quoted in Knapp of 1 $\mu c/m^2$ deposition leads to 0.15 $\mu c/_\ell$ (by R. J. Garner) and apply it to the $1.3 \times 10^{-9}\ c/ft^2$ on p. 3 of USNRDL-LR-70. This gives ~ 2,000 $pc/_\ell$ which agrees with stated value above.

[redacted]

UNCLASSIFIED

[redacted]

It seems that NRDL's arithmetic is okay, but that they should carry it further to milk concentrations or thyroid doses instead of stopping at ground depositions. The 30 degree wind shear used by NRDL could be criticized as too large; however, much uncertainty exists in attempting to advect a 600 m high cloud a distance of 300 km over terrain whose roughness elements average about 600 m.

In conclusion, it is conceivable that hazardous I^{131} milk concentrations could occur off-site from this small event, but that weather conditions should be selectable such that much shear and turbulent mixing would reduce any concentrations to insignificant levels.

HWChurch:5414:cw

Distribution:
H. W. Church, 5414