Evidence of Enriched Uranium in guided weapons employed by the Israeli Military in Lebanon in July 2006

Preliminary Note

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Background

There has been considerable interest since the first Gulf War in the use of battlefield weapons employing Depleted Uranium and the effects of the fallout from these weapons on local populations. Uranium metal has a high density and is pyrophoric, burning at very high temperatures upon impact with a hard target. This makes it valuable for penetration of armour. It was originally developed for this and showed its value against battlefield tanks in the first Gulf War and later in the Balkans. More recently, there have been suggestions (based on research on weapons patents) that uranium is being used as a penetrator in certain bunker busting bombs and Cruise missiles.

The US and UK military have consistently denied that this is so and owing to the high degree of post battlefield control exercised by the US, in Afghanistan and Iraq, this has been difficult to investigate.

Most recently, there has been suspicion that the Israeli military operation in south Lebanon has involved the use of bunker busting bombs and missiles employing uranium warheads. It is probable that these weapons systems have been supplied to Israel by the United States. 500 guided weapons were supplied to Israel via the UK in July 2006.

The war in Lebanon finished on 14th August. There was heavy bombing throughout the four week conflict. One bomb crater in Khiam resulting from the use of a large guided bomb was reported by Lebanese Press (Daily Star) on 21st August to be mildly radioactive. On 17th September one of us (DW) visited Lebanon and obtained soil samples from various craters left behind by the use of bombs and missiles. A sample of soil from close to this crater was collected and was among other samples brought back to the UK from central and south Lebanon and examined by Green Audit using a scintillation counter and also CR39 alpha tracking plastic methods. Since this sample showed elevated radiation signatures using both methods, the sample was sent to the Harwell laboratory in Oxfordshire for Mass Spectrometry to establish the concentration of Uranium isotopes and the Uranium isotopic signature. Although further work on these samples is underway we report here the preliminary results of these examinations.

The samples

Several samples were obtained from Lebanon. Two samples of soil from the area will be compared in this report. The first sample LS6 was a piece of impacted red soil or clay which had been thrown from the explosion of a heavy bomb or guided bomb which exploded in Khiam in S Lebanon. The crater is shown in Fig 1. The sample had a blackish surface discoloration (see Fig 2). A similar sample was obtained from a separate crater near Taire, in a different area. This sample was LS7 and was also of reddish clay, but the scintillation counter results were lower and were similar to other soil samples from the area. Both LS6 and LS 7 were placed in a lead castle and examined at a distance of 2cm for alpha and beta surface activity using an alpha discriminating Electra 1A scintillation counter with a type DP2 4 inch square probe (Nuclear Enterprises, Beenham Berkshire). In addition the samples were left overnight (for 12 hours) in contact with CR39 plastic slides (see Fig 2) and the alpha tracks were then etched with 6N Potassium hydroxide at 70degrees and counted using a light microscope (See fig 2). This gave a measure of the surface alpha activity.

Fig 1 Crater from which sample LS6 was taken. The sample had been thrown on to a nearby roof. Geiger counter is measuring 700nSv/hr. Background in Beirut is 35nSv/hr.

Fig 2 Sample LS6 with CR39 plastic microscope slide placed on it for alpha track counting. Note the scorched blackish surface. This was scraped off and used for the Mass spectrometric analysis of uranium.

Results

The results are summarized in Table 1 and Table 2. They show that the sample LS6 was more radioactive than either the background or the Lebanon sample LS7 both in terms of alpha and beta activity and LS6 contained significant amounts of Enriched Uranium. This was shown by the isotopic ratio of 108 found by the Harwell measurements using a Mass Spectrometer. The LS7 sample did not contain more Uranium than might be expected in a normal soil and the isotope ratio was representative of normal Uranium.

Table 1 Results: Radioactivity of samples. Counts per second (cps) were averaged over 6 or 12 separate integrations of 60 seconds duration. Standard Deviations (SD) are calculated from the individual count periods.

Sample	**Mass of sample examined**	**Scintillation alpha cps**	**Scintillation Beta (SD)**	**CR39 tracks**
LS6 Khiam	25g	0.04	3.4 (0.23)	128 (16)
LS7 Taire	25g	0.03	2.3 (0.25)	Not measured yet
background		0.01	2.3 (0.15)	58 (5.4)

Table 2 Results: Harwell Scientifics measurements using Mass Spectrometry. For LS6 the surface discoloured layer was used.

	U-238 mg/Kg	**U-235 mg/Kg**	**U total mg/kg**	**Ratio U238/235**	**Comment**
LS6	13	0.12	13.12	108	Enriched
LS6 duplicate	13	0.12	13.12	108	Enriched
LS7	0.92	0.007	0.927	131	Maybe enriched slightly
LS7 duplicate	0.85	0.006	0.856	142	Probably normal

The activity concentrations for total uranium were about 182Bq/kg for LS6 and about 11 Bq/kg for LS7 assuming an activity of about 14MBq/kg for Uranium. Soil Uranium concentrations are usually between 5 and 20Bq/kg.

Discussion

In sample LS6 the isotope ratio was 108 which is indicative of the presence of enriched uranium. The mass concentration of 13mg/kg translates to an activity concentration of about 180Bq/Kg which is high: in a normal soil it would be between 5 and 20Bq/kg. It was the blackish surface material that gave these results. See Fig 3.

Fig 3. LS6 soil sample was taken from this debris.

The normal background isotope ratio of uranium isotopes U238/U235 is 137.88 and examination of uranium in the environment rarely gives results that are significantly different from this. Even near nuclear sites where there is considerable pollution the depletion or enrichment ratio signatures are rarely more than 10 units above or below this value. Depleted Uranium used in weapons is assumed to have a ratio of 450 and Enriched uranium as it is used in a nuclear reactor has a ratio of about about 60 and iun a bomb it is about 25. In West Cumbria, measurements near Sellafield and the MoD site at Eskmeals showed Uranium ratios in soil of as high as 140 (Eskmeals) to 155 (Sellafield). Enriched Uranium ratio signatures are found close to the diffusion plants where nuclear fuel is prepared e.g. BNFL Capenhurst in Cheshire. Enriched Uranium is not natural and does not exist in the environment unless it has been put there by human activity. The existence of a high amount of total uranium and the enrichment signature in the sample LS6 must be a consequence of its use in the weapon that made the crater. There are two possible scenarios. The first is that the weapon was some novel small experimental nuclear fission device or other experimental weapon (e.g. thermobaric weapon) based on the high temperature of a uranium oxidation flash. A photograph of the explosion is shown in Fig 4. Note the large clouds of black smoke that might result from the burning uranium i.e. uranium oxide particles. The second is that the weapon was a bunker busting conventional uranium penetrator weapon employing enriched uranium rather than depleted uranium. We favour the non fission explanation since if the weapon was a fission device, then the levels of radioactivity in the area would be much higher. We believe that the uranium was from the waste stream of a nuclear reactor (i.e. was derived from spent fuel in some way) and was used in a weapon owing to its cheapness. Further work on examining the full isotopic composition of the material using gamma and alpha

spectrometry and its electro microscope characteristics are on-going and results will be reported. The health effects in local civilian populations following the use of large uranium penetrators and the large amounts of respirable uranium oxide particles in the atmosphere are likely to be significant and we recommend that the area is examined for further traces of these weapons with a view to clean up.

Fig 4 The sample LS6 was taken from near the position of this strike at Khiam that occurred on 25th July 2006