Chapter 5 Appendix 11

BUSTER-JANGLE SHOT DOG

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Shot Dog of the Buster-Jangle Series used a device which had a high-explosive configuration virtually identical to that of the Nagasaki bomb, though with different fissionable components. Dog was detonated at a height of 431.9 m with the mean atmospheric conditions between burst and ground being dry air density 1.027 mg/cc and atmospheric moisture density 0.006 mg/cc. The ground was taken to be that of Nevada test site (NTS) area 9 with a water content of 8% by weight. The yield of the weapon was 21 kt.

Results shown here for Buster-Jangle Shot Dog have been scaled from those calculated for Ranger Shot Fox. The design features and burst geometries of the two devices were deemed sufficiently similar to make this substitution in the absence of a radiation leakage spectrum calculated explicitly for Buster-Jangle Shot Dog. However, while the relative atmospheric moisture contents of the two shots were very similar, Shot Fox took place in air of approximately 10% greater density than Shot Dog. Thus, scaled calculated results counld not be obtained to compare with the three closest measurement points at Shot Dog.

Measured and calculated sulfur threshold fluence ($E_n > 3$ MeV) are shown in Table 1 and Figure 1. Ranges have been adjusted to account for burst offset from the target point. Two calculation results are provided in Table 1. The first is the neutron fluence with E > 3 MeV at a detector point 1 m above the ground surface. The second is a "sulfur-measurement fluence" as would have been measured by sulfur foils calibrated at a fast reactor. To obtain the latter value the total number of S(n,p)P reactions per unit mass were determined by integrating the product of the appropriate cross section and the calculated fluence over all energies at each detector location. The total reactions were converted to sulfur-measurement fluence by multiplying by the calibration factor determined at a fast reactor facility at a station having a known fluence, E > 3 MeV. The fast reactor spectrum used for this purpose was that at the surface of the APRD reactor.

As can be seen from Table 1 the sulfur-measurement fluence calculation results agree better with the measured values than do the simple fluence values above 3 MeV. Only

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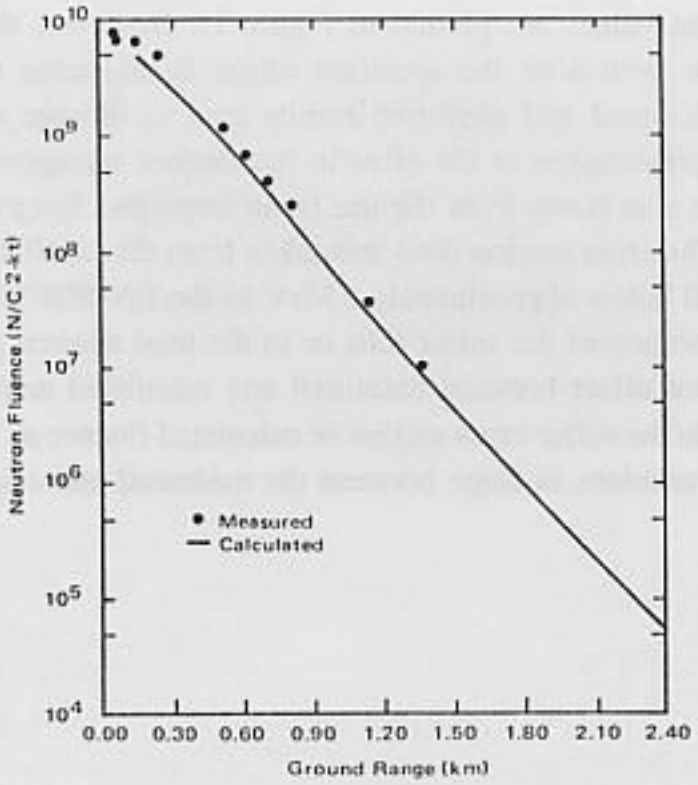

Figure 1. Buster-Jangle Dog "sulfur-measurement fluences" per kt versus ground range

Table 1. Measured and Calculated Sulfur Foil Fluences at Buster-Jangle Shot Dog

Ground[a] range (m)	Slant[b] range (m)	Fluence per kt (cm^{-2} kt^{-1}, E>3 Mev) Calc.[c]	Calc.[d]	Meas.	Δ[e]
96.96	441.76		7.00×10^{9}		
90.03	440.29		7.90×10^{9}		
180.38	467.21		6.62×10^{9}		
271.47	509.36	2.76×10^{9}	3.13×10^{9}	5.00×10^{9}	−0.37
545.43	695.16	7.37×10^{8}	8.34×10^{8}	1.18×10^{9}	−0.29
636.83	768.96	4.43×10^{8}	5.01×108	6.86×10^{8}	−0.27
728.23	846.21	2.65×10^{8}	2.98×10^{8}	4.11×10^{8}	−0.28
819.65	926.05	1.59×10^{8}	1.78×10^{8}	2.41×10^{8}	−0.26
911.06	1007.86	9.50×10^{7}	1.06×10^{8}	1.18×10^{8}	−0.10
1139.62	1218.39	2.74×10^{7}	3.01×10^{7}	3.71×10^{7}	−0.19
1368.19	1434.47	8.14×10^{6}	8.80×10^{6}	1.05×10^{7}	−0.16

a. Ground range from the actual ground zero, which was 56±15 ft north and 36±15 ft east of the target.

b. Slant range from detectors to the actual burst location.

c. Calculated fluence, E > 3 Mev.

d. "Sulfur-measurement fluence" with E > 3 Mev, based on assumed fast reactor calibration; see text for explanation.

e. (Sulfur-measurement fluence - Measurement)/Measurement.

these sulfur-measurement values are plotted in Figure 1. However, these values are still approximately 15% low even after the spectrum might be expected to have reached an equilibrium shape. Calculated and measured results tend to diverge approaching ground zero. This could be representative of the error in the fluence transport as applied to Shot Dog. However, it could also result from the use of an imperfect S(n,p)P cross section and fast reactor spectrum. The cross section used was taken from the LENDL library circa 1975. This compares very well below approximately 9 MeV to the ENDFB V library.

An error in the calibration of the sulfur foils or in the total neutron yield of the weapon could result in a constant offset between measured and calculated neutron fluence values. However, only an error in the sulfur cross section or calculated fluence as functions of neutron energy could result in variations in slope between the measured and calculated values.