Evidence for the use by Israel of a neutron uranium warhead in Palestine and Lebanon

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Abstract

Since 2003 measurements made by Green Audit in Fallujah, Iraq 2003, Lebanon 2006 and Gaza 2008 have provided unequivocal evidence of Uranium residues which show anomalous Uranium U-238/U235 isotope signature ratios. Results of measurements by independent laboratories in Europe and the UK, using different techniques, revealed the presence of enriched Uranium in biological materials and environmental samples including soil, bomb craters and air (as recorded in vehicle air filter dust). From recent 2021 results published in the Journal Nature, enrichment levels in background samples from Gaza show that enrichment ratios have been increasing markedly since 2008. Since enriched Uranium is an anthropogenic substance which does not exist in nature, the question arises as to the source, in the weapons employed by the USA (Fallujah) and Israel (Lebanon, Gaza). It is proposed that the only logical answer is that a Uranium-based weapon exists that produces U-235 by neutron activation and has been deployed. Such a weapon must be some kind of neutron bomb.

1. Background

The issue of the health effects of Depleted Uranium munitions continues to be an area of significant scientific differences of opinion since the weapons began to be employed by the USA in Iraq in 1991, and later in the Balkans. The authorities in the West, employing the risk model of the International Commission on Radiological Protection (ICRP) moved to deny the health effects which quickly emerged in Iraqi populations in the 1990s, including cancer increases and birth defects, by arguing that owing to its very low radioactivity, DU could not be considered as a cause [1, 2, 3, 4]. However, similar remarkable increases in cancer were reported from the Balkans (Serbia) with reports of cancer increases in UN Italian and Portuguese KFOR peacekeeping soldiers stations on areas of Kosovo where DU had been conceded by the USA to have been deployed. A survey by Green Audit of Kosovo in 2001 revealed the existence of DU particles in Djakove, Kosovo, and samples were analysed in the UK [5]. The isotope ratio, Uranium 238/Uranium-235, which in the natural soils is 137.88, showed Depleted ratios as high as 300. Following complaints of US and UK Gulf War veterans of a range of conditions (termed Gulf War Syndrome) which they blamed on their exposure to DU dust, created when the penetrator weapons struck their target and burned significant scientific interest turned to the issue. This contribution will not rehearse the arguments about DU and health. It is concerned with a different investigation.

2. Lebanon 2006

In 2006, Israel bombed the Lebanon. Green Audit was contacted by Prof Ali Al Khobeisi, a physicist and member of the Lebanese Academy of Sciences. He was aware that Busby was a member of the UK Ministry of Defence Depleted Uranium Oversight Board (DUOB) and part-author of the DUOB Minority Report [6]. He was concerned about gamma radiation measurements he had made of a weapon crater in Khiam, Lebanon, which revealed an approximate 8-fold excess in gamma radiation dose rate, relative to background, at the crater.

Busby asked a colleague (Dai Williams) to fly to the Lebanon, and obtain samples from the crater soil and possibly from an ambulance operating in Beirut, where some very large bombs had been dropped to destroy a command bunker. Several samples were brought back and analysed, using both alpha spectrometry in one laboratory and Inductively Coupled Plasma Mass Spectrometry (ICPMS) in a separate one. Later Prof Khobeisi came to the UK with further samples to discuss the issue at the Green Audit laboratory in Aberystwyth. The presence of Enriched Uranium in the Lebanon in 2006 became a Media issue when it was written up by Robert Fisk in the Independent "Israel's secret Uranium bomb" [7]. The UN sent a team to the Lebanon to take samples and Green Audit asked Mr Williams to also take samples so that split samples could be analysed. The Green Audit samples continued to show enriched Uranium, but the UN samples were said to show natural ratios. The issue has never been resolved. The Green Audit results are summarised in Table 1.

3. Gaza 2008

The issue of the enriched Uranium in the Lebanon had, by the time of the 2008 bombing of Gaza, been widely covered by media. In 2009, Green Audit was contacted by doctors in Gaza who were concerned about very unusual weapon effects seen in children and adults exposed to the flash and shock from Israeli bombs and missiles. Busby arranged to visit Egypt to obtain samples, again, vehicle filter samples. However, despite a cover letter from the President of International Doctors for the Environment in Belgium, the UK Foreign Office would not provide permission. Samples were nevertheless smuggled out of Gaza to the UK via the Irish Republic, and measurements made of the Uranium enrichment ratio. As in the Lebanon, results showed presence of enriched Uranium (see Table 1).

4. Fallujah Iraq, 2003

In 2010, a series of epidemiological and environmental studies were carried out to investigate reports of high levels of cancer and birth defects being reported by doctors in Fallujah, where there had been very concentrated bombardment of the town by the US forces in 2003 [8,9,10]. Following a questionnaire epidemiology study [10] which found profoundly alarming levels of genetic damage (cancer, birth defects, sex ratio perturbation) samples of hair from the parents of the birth defect children were obtained and analysed for 52 elements using ICPMS. Results showed significantly raised levels of Uranium (relative to published and control values) but more important, indicated enriched Uranium signatures. The authors pointed out this anomalous finding and speculated that some new weapons had been deployed in the Fallujah bombardment [9].

5. Gaza 2021

An important study of samples of soil, sand, recycled building material from Gaza and sand from Sinai was published in 2021 [11]. Results indicated enriched Uranium in all the Gaza samples except those from Sinai. The method employed was gamma spectrometry which is arguably more accurate than alpha spectrometry of ICPMS since it is a whole specimen method and does not rely on pre-measurement chemistry which is known to lose up to 40% of the Uranium in the sample. The degree of enrichment found by the authors was very much greater than found in Gaza after the 2008 bombing. Gaza had also been bombed by Israel in 2014.

Table 1. Summary of Uranium Enrichment (atom Ratio) in all samples from Iraq and Palestine 2003-2021.

Event/ Date	**Sample**	**Method/ Laboratory**	**U238/ U235**	**Reference**
Fallujah 2003	hair	ICPMS/Germany/ Blaurock Busch	132-135	Busby [9]
Fallujah 2010	soil	ICPMS/ Germany/ Braunschweig	138	Busby [9]
Lebanon 2006 1st trip	Soil crater	ICPMS/ Harwell Alpha / Bangor	133 116	Busby/ Williams [12]
Lebanon 2006 1st trip	Soil crater	ICPMS/ Harwell Alpha / Bangor	112 116	Busby/ Williams [12]
Lebanon 2006 2nd samples	Ambulance filter	ICPMS/ Harwell Alpha / Bangor	117	Busby/ Williams [13,14]
Lebanon 2006 2nd samples	Soil		U235 also U234 excess	Busby/ Williams [13, 14]
Lebanon 2006 1st samples	Crater After explosion.	Geiger counter	20 x local background	Al Khobeisi [12]
Lebanon 2006 2nd samples	Crater	CR39 alpha	2.4x alpha + hot particles	Busby/ Williams [13, 14]
UN 2006	Soil/crater	ICPMS/ Spietz	No anomaly	UNEP [15]
Gaza 2008	Ambulance filter	ICPMS/ Harwell Alpha/ Bangor	133	Busby/Williams [13]
Gaza 2008	soil	ICPMS/ Harwell Alpha/ Bangor	116	Busby/Williams [13]
Gaza 2021	Demolition debris	Gamma Spec./Germany	109	Abd El-Kader et al [11]
Gaza 2021	Recycled plaster	Gamma Spec./Germany	96	Abd El-Kader et al [11]
Gaza 2021	Recycled concrete	Gamma Spec./Germany	103	Abd El-Kader et al [11]
Gaza 2021	Soil	Gamma Spec./Germany	83	Abd El-Kader et al [11]
Gaza 2021	Sand	Gamma Spec./Germany	83	Abd El-Kader et al [11]
Sinai 2021	Sand	Gamma Spec./Germany	126	Abd El-Kader et al [11]
Natural uranium	Soil etc		137.88	Royal Society 2001 [1, 2], IAEA [4] DUOB [6]

* Note: Isotope Ratio U238/U235 calculated from activity ratio reported assuming natural ratio in activity is 21.5

6. Natural Uranium in the environment.

Uranium in the environment, as mined, has three isotopes, U-238, U-235 and U-234. Once the importance for A-Bomb development of the fissile isotope U-235 was realised, various methods were employed from 1943 to construct massive projects to separate the U-235 from the natural Uranium and employed in the Atomic bomb and used in the war with Japan in 1945 at Hiroshima. In passing it is of interest that in separating the U-235 using centrifuges, or methods relying on mass differences, the resulting enriched Uranium also had large quantities of the even lighter U-234, which is a decay product of U-238 (via two short lived isotopes, Thorium-234 and Protoactinium-234m) present in natural Uranium in activity equilibrium with the U-238. Thus, every decay of natural Uranium has the same activity of U-238 and U-234. After separation of the U-235, the resulting Uranium is termed Depleted Uranium, or DU. It is, of course radioactive, and so must be disposed of by law as a radioactive substance. Its activity is considered low, 12.4 million decays per second (Becquerel) per kilogram, and since these decays are alpha particle decays which cannot penetrate skin, it only represents a health hazard if internalised by ingestion or inhalation.

It must be stressed: if enriched Uranium is found in environmental samples, the origin has to be from an enrichment plant or some anthropogenic process. It is not natural. Since enriched Uranium has been turning up in the Middle East, and increasingly so in Gaza, the question arises, where is it from.

7. Enriched Uranium in Gaza, the Lebanon and Iraq.

Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tends to be the difficult ones.

Donald Rumsfeld, Pentagon News Briefing, Feb 2002

There are many questions relating to the findings of Enriched Uranium in Lebanon, Gaza and Fallujah. But logic points to only one overall conclusion, in Rumsfeld terms, a thing we know we know. This is that U-235 is in clear and statistically significant excess: it is present in the samples. In the case of the recent 2021 Gaza study, it is definitely there in 55 of 69 samples. The only samples where it is not clearly present are the 14 samples from Sinai, that is, not from Gaza, and which therefore could be employed as a control group.

WE also know that U-235 in excess can only come from anthropogenic sources:

- It can be separated from the Uranium ore by refining and employing centrifuges or other technical means to remove it on the basis of its slightly lower atomic mass.
- It can be produced by neutron activation. That is the irradiation of U-234 with neutrons. Such a production occurs in a nuclear explosion, or in a nuclear reactor.
- According to the late Prof Del Guidice (see below [16]) it can also be produced by the irradiation of U-238 with neutrons, leading to the formation of U-239 which may lose an alpha particle and produce U-235. The normal decay product of U-239 is Plutonium-239.

Following logical questions, if U-235 is found in the three locations in the Middle East shown in Table 1, there are only two possibilities:

1. The Israelis dropped U-235 which they had produced in Israel or purchased in bombs or other Uranium weapons.
2. The Israelis employed a weapon which contained U-238 but which produced U-235. Such a weapon must produce neutrons, and would be designated a neutron bomb.

The first of these possibilities can be discarded: to drop enriched Uranium on your enemy is absurd. It is expensive. It is like killing your enemy by dropping diamonds. Enriched Uranium reportedly was valued at £250,000 a kilogram in the 1990s [17]. This leaves result (2), which is that the source of the U-235 is a neutron-producing bomb.

8. Neutron Bomb

The known knowns

This contribution will not provide a review of what is known about neutron bombs. The Rumsfeld known known here is that they were apparently invented by Sam Cohen who worked for the Rand Corporation and argued that the employment of an Enhanced Radiation Weapon which irradiated local populations with neutrons was an efficient war method since it killed enemy personnel who were sheltering behind concrete walls or in bunkers without destroying the buildings or infrastructure providing shelter. Cohen argued for the use of neutron bombs in Vietnam, but was sacked by the Rand Corporation which employed him. Later in the Reagan period, Cohen returned to work under Reagan and the USA began to manufacture neutron warheads for anti-ballistic missile systems. By the 1990s it was generally conceded that all the major nuclear States had neutron bombs in their stockpiles. This included Israel which, according to whistle-blowers like Mordecai Vanunu had tested a neutron bomb in South Africa [18]. However, the design of the Cohen type warhead was fairly conventional. It was merely a conventional U-235 warhead of low yield without a Uranium-238 DU tamper case to reflect the initial neutron burst back into the system and thus increase the yield. It contained Tritium and Deuterium and relied upon a fusion reaction to create Helium4 and release neutrons. In this case, the yield (kT TNT) is not the object. The creation of lethal neutron exposures is what is aimed for. In passing, neutrons have between 10-fold and 100-fold biological effectiveness, and so would also be a perfect weapon for those wishing to destroy the genetic integrity, fertility, and longevity (cancer etc) of the enemy civilian population.

The known unknowns: the Cold Fusion warhead—Red Mercury

We know that there are things we know that we don't know. But there are pieces of evidence that suggest strongly that there is a new weapon that involves Uranium, which creates enriched Uranium and which employs cold fusion was invented by the Soviet Union at some time in the 1980s and produced in the 1990s. In the 1990s there were widely discussed reports and statements about a new radioactive weapon based on a material called Red Mercury. The UK Channel 4 produced a documentary about this weapon in which they consulted with Dr Frank Barnaby to see if there could be some explanation. Did Red Mercury exist? What was it? Could it form the basis for a bomb (which one Russian expert told them was the size of a ball point pen cap but could destroy Moscow) [17]. Apparently Red Mercury was a chemical compound, Mercury Antimony Oxide ($Hg_2\ Sb_2\ O_7$) that had been

placed in a reactor for some weeks, was radioactive, and potentially could explode with the level of energy that could destroy Moscow and so forth. Later, after this documentary, the idea that such a weapon was likely or possible was dismissed by the scientific community. And rightly so. Nevertheless, Sam Cohen stated that he believed it possible. But there were some interesting pieces of information about Red Mercury that emerged for those who knew what was important.

Interestingly, Cohen referred to a "ballotechnic" mechanism for Red Mercury. This is an explosive that releases energy on impact purely as a result of impact pressure.

These included:

- The material was being sold at £250,000 a kilogram, and the Soviets were selling it, there were orders and other documents seen by Channel 4.
- The material was very dense, the density was 20g/cc.
- The Soviet code word for Enriched Uranium in the 1940s was "Red Mercury".
- Cohen, who would know, referred to an impact initiation weapon, a "ballotechnic".

It is not difficult to conclude from this that Red Mercury was, in fact, some kind of Uranium which had been processed in some way. Mercury has a density of 13.5, Antimony 6.7 and it is hard to see how a compound of the two could have a density of 20 after irradiation with neutrons for 3 weeks. It is chemically impossible. Uranium does have a density of around 20. In which case, why was this Red Mercury idea started? It is easy to speculate that it was a cover for a real weapon, a novel and very small nuclear weapon based on what was already known, indeed what Sam Cohen is unlikely not to have known.

The Cold Fusion Neutron Bomb

Fusion of Tritium and Deuterium to give Helium-4, a neutron and huge amounts of energy has been and remains the Holy Grail of Physics. The energy of fusion produces enormous temperatures, no nuclear waste in the form of fission products like Strontium-90 and Caesium-137 and the reaction is the one which powers the Sun. But the temperatures involved are so great that the problem is how to constrain the reaction. Normal materials will vapourise and so the reaction must either be very short and/or constrained in a magnetic field.

In the 1980s Fleischmann at Southampton (UK) and Pons in USA claimed to have brought about fusion by electrolysing Deuterium Oxide with Palladium electrodes [19]. The experiment was repeated by the Harwell laboratory in Oxford (the UK government Atomic Energy Authority laboratory) and reported to not occur. Since then, the question of cold fusion has continued to exercise the scientific community [19].

Shortly after the Green Audit report on Enriched Uranium in Lebanon, the author (Busby) was contacted by a Italian physicist, Emilio Della Guidice [16] who travelled to London to discuss his ideas about the finding.

The bomb, he suggested, is a version of cold fusion discovered by Fleischmann. This author (Busby) worked with Fleischmann in 1979 on the Raman spectrum of adsorbed water. Del Guidice said that Uranium dissolves hydrogen (or Deuterium or Tritium) which then becomes trapped in the matrix. This is plausible as the Uranium atom (mass 238) is very large compared with hydrogen (mass 1) so there is a lot of space in the crystal, also a lot of

electrons in the outer shell of the Uranium (92, Hydrogen = 1). Del Guidice believed that if the Uranium laced with hydrogen hit a target and deformed whilst also burning at a very high temperature, there would be fusion. In this case (he said) the 14MeV neutron produced would knock the U-238 up to a metastable U-239 and this would decay to U-235 with emission of an alpha particle. The reaction he referred to is

$$T2 + D2 ===> n(0) + He4 + 14MeV$$

At the time, I believed this. But later thought some more about it. First, U239 decays to Plutonium-239 and not to Uranium-235. Plutonium-239 decays to U-235 with an alpha decay, but with a long half life. But what is certainly in the Uranium is U-234. This would take up a neutron to give U-235. This reaction is a much more likely source of U-235. The second problem with the Del Guidice bomb, is that hydrogen does not dissolve in Uranium. It may have been that (as a physicist, and an Italian) Del Guidice did not use the correct English.

If you heat Uranium metal to 300 degrees it *reacts* with hydrogen to give Uranium hydride UH3. Presumably then also Deuterium and Tritium. These are molecular species, not as Del Guidice told me, a solution or an intersticial affair. When the system gets above about 700 degrees the hydrides decompose back to Uranium and hydrogen. This is the basis for a nuclear power system which cannot melt down as the neutron moderator, hydrogen, reversibly leaves the Uranium and stops the reactor. Neutrons are stopped by low atomic number elements, Lithium, Beryllium, Boron ,Hydrogen. They pass through high atomic number elements (e.g. in concrete). They are stopped ballistically not ionically as they carry no charge. Their relative biological effectiveness (ionisation) results from the kinetic energy they impart to hydrogen in water. As already stated, it is about 100 (alpha is 20).

So a plausible method is as follows: a mix of Depleted Uranium is made with varying quantities of UT3 and UD3. When these are heated up, by explosive or just by impact they do fusion, as Del Guidice believed, producing a massive neutron release of 14MeV and to a lesser extent 3.5MeV plus an alpha particle. There is no tamper, as with thermonuclear, so the neutrons are not reflected back into the bomb but are allowed to escape. The device is very small and low yield. It is reported that countries like Israel and USA had neutron land mines and shells. The key is the very low yield explosion (tons of TNT).

If the neutron activation of U-238 is the case, or partly the case, then there will be Plutonium-239. In the Depleted Uranium Oversight Board, it was reported that Pu-239 was measured in DU residues, also U236, but this was explained away as due to contamination in the source material. However, no Plutonium was found in the Lebanon samples [13].

This weapon is arguably the fabled Red Mercury. It would be small, there is no initiator as it is an impact weapon. Though versions with initiators might also exist. It would be produced from Uranium reacted with Tritium and Deuterium in some ratio, and possibly alloying substance like Niobium (found in excess by Green Audit in the Gaza samples). It could be tunable, the proportion of UT3 and UD3 in the mix is decided in the manufacturing process.

Unknown Unknowns

For obvious reasons, little can be listed here. However, the Del Guidice outline neutron bomb may be only one version of the system. There may be other initiator processes. It is pointless

speculating further here. It is hoped that someone in the military will provide or be forced to provide further details.

9. How might this issue be investigated?

Of course, there will be activation products in local materials, soil concrete etc. I obtained some concrete from the Baghdad airport after the US killed the Republican Guard who were defending it. However, there was no money to measure anything, and by the time the material came to England any excess induced radiation will have decayed. I was told by Iraqis that there was a big flash and they were all found dead in their bunkers the next day. The US would not let IAEA in to measure anything for 6 months and fenced the site off and removed the debris into the desert. Note that Co-60 is an activation product which would have been in the steel. Metal guns, metal shielding, reinforcing rods etc. There would be residual gamma radiation at the impact site. There could be residual Tritiated water and Carbon-14 residual contamination.

The late Prof Ali Khobeisi measured residual gamma in the Khiam Lebanon crater in 2006, radiation which disappeared over 6 weeks. About 20 times background. That is a reasonable decay period for the immediate neutron activation products in soil (except Co-60 in steel). Table 2 gives a list of methods that can be employed to identify the use of a neutron bomb.

Table 2. What methods can be employed to investigate the use of a neutron weapon?

Residue/ investigation	**Measured by**	**Note**
Geiger Counter shows excess gamma dose rate	Geiger Counter, portable scintillation counter	A simple cheap Geiger counter will do this, Compare with background away from crater.
Tritium oxide (Tritiated water in pool in crater	Beta scintillation counting	Requires dedicated lab/ expensive
Carbon-14 excess in water in pool in crater	Beta scintillation counting	Requires dedicated lab/ expensive
U-235 excess in soil at impact site/ in vehicle air filters	Alpha spectrometry, gamma spectrometry, ICPMS	Requires dedicated lab/ expensive. But already done.
Cobalt-60 in steel near crater	Gamma spectrometry Strong emissions at 1173 and 1332 keV are easily detected. Half life 2.6y.	A good portable gamma spectrometry NaI crystal is good enough, or else a laboratory with cooled detectors.
Other activation products, e.g. Zn-65, Ca-45.	Gamma spectrometry will find Zn-65	Requires dedicated lab/ expensive
Pu-239, U-236	Alpha and gamma spectrometry	Requires dedicated lab/ expensive

10. Health effects

This contribution would not be complete without touching on the health effects seen in populations where these weapons were deployed. If the weapons caused exposures to (a) neutrons and (b) Uranium aerosol particles, then it would be expected that there would be genetic effects and immediate effects involving severe burns or even vapourised limbs of humans. No reports of such effects have been published for Lebanon as far this author can find. For Fallujah the genetic effects found were profound, and included congenital malformations, high rates of cancer and leukemia, and a skewed birth sex ratio [8,10].

For Gaza, there have been several reports of excess birth defects together with measurements of elements in hair, including Uranium [20,21]. The authors did not single out Uranium as a cause, but rather seemed to believe that the effects were due to some "heavy metal" effect. It is reasonable from the Fallujah results and other studies of the Iraq and Balkan populations, that these weapons are effectively genetic destruction weapons.

Conclusion and further investigation.

An inevitable deduction from the consistent findings of enriched Uranium in samples from Gaza, Lebanon and Iraq, is that a neutron weapon of some kind has been employed since the second Gulf War, and possible before then. This is an Israeli secret weapon, as reported by Robert Fisk in the Independent in 2006 [7]. The increases in congenital effects seen in the Fallujah population [8,9,10] and also in Gaza [20,21] can plausibly have resulted from exposure to neutrons as well as the Uranium particulate aerosols. The weapon is ideal for armies employed in methodological destruction both of fighters hidden in urban environments (where neutrons pass through walls) and for any State that has the aim to destroy the civilian population using a genetic mutation weapon (cancer, fertility loss, birth defects). It is, however, a nuclear weapon and those deploying it are using a nuclear weapon against civilian populations as part of a cynical project to destroy an enemy State population without acknowledging this, and this is a war crime.

The problem that exists is that the laboratories where samples are measured, using the very expensive equipment necessary to obtain relevant results are mostly funded directly or indirectly by government and the nuclear military complex. Furthermore, as this author found in the case of the UN investigation of the Lebanon craters, the laboratories used by the UN, in this case the Spietz lab in Switzerland, which measured the split samples obtained by Green Audit in 2006 do not tell the truth.

Furthermore, as this author also knows, Scientific Journals often either refuse to publish contributions that address such politically sensitive topics, or their reviewers dismiss results. In the case of a recent paper reporting increases in Uranium from the Ukraine war in February March 2022, found in High Volume Air Samplers deployed at the Atomic Weapons Establishment Aldermaston, UK which was sent to two journals, the first Journal flatly refused to accept it, the second sent it to a reviewer and then dismissed it. Yet the raw data showing the significant increase in Uranium particles in the air were supplied to the journals: a child would have seen the increases.

But the public have access to simple methodology, and at minimum can record radiation in creases near any impact site and now report this on videos that they can upload to the internet. This development, the use of the neutron weapon is a very large ethical and public health issue.

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