From: Cory (Martha) Harden [mailto:mh@interpac.net]
Sent: Tuesday, May 28, 2013 9:28 AM
To: 'Gary.Gill@doh.hawaii.gov'
Subject: comments on draft depleted uranium fact sheet

Please acknowledge receipt
Attachment is identical

Hello Gary Gill,

Thank you for your work on a Hawai'i DU Fact Sheet. Enclosed is "CONCERNS ABOUT DEPLETED URANIUM (DU) IN HAWAI'I", which I hope will be helpful.

To summarize concerns, I quote Marshall Blann, PhD, consultant at Los Alamos and Lawrence Livermore National Laboratories:

> "Many…papers find, in in-vivo experiments, that Uranium isotopes can cross the blood-brain and placental barriers, concentrate in heart, muscle, brain, lung tissue, overaires, testes, bone and lymph nodes…
>
> As the biological effects of radiation have been investigated more extensively, 'safe' exposure levels have been steadily revised downwards…
>
> ..the Pohakuloa area is used for bombing practice, using two-ton dummy bombs. If a bomb were to impact a DU casing, it could cause the pyrophoric DU to ignite, sending a plume of uranium oxide hundreds of feet high in the resulting convection current…
>
> …the radioactive uranium oxide plume would…disperse, not uniformly around the county, but would rain fine oxide particles preferentially in the community winning that day's radiation lottery. …The probability may be low, but the consequences may be high.
>
> ..detectors on the ground would not detect them. [alpha particles]"
>
> *[editorial by Blann, West Hawai'i Today, 9-6-09]*

I would add these concerns: DU that was never accounted for, questionable air monitoring, unauthorized Army activities with DU, Army proposals to avoid Nuclear Regulatory Commission (NRC) oversight, apparent misstatements in Army DU documents, and possible Army DU contractor bias.

Thank you for considering this information.

aloha,

Cory Harden, PO Box 10265, Hilo, Occupied Hawai'i 96721 808-968-8965 mh@interpac.net

CONCERNS ABOUT DEPLETED URANIUM (DU) IN HAWAI'I
for Gary Gill, Deputy Director, Hawai'i State Department of Health
May 28, 2013
compiled by Cory Harden, PO Box 10265, Hilo, Occupied Hawai'i 96721 808-968-8965
mh@interpac.net
(see end for profiles on people who were quoted frequently)

The Army didn't know, or didn't tell, about DU in Hawai'i, then was "outed" by citizens.

[the Army has been] "repeatedly denying depleted uranium use here, most recently in the March 2005 draft environmental impact statement for Makua and at a public hearing for the Stryker brigade EIS in 2004." *[Schofield uranium find prompts calls for probe, Honolulu Advertiser, 1-6-06]*

"Schofield Barracks, Hawaii--In August 2005, 15 tail assemblies from spotting rounds made of D-38 uranium alloy, also called depleted uranium (DU), were recovered…"
[1-5-06 media release by U.S. Army Hawai'i]

"The Army statement was issued several hours after a DMZ Hawai'i/Aloha 'Aina news conference announcing the e-mail findings [revealing the Army had discovered DU]…" *[Schofield uranium find prompts calls for probe, Honolulu Advertiser, 1-6-06]*

The Army planned and conducted unauthorized activities in DU areas.

""The Corps [Army Corps of Engineers] had planned to begin the $80 million [Schofield] construction project with a controlled burn at the range. Instead, NRC staff warned the Corps that it risked sanctions if it proceeded because it has no license to possess, decommission or transport radioactive depleted uranium at Schofield …
the Army conducted an unauthorized cleanup of soil contaminated by depleted uranium at Schofield in 2008…[NRC attorney Brett Klukan told Honolulu Weekly] that the NRC had advised the Army that areas with depleted uranium should not be disturbed." *[Stryker brigade snag, Honolulu Weekly, 11-3-10]*

"…it appears that the scope of activities actually conducted at Schofield Barracks in support of BAX construction, including soil removal and testing, prior to the January 13, 2010 oral argument may be far broader than that described by counsel for the Army at the oral argument." *[letter to Army Col. Gregory Baldwin from Keith McConnell of NRC, 11-4-11]*

"…NRC staff raised concerns regarding the Army's legal authority to perform construction activities at the Schofield Barracks installation, Army statements made during oral arguments before the Atomic Safety and Licensing Board (ASLB) regarding the U.S. Army's possession-only license application at the Pohakuloa Training Area and Schofield Barracks, and Cabrera's legal authority to perform work for the USACE at the Schofield and Pohakuloa installations… *[letter to Dr. Cherry of the Army from Keith McConnell of NRC, 11-24-10, ML103160174]*

Sweeping Army proposals for less oversight were rejected by the Nuclear Regulatory Commission (NRC). *[quotes from Staff Assessment enclosure in memorandum from Dominick Orlando of NRC to Andrew Persinko of NRC, 12-27-12, ML12354A165, bold and indentations added]*

The Army **claimed the spotting rounds did not require a license**, based on a RESRAD "computer model code designed to estimate radiation doses and risks" .

NRC disagreed, saying RESRAD "does not attempt to simulate the environmental conditions present during ground disturbing activities such as a fire or use of high impact explosives and therefore is not relevant to the requirements for air monitoring." *[pp. 1-2]*

"The Army is requesting that NRC **not require environmental radiation monitoring plans.**
The NRC staff has determined that…some environmental monitoring is necessary." *[p. 3]*

"The Army requests that staff **not require monitoring** when personnel or equipment exits the Battle Area Complex (BAX) Radiation Control Areas (RCAs) after training exercises because the Army did not detect contamination on personnel during BAX construction and because the Garrison does not have the equipment or personnel to support monitoring.
The Army did not provide data supporting their statement that they did not detect contamination on personnel or equipment during BAX construction…[NRC] staff does not agree with this request." *[p. 3]*

"The Army requests **relief from environmental monitoring at all DU ranges**.
Because each site will entail different environmental conditions, the [NRC] staff cannot determine *a priori* if environmental radiation monitoring plans will be necessary…[NRC] staff does not agree…" *[p. 3]*

"The Army requests that all changes made to the requirements for installations named in the license be applicable to any newly identified installations…
[NRC] **conclusions** regarding the type of information necessary to support an amendment to include the unidentified installation on the license **cannot be drawn *a priori***…[NRC] staff does not agree…" *[pp. 3-4]*

"**The Army states that [their directive]… does not prohibit firing high explosive rounds into areas containing DU.**
This statement appears to be inconsistent with previous statements made by Army staff since 2010….[NRC decided] If the Army were to implement air monitoring adequate to detect airborne depleted uranium during ground disturbing activities, including firing high explosive ordnance into the RCAs, the license condition could be revised." *[p. 5]*

"The Army requests [revision to]…the license condition [that] applies to site decommissioning and activities that would require the ground to be disturbed with the intent to release the site or portion of the site for unrestricted use and remove it from the RCA…
In the past **the Army has performed decommissioning activities at HI sites** and determined that the areas are suitable for release for unrestricted use. The license condition, in conjunction with conditions 22-24, are necessary to ensure the Army complies with …NRC's decommissioning regulations…the [NRC] staff does not agree with this revision." *[p. 5]*

"The Army requests that the NRC delete the requirement to inform NRC of intended decommissioning at its HI installations…
in the past **the Army has performed decommissioning activities at HI sites** and determined that the areas are suitable for release for unrestricted use. The license condition, in conjunction with conditions 21-24, is necessary to ensure that the Army complies with the requirements of 10 CFR 40.42." *[pp. 5-6]*

"The Army requests that the requirement to perform **continuous air monitoring be deleted**…
[but] the Army's burn data had large uncertainties…[and] RESRAD does not attempt to simulate the environmental conditions present during ground disturbing activities such as a fire or use of high impact explosives…the [NRC] staff does not agree with this requested revision." *[p. 6]*

"The study the Army provided to support the license application concludes that there was plant uptake of DU.

> NRC staff believes that was an inaccurate conclusion because the **data collection was compromised** by mixing the plant ash with soil beneath the plant that contained oxidation products…The only Army studies that have shown plant uptake have been in the plants that absorbed the DU from contaminated surface waters. Therefore, the [NRC] staff does not agree with this revision." *[p. 7]*

Concerns were raised about air monitoring methods.

"A contractor performed air sampling for a year at PTA from February 2009 to March 2010. From the limited description of the procedure (page 34) it appears standard equipment was used for the air sample collection. Although the type of filter and its pore diameter are not mentioned, and the studies appear to be diligent within some imposed limitations, it is noted that the analysis of the filters was for uranium as a portion of the total suspended particulate collected, and not DU. Consequently, it is unknown how much of the total uranium was DU. Further, without knowing the pore diameter of the filter, it is not known how much respirable particulates, including DU are revealed by this monitoring. It is believed the tables used for health guidelines are only for natural uranium…" *[comments on the September 10, 2012 "Army Response to US Nuclear Regulatory Commission (NRC) Proposed License Conditions for Davy Crockett M101 Spotting Round Depleted Uranium (DU)" by Reimer, 10-22-12]*

"My review of the sampling methods used, especially airborne collections, indicate that the methodology was one that would not find DU at the probably anticipated concentration levels." *[e-mail from Reimer to Dominick Orlando of NRC, 7-13-12]*

"First Ask Dr Morrow what did he find versus background control areas in Hawaii. Ask Dr Morrow point blank if his levels exceed or not the IOM health threshold cited by the Army in their appendix. Trick question – no health levels could be set! Ask if the EPA and WHO data specifically cover aerosolized DU dust from weaponry – there are big qualitative differences here." *[9-3-10 e-mail from Pang]*

"I felt that the contractor for the Army, Jim Morrow, was extremely knowledgeable about DU and sampling methods. He is limited by the specifications of the contract…" *[e-mail from Reimer to Harden, 10-27-09, 5:05 PM]*

"…DOH tries to make a survey more sensitive by only considering fancy machinery--they do not seem to appreciate or understand that increased sampling number and sites also makes the survey more sensitive--especially when the target is not homogenous in place and time." *[e-mail from Pang to Jim Albertini, 9-22-09]*

The Army's DU contractor appears biased.

Cabrera Services, which did studies and operations on Hawai'i DU, calls findings of little radiation risk, in Hawai'i and elsewhere, "successes".

Excerpts from a Cabrera brochure—

> Continued to establish **evidence of NO DCSR** [Davy Crockett spotting rounds] **at Makua** and narrowed down the likely **impacted areas at PTA from 2500+ acres to under 500 acres**
>
> Performed Human Health Risk Assessment for SB (Schofield) BAX Construction Area **finding no appreciable risks exist at site…**

Negotiated with NRC and State of Kansas to **dispose of 97% of soil as non-radioactive**…

Negotiated approval for non-rad disposal of over 5,000 cubic yards…

CABRERA performed radiological/chemical characterization and developed a risk assessment model to quantify radiological and chemical risk, **justifying no further action** …

Achieved no further action at LCAAP range, avoiding potential impact to munitions production…

CABRERA has similar successes at other DoD penetrator sites…

[Davy Crockett Spotter Rounds, http://www.cabreraservices.com/media/DCSR%20Program%20Summary.pdf, bold in original]

Concerns have been raised about Army documents on DU.

- **Army Response to US Nuclear Regulatory Commission (NRC) Proposed License Conditions for Davy Crockett M101 Spotting Round Depleted Uranium (DU), September 10, 2012**

DU may migrate much farther than the Army claims.
"There is a generic claim that DU, with a high physical density, cannot be transported more than 100 m. This is an example of misinformation. Transportation distances depend in large part on the size of the material. Generally, larger dust particles have rapid settling velocities but aerosol sizes are influenced by factors other than gravity to determine transportation distances. Even so, dusts from deserts are blown thousands of kilometers before deposition (R.B. Husar et al., 2001, JGR-ATM. 106 (D16): 18317-18330)." *[comments by Reimer, 10-22-12]*

- **Environmental Radiation Monitoring Plan for Pohakuloa Training Area, submitted to NRC, prepared by U.S. Army Corps of Engineers for Army, February 3, 2012**

The plan may contradict previous Army statements that fires could NOT generate tiny DU particles.
"In order to produce particles with an activity median aerodynamic diameter (AMAD) less than 5 µm, M101 rounds must be physically acted upon, impacted or heated to temperatures over uranium's melting point of 700-1,000 degrees Celsius (Army Environmental Policy Institute (AEPI), 1995). **The type of activities that could potentially produce DU particles in the 5-µm AMAD range** are: 1) use of heavy equipment on former M101 ranges could, through mechanical grinding of M101 rounds; 2) kinetic impacts between munitions and M101 rounds; and 3) **incidental range fires or prescribed burns** by range personnel to control vegetation." *[Plan, p. 15, bold added]*

"Under certain circumstances and at very high temperatures, **DU can aerosolize**. Research by military and non-military agencies confirm that **this does not occur during brush fires**." *[2007 Army Information Booklet/ Depleted Uranium (DU) in Hawaii, p. 5, bold added]*

Only about 1,000 of the 51,000 acres of the Pohakuloa impact area were closely surveyed.
"Aerial gamma surveys and gamma walkover surveys (GWS) surveys [sic] were performed over a total of 936 and 50 acres, respectively." *[Plan, p. 6]*

DU may settle in "hot spots"--not be evenly distributed. (*see next section)*
"The 299 pounds of DU was assumed to be evenly distributed over an area of 10,000 square meters to a depth of 0.457 meters (18 inches)." *[Plan, p. 12]*

- **Final Pohakuloa Training Area Firing Range Baseline Human Health Risk Assessment for Residual Depleted Uranium, submitted to Army by Cabrera Services, June 2010**

DU may settle in "hot spots"--not be evenly distributed

"To estimate the dosage workers in the area might encounter, the starting point [in Army reports on Hawai'i DU] was a radioactivity density obtained by dividing the estimated total amount of DU used in the training/firing area, by the area of the range to get the radiation per unit area. Sounds mathematically obvious, but let us (at least my fellow ancient mariners) think back to the cold war days of atmospheric testing of nuclear weapons in the upper atmosphere. With the assumption that the total radiation produced was divided by the surface area of the earth, it might have been estimated that the fallout would be at 'safe' levels. Unfortunately for this mathematical construct, many folk bought Geiger counters and checked around their neighborhoods, thousands of miles from 'atmoshpere zero'. The meters would give an occasional 'beep', then the detector would pass over a tiny speck of ash and the speaker would go crazy, the needle would 'peg out' at maximum radiation level for the meter.

The radiation had not spread uniformly according to the assumption, but fell out in tiny highly toxic pieces of ash, fluctuations from a safe average. The dangers of this potentially lethal fallout were recognized (after citizen groups called it the attention of their governments), and in a cold war these feuding governments signed a treaty banning further atmospheric testing…" *[comments by Blann; final draft published in West Hawai'i Today about 10-8-10]*

There is no "safe" level of radiation.

"The present industrial standard to my own experience, is 'ALARA', an acronym for 'As Little As Reasonably Attainable'. This is because in the past, the published 'safe' doses were adjusted downward by huge factors (e.g. to 1/3 last values), and it was finally realized that there is no 'safe' level. Each bit of exposure increases risk of biological damage. And workers on the range (and possibly citizens outside) are subject not to average levels, but the fluctuations along their daily path.

Because all labs in which I worked would immediately clean up any 'spill'- i.e. uncontained spread of radioactive sources, the recommendation to 'leave in place' the contamination at the range comes as a surprise. It will not be practical to recover it all, but an action in between, coupled with procedures to mitigate spreading outside the range seems prudent." *[comments by Blann; final draft published in West Hawai'i Today about 10-8-10]*

[the BHHRA]"…ignores U.S. Environmental Protection Agency's pronouncement that any exposure to ionizing radiation linearly increases risk." *[9-4-10 Commentary by Michael Reimer in West Hawai'i Today]*

DU increases in radiation over time.

"DU, unlike other radioactive materials that have decreasing radiation over time, DU actually increases in radiation, small but detectable. .."*[9-18-10 e-mail from Michael Reimer]*

DU may contain other isotopes.

"… if uranium is processed from spent fuel rods, because nothing can be absolutely pure, it retains some of the fuel rod isotopes…Uranium -236 is a good indicator of fuel rod processing and should be looked for when doing analyses. In fact, the spotting round fragments shoudl [sic] be analyzed to answer this question." *[9-18-10 e-mail from Michael Reimer]*

"I further challenge someone to prove there are no other transuranic radio elements in the DU alloy, such as neptunium, plutonium, or for that matter even other isotopes of uranium…" *[9-4-10 Commentary by Reimer in West Hawai'i Today]*

[Jim Morrow, contractor for the Army] "felt frustrated that the Army would not analyze one of the DU fragments to see if it contained transuranics and what the DU ratios were." *[9-3-10 e-mail from Mike Reimer]*

Other concerns…

"…the recently released Baseline Human Health Risk Assessment from depleted uranium on the Big Island is, at best, an estimate using scant empirical isotopic data to substantiate its conclusions… The risk assessment is the conclusion of a single model approach and there are numerous models that could have been used in determining risk. I take issue with the…claim that DU has 40 percent less radioactivity than natural uranium…It is misleading and technically wrong…. I challenge anyone to tell me in good conscience that the DU remaining at PTA from the Davy Crockett tests in the 1960s has 40 percent the radioactivity of natural uranium. … consideration of alternate expression of risk should be discussed and included… It ignores the emerging science that DU and its alloys or oxides in lesser quantities than natural uranium may indeed elevate risk from exposure. It ignores the fact that 40-plus years of bombing may have created aerosols capable of rebound or resuspension and be transported many miles anytime there is renewed disturbance of the surface." *[9-4-10 Commentary by Michael Reimer in West Hawai'i Today]*

"They mention oxides but did not enter their factors of insolubility into the risk equation. They need to be weighted regarding their comparatively slow (50 fold) clearance from the body due to aqueous insolubility." *[9-4-10 e-mail from Lorrin Pang]*

The report is "ignoring the form of Uranium as an oxide" *[9-1-10 e-mail from Mike Reimer]*

Jim Morrow "is measuring total uranium, not DU. So of course his risks show 10,000 times less based on U exposure. He must then ASSUME U and DU are the same and that has not been proven." *[9-1-10 e-mail from Mike Reimer]*

- **Final Technical Memorandum for Pohakuloa Training Area (PTA) Aerial Surveys, prepared for Army by Cabrera Services, July 24, 2009**

Over 2,000 spotting rounds may have been fired at Pohakuloa, based on three lines of evidence: old training manuals, the number of pistons found, and the Archive Search Report.

Manuals:

"U.S. Army Colonel Killian…said the types of exercises conducted at PTA (Pohakuloa Training Area) would require the firing of at least 2,050...spotting rounds." *[Depleted Uranium at Pohakuloa, West Hawai'i Today, 2-4-09]*

"**Killian** …if you go through the training manuals of the era…it would require more than 714 rounds over an 8 year period of time to qualify the requisite amount of crews…
Councilmember Hoffmann Is there any possible support for a figure of 2,000 spotting rounds at PTA?
Killian If you, if you do the math, if you extrapolate the math with the, the contemporary training manuals I think you'd come up with number of 2, 050."
[from Harden's transcript of the official DVD of Hawai'i County Council Public Works & Intergovernmental Relations Committee meeting, 2-3-09]

Pistons:

"An environmental consultant [Peter Strauss, hired by Sierra Club] estimated there may be as many as 2,000 depleted uranium rounds at Pohakuloa Training Area…The consultant's analysis

was based on an Army report estimating that between 120 and 400 firing pistons are scattered around impact ranges at PTA…Each piston would have fired up to five of the DU rounds, for a total of between 600 and 2,000 rounds fired, Strauss said." *[Sierra Club consultant disputes Army's DU tally, Hawai'i Tribune-Herald, 8-26-08]*

Archive Search Report

"Total rounds verified shipped from Oahu from Lake City Ordnance Plant were 714 rounds… It is highly probable that additional stocks of the Cartridge, 20 mm Spotting M101 were order [sic] from one of the Ordnance Depots (Letterkenny or Pueblo) during the six active years of the Davy Crockett Weapon System in Hawaii." *[ASR p. 41]*

Thorough surveys were impossible.

"The Army acknowledged in its license application that rough terrain and hazards presented by unexploded ordnance made it impossible to conduct a thorough survey for DU at Pohakuloa and Schofield." *[Waste not, Honolulu Weekly, 10-17-12]*

"…the overflights are using equipment to detect very low energy gamma rays from the decay of the material. They have stated that to detect a spotting round, it must be at the surface and to detect fragments one-third the size of the spotting round, they can be buried no deeper than 2-4 inches." *[e-mail from Reimer to Harden, 12-18-09]*

Instead of 2,000 spotting rounds, only a few rounds and fragments were found. Cabrera speculated the missing rounds had been cleaned up.

"…the team located a Davy Crockett SRB…" *[Final Technical Memorandum, Depleted Uranium Scoping Investigation, Makua…Pohakuloa…Schofield…prepared for Army by Cabrera Services, p. 4-3]*

"Ground based GWS [Gamma Walkover Survey] located and identified 2 DU metal fragments, one essentially intact spotter round body with no tail fin assembly...and one aluminum tail fine [sic] with some DU spotter round body still attached. …
The number of DU spotter round bodies, aluminum fin assemblies and DU fragments are much fewer than would be expected given the total number of pistons which were identified.
This fact, and in comparison to the number of DU fragments and portions of the Davy Crockett spotter rounds found at Schofield Barracks, suggests that some type of range clearance may have occurred at PTA." *[Memorandum pp. 5-1 to 5-2, indentations added]*

But there are other possibilities.

"…the "ENVIRONMENTAL RADIATION MONITORING PLAN FOR DEPLETED URANIUM AND BERYLLIUM AREAS, YUMA PROVING GROUND" (Ebinger and Hanson, Los Alamos Report LA-UR-94-1838, May 11, 1994) prepared for the U.S. Army Test and Evaluation command [notes]…fired rounds have the propensity of skipping across the surface, like a thrown stone skipping across water, ending up at distances much greater than the calculated range of the munitions.
…as the firing ranges searched for DU have been used for training with explosive ordinance and vehicular traffic after DU was used, the DU may have been highly distributed as aerosols from the decades of continued explosions and grinding under tires and tracks of vehicles. Now continued use of these areas will only result in the continuous airborne resuspension of the material."
[e-mail from Reimer to Dominick Orlando of NRC, 7-11-12]

"[perhaps] …the searches were conducted in areas that were not primary target areas." *[e-mail from Reimer to Harden, 7-8-12]*

"…Fort Benning range personnel recently found a Davy Crockett piston on a range that previously was not an area of interest to the research team." *[Robert Cherry of the Army speaking at a November 16, 2010 meeting with the Nuclear Regulatory Commission (NRC), from meeting transcript, pp. 34-35]*

Aerial searchers looked for highly visible back/ rear plate assemblies as markers for old spotting round areas.

> "The components of the Davy Crockett system particularly back plate assemblies and windscreens have a very distinct coloring as seen in photos 4-4 and 4-5 [actually 4-9 and 4-10] and are readily observable from the air." *[Memorandum, pp. 4-26 to 4-27]*

But the Davy Crockett could be fired from a truck. [[Archive Search Report On the Use of Cartridge, 20mm Spotting M101 for Davy Crockett Light Weapon M28, Schofield Barracks and Associated Training Areas, Islands of Oahu and Hawai'i, Army Corps of Engineers, May 2007, p. 3-11]
This might leave back/ rear plate assemblies on the truck instead of on the ground.
Hawai'i had 14 trucks for the Davy Crockett. [ASR p. C-291]

Hazardous disposal practices were used during the spotting round era.

> "…until the late 1960s, ocean dumping was one of the ways chemical agents and munitions were routinely disposed of since World War I. The other means were **open-pit burning and land burial**…" *[Honolulu Star-Bulletin, 11-9-05, bold added]*

The spotting rounds might have been treated as scrap, since a 1961 study recommended

> "that all spotting rounds be left in the impact area and that the impact area not be considered a radiation area. This suggestion was favorably considered by the…Atomic Energy Laboratory [of the Atomic Energy Commission] *[Uranium Alloys for Critical Ordnance Components, Watertown Arsenal Labs, 23 Oct 1961, p. 3; ASR p. 5-26 and p. C-120]*

A memo describes how scrap from range clearance (not DU, not from Pohakuloa) was dumped into a crater in 1962--

> "The 6th Ordnance Detachment (ED) conducted range clearance in the Lalamilo Farm Lot, near Kamuela, Hawaii, during 19 February 1962 through 2 March 1962. Recovered were 800+ items of which 333 were destroyed by demolition and the remaining items were classified as scrap. With permission received from the Base Camp Commander, this scrap was dumped into a crater in the artillery impact area at Pohakuloa." *[Appendix C-20, NARA College Park, Maryland (CP), Report for HQ, United States Army, Hawaii, APO 957 entitled Staff Office Report, Office of the Ordnance Officer, January-March 1962, dated spring 1962, RG 550, Records of the United States Army, Pacific, Entry 17, U.S. Army Hawaii 1959-1963, Box 10, CP-121406-003, in ASR, p. C-296]*

Contrary to the Technical Memorandum, DU seems to be present, and in the dangerous oxidized form, and mobile.

"The report makes a comment that from the soil sampling done at PTA, there is no evidence that DU is present. This is based upon isotopic analysis of uranium and that the signature is not consistent with that of DU.
Insufficient information is provided to state that conclusion and the data provided do, in fact support the alternative conclusion. The results of a 2007 soil analysis is presented in Table 2-1 and the location of the nine samples are referenced to Table 2-3. There is no table 2-3 but the locations do appear on Figure 2-2. Table 2-1 lists the activity for uranium isotopes. The soil samples were collected in areas where sediment had or may have collected from past

runoff or erosion. That seems to indicate it could be a time integrated sample with several or multiple sources along the lines of flow contributing to the sediment accumulation. The text on page 2-3 states “None of the results indicate uranium depletion, where the 234-U activity concentration is significantly lower than the238-U activity concentration.”
Although it might be useful to define “significantly lower,” the amount as presented by the IAEA in a question and answer information sheet should suffice to indicate this magnitude. http://www.iaea.org/NewsCenter/Features/DU/du_qaa.shtml
The activity ratio of natural uranium 234/238 is 1, suggesting secular equilibrium. The activity ratio of depleted uranium 234/238 is 1:5.5, a lower value, and up to the reader to determine degree of significance.
Of the 9 samples listed in Table 4-1, three have activities of 234-U below that of 238-U. Sample 4011 is 25 percent lower. A reasonable challenge to the “no DU” statement can be made based on the analytical results and the method of sample collecting. As the sample could be integrated over time and derived from several locations, it is very likely a mixture of natural and DU contaminated soils. Thus, DU is not only present but it is mobile!
…The report states (page 2-3) “The visual and scanning surveys identified no distinct surface areas with yellow, oxidized DU metal fragments.” Yet the figure Photo 4-1 (page 4-7) clearly shows a partial metal DU fragment of a spotting round with yellow coloration on its surface. Later (page 4-8), the report states that only very minor oxidation is present, but again the subjective characterization is open to interpretation. Regardless, there is oxidation present and the oxidized form is readily converted to aerosols and thus available for migration.
[e-mail from Reimer to Harden, 10-27-09 6:08 PM]

[Army] “reports on airborne U concentration state they follow the WHO guidelines on soluble uranium…DU and DU oxides are not soluble (have a low solubility). I think WHO groups the two anyhow. Also, ASTDR (agency for toxic substances and disease registry) looks at chronic exposures and uses soluble uranium as a guide. When entrained in your body, the soluble U has a more rapid clearance time and is considered less of a health risk.” *[e-mail from Reimer to Harden, 9-25-09]*

Helicopter searches may have failed to find DU because rotor wash blew it away.
“This report primarily summarizes on an air mapping of the Pahakuloa Training Area to search for DU, and oxides of Uranium which may have resulted from DU on the range. I would like to analyze the sensitivity/adequacy of the methods used. Before getting to those calculations, I would make comments on the technique used, and on the data for alpha spectrometry presented in the report.
“Data collection:
A set of 4 NaI detectors were used under a helicopter flying at 3-4 meters altitude.It was noted on p 4-15 of the report that flight restrictions were required " due to the presence of lightweight debris (plywood, aluminum scrap, aluminum target, and munitions debris) which could become airborne due to helicopter rotor wash. Volcanic dust limited the minimum altitude in places throughout the range". It seems reasonable to assume that the Uranium oxide dust, a contaminant critical to measure, would likewise be blown away by the same rotor wash before it could be measured.” *[comments by Blann, 7-24-09]*

The soil sample analysis method may have been inappropriate.
“Alpha spectrometric results:
Table 4-1 gives results for soil sample analyses by alpha spectrometry, on p. 4-1 " by a NELAP accredited laboratory using method ATSM-D3972."
I assume that this meant to be "ASTM-D3972", which is a protocol for testing water samples for U. Water samples differ from soil samples, especially if trace alpha emitters are the focus. The protocol cited is not valid. How was a weightless sample obtained for the alpha spectroscopy?

The soil sample would have to be completely dissolved. Before running through an anion exchange column to get the U fraction, how was the bulk of silicon etc. removed? If by precipitation, then likely trace radioactivities were co-precipitated and lost to the sample. My point is, that there is a lot of chemistry to be done before being able to do meaningful alpha spectrometry on a soil sample; citing an inapplicable protocol leaves me with no confidence in the table presented. "Trust me" is not an acceptable basis for a scientific report." *[comments by Blann, 7-24-09]*

Aerial survey methodology may have been inappropriate.

"Results of aerial survey:

Is the methodology appropriate to the task? In flyover radiation counting, 4- 4 liter volume Tl activated NaI detectors were used to gather gamma spectra, looking for 766 and 1001 keV photons emitted by 234mPa decay.To evaluate sensitivity, we need to know the branching ratios for the gammas observed, the photopeak efficiencies of the crystals for those gamma energies, and the detector solid angle. Tthe 1001 keV gamma has a branching ratio (abundance per decay) of just 0.8% (0.008)[NIM in PhysicsResearch, A424(1999)425-443], and the 766.36 keV gamma has a branch of 0.294, with a transition at 781.37 (0.00778 branch) which would be non-resolvable from the 766 using the NaI crystals of this measurement. I do note a discrepancy in branching ratio for the 1001. KeV photon with a branch of 0.837 in the Nuclear Data Table result, vs. the 0.0083 of the published research paper. The latter result seems accepted in other works- but this point needs further scrutiny. If the published paper cited is correct, Cabrera was seeking a phantom." *[comments by Blann, 7-24-09]*

Blann recommended a "more sensitive assay of ground radiation".

"Solid angles: The altitudes cited were of 3-4 meters height. NaI detectors are usually right circular cylinders with PM tube mounted at the top of the cylinder with suitable reflector/light pipe. Resolution is poor for these detectors (e.g. vs. (HP)Ge), and the photoefficiency for the 2 gammas of interest is not cited- a guess might be around 0.4 (40%). Lacking the data on detector geometry, we might generously assume a cubic 4 liter crystal, so that one face would be 252cm**2. At 3 meters height, the area of a sphere would be 1.13x10**6 cm**2 (1.13 million square centimeters), so the solid angle of one NaI detector would be 2.2*10**(-4) . At 4 meters altitude the solid angle would be reduced to 1.25*10**(-4).

Count rates required for detection: The report states that the detector system travelled at 2-3 m/sec, with countsbeing taken at 1 second intervals. My own guess is that a minimum of 50 counts of either gamma would be required to resolve the appearance of a possible peak rising above the Compton scatter plus cosmic ray background. Trying to concentrate analyses of these gammas on just' regions of interest', without a proper unfolding of photo/Compton responses, beginning at the highest energies and working down, or by simultaneous least square fitting, is to my opinion asking for questionable results.

If the solid angle is 2.2*10**(-4), the BR(branching ratio) is 0.294, and the photopeak efficiency of the detector is 0.4, the number of dps necessary averaged over the 2-3 meters travelled, will be (50 counts detected)/[(0.4 photopeak efficiency)*(0.00022solid angle)*(BR=0.26 or 0.008)= 1.7*10**6 or 5.5*10**7 Pa234 dps. Since there is transient equilibrium with 238U, 234Th and 234Pa- and 234U, the actual dps implied will be triple these numbers. If the altitude during sampling were 4 m, these numbers would all be approximately doubled due to reduced solid angle. I have not divided by 4 due to use of 4 detectors, because I believe that each will require the 50 counts to be able to separate peak from background. If better detail had been given in the report, this point could be based more on fact than experience. From this exercise I deduce that the gamma ray measurements would only yield positive detector response if the average ground radiation levels were 4.5 milliCuries for the 1001 keV gamma, or nearer 0.15 milliCuries for the 766 keV gamma.

These levels are the noise levels below which I believe definite, reliable 'signals' would not be received by the apparatus used. The gear apparently had no anti-coincidence shielding, nor was discussion given of any attenuation between 'sample' and detector. I do not feel that this lower level of radiation gives confidence in the safety of the facility for personnel working there, nor does it address the question of possible migration of oxides offsite over the past 40 years. A more sensitive assay of ground radiation should be undertaken." *[comments by Blann, 7-24-09]*

- **Final Technical Memorandum, Depleted Uranium Scoping Investigation, Makua...Pohakuloa…Schofield…prepared for Army by Cabrera Services, April 2008**

  Difficult, dangerous conditions prevented a thorough search at Makua.
  "…the vegetation was very dense, and the aerial survey was limited to ravines and dry stream beds. No pistons were spotted during the aerial survey of MMR. Physical entry to range areas was precluded by safety concerns… No DU fragments were identified at MMR." *[Memorandum p. 4-1]*

  Some identical text appears in reports for different sites.
  "…the final technical report reads the same of PTA as it does for Makua." *[e-mail from Reimer to Harden, 10-1-09]*

  Identical photos—with different labels—appear in reports for different sites.
  "In the Makua technical memorandum, the text refers to figures 4-4 and 4-5 showing oxidized parts of DU spotter rounds. Both photographs are labeled photo 4-5. The same two photos appear in the PTA final technical memorandum labeled as 4-9 and 4-10 but are not referenced in the text as far as I noticed. One might reasonably ask if these parts are from Makua or PTA or are they simply staged photos for illustrative purposes?" *[e-mail from Reimer to Harden, 10-1-09]*

- **Final Characterization Report, Schofield Barracks Davy Crockett Impact Area, April 2008**

  Again, difficult, dangerous conditions prevented a thorough search.
  "Due to the steep slopes and safety considerations, a GWS (Gamma Walkover Survey) was not performed of the ravines." *[Report p. 3-5]*

- **Final Technical Memorandum, Schofield Barracks Firing Range, Monitoring of Air Quality During Burning of Vegetation, by Cabrera Services for the Army, April 2008**

  NRC criticized the study.
  "…the Army's burn data had large uncertainties…" *[Staff Assessment enclosure in memorandum from Dominick Orlando of NRC to Andrew Persinko of NRC, 12-27-12, ML12354A165]*

  Surface scrapes of ash, soil, twigs and sticks were substituted for ash samples.
  "The sampling design for collecting ash samples was to place vegetation in a foil tray during the burn and collect ash from the tray following the burn. However, activities of the Army personnel during the prescribed burns and high winds potentially affecting the ash or the foil trays made this approach impractical. Therefore, ash samples consisted of surface scrapes that included a mixture of soil and ash…" *[Memorandum p. 2-3]*

  "…surface scrapes were used to collect ash samples, although some surface soil and solid material (e.g. twigs, sticks) were included in the samples. The wind continually stirred up the ash making it difficult to collect ash samples." *[Memorandum p. 3-4]*

"I am truly unimpressed at the care in some sample monitoring at Schofield…when the wind was too strong to collect the filters for aerosol determination, some brushings from the soil were used instead for analysis." *[commentary by Reimer, West Hawai'i Today, 9-4-10]*

One air sampler failed.
"…eight air samplers were deployed around the test burn area…Following the test burn it was found that the air sampler for filter 1050 had shut down during the test burn. …Air filter 1050 was analyzed to provide qualitative information on the presence of DU." *[Memorandum p. 3-4]*

Some post-burn samples were collected away from pre-burn sample sites.
"…three of the locations where pre-burn soil and vegetation samples were collected had not been burned. … Five ash samples were collected from locations where sufficient amounts of ash were present for sampling, but not corresponding to the soil and vegetation sample locations selected prior to the burn." *[Memorandum p. 3-4]*

Pang says the study shows DU contamination and numbers were too small for analysis.
[the Memorandum] "…uses U 238: U 234 ratios and clearly shows the targeted burn site was highly contaminated with DU. …For air sampling the numbers are too small for statistical analysis…" *[e-mail from Pang to Harden about May 2008]*

- **Army Information Booklet/ Depleted Uranium (DU) in Hawaii, 2007**

There are contradictory statements about the size of DU remnants.
"…the uranium primarily exists as large metal fragments…" *[Booklet p. 5]*

"Most DU found in the Schofield impact area is in the form of flecks and grains.." *[Booklet p. 5]*

"DU fragments have been observed throughout SBIA [Schofield Barracks Impact Area] as discrete metal fragments and as fine particulate matter." *[Schofield Characterization, p. vi]*

The Army did not do monitoring as promised.
The booklet says

> "The Army will…continue to monitor these ranges to determine whether migration occurs." *[Booklet p. 6]*

Later I wrote to Col. Killian

> "Was there any monitoring for airborne DU or other radioactivity during or after impacts from several 2,000-pound bombs dropped on October 23, 2007?" *[letter from Harden to Killian probably in 2008]*

He wrote back

> "The Army did not monitor these events." *[letter from Killian to Harden, 4-15-08]*

<u>Concerns were raised about a civilian report.</u>

Waiki'i Ranch DU Report July 2008
Including: Report on Uranium Isotope Analysis, done for Waiki'i Ranch by Prof. Randall Parrish, NERC Isotope Geosciences Laboratory, British Geological Survey

DU was found at the detection limit of the technique, so the actual measurement could range from zero to twice the measured value.
"The value of this quantity we measured in your sample was 5 x10-7, in other words this measurement is just at our detection limit." *[Report on Uranium Isotope Analysis, done for Waiki'i Ranch by Parrish]*

"The analysis showed a uranium ratio suggestive of DU but at a concentration that was close to the lower detection limit of the technique, resulting in a "trace within a trace", but it was still there!" *[comments on the September 10, 2012 "Army Response to US Nuclear Regulatory Commission (NRC) Proposed License Conditions for Davy Crockett M101 Spotting Round Depleted Uranium (DU)" by Reimer, 10-22-12]*

"Initially the army argued that since the uncertainty of the measurement was plus or minus 1% and 1% was found perhaps the real value could be zero—and so they declared that none was detected. It was pointed out that it could have equally been 2%--and they stopped making this claim. …" *[e-mail from Pang to Harden, 5-23-10]*

"I also agree that a measurement with an uncertainty that is as large as the measured value itself could range from zero to twice the measure value." *[e-mail from Allen, 7-20-09]*

"If he [Parrish] is going to say that the reading is 1% DU with a measurement error of 1% then it might really be 2%...can one do a back calculation to see if even at 1% of the U being DU is that compatible with the amount of DC [Davy Crockett] weapons that they report used?" *[e-mail from Pang, 7-19-08, 8:19 AM]*

Particle size was not measured, though smaller particles are more hazardous.
"I will assume that all the DU would be the oxide form in fine dust without the self-shielding vs larger chunks of natural uranium…oxidized forms persist in the body for decades…" *[e-mail from Pang to Harden, 5-23-10]*

"Unfortunately, the method used to analyze the sample does not measure particle size…This parameter is important for reasons Dr. Pang mentioned. Yes the smaller particles will travel farther downwind and pose more of a health risk…A question to consider is does dust with 7 ppb (or 14 ppb) DU fall within the acceptable range of exposure to DU?...oxidized forms [of U] are more dangerous. The rate of oxidation will depend on particle size."
[e-mail from Allen, 7-20-09]

"..they should take electron microscope pictures of the uranium found in Hawai'i to see if it had been fired. Uranium burns at 3000 to 6000 degress Centigrade (at ambient temperature due to friction) and creates the serious biohazard metal fumes and nano-particles." *[e-mail from Bertell, 7-16-09]*

"…the health risk and relevance must take into account the size and chemical (oxide) composition—versus the background U…does not the ratio of DU/ U change versus distance from target site?" *[e-mail from Pang, 7-19-08, 11:44 AM]*

There was only one sample.
"Dr. Pang is correct that a single sample does not provide statistical data…" *[e-mail from Allen, 7-20-09]*

"Suppose the wind variation and the on ground DU distribution made aggregate dust sampling non-homogenous, just as a person's blood glucose level changed form hour to hour. Now suppose that you tried to determine if a person was diabetic from a single sample—worse yet if an entire population's diagnosis of diabetes depended on that single sample." *[e-mail from Pang, 3-11-09]*

"It is hard to do statistics with a sample of one…" *[e-mail from Pang, 7-19-08, 8:19 AM]*

DU from spotting rounds may ignite spontaneously.

"…depleted uranium was ultimately selected [for munitions] because of its…pyrophoricity (spontaneous combustion upon exposure to air)." [*NRC Fact Sheet, License Application for Depleted Uranium at U.S. Army Sites, August 2009]*

"Uranium, especially in concentrated fine grained form, is pyrophoric at ambient temperatures…" *[Comments of Depleted Uranium Information by Bertell, 12-18-07]*

"Chemically, DU is identical to "normal" uranium…At room temperature, humidity can promote the oxidation of uranium. When uranium is fragmented in chips, powder, and turnings, the metal becomes pyrophoric, spontaneously ignites in air." *[DU Technical Brief, EPA 402-R-06-011, Dec. 2006, p. 20]*

Wildfires and controlled burns may disperse DU.

[a study] "…concludes that fires in forests where depleted uranium is present can cause the DU to be carried in the air…only small amounts of depleted uranium are dispersed by fires. The study said the dispersal of DU can happen whether the fire is a wildfire or a controlled-burn conducted for forest management." *[Depleted uranium at JPG [Jefferson Proving Ground] on meeting agenda for tonight, Madison Courier, 7-18-06]*

"The Cerro Grande [nuclear research facility area] fire did contribute a higher [radiation] dose to the public than the Viveash [area with no human-made nuclear material] fire…both doses wer 1/10,000th the federal radionuclide NESHAP [acronym not defined] limit…" *[Volkerding, Comparison of the radiological dose form the Cerro Grande fire to a nautral wildfire, environment International, 29 (2003) pp. 987-993]*

Animals may carry radioactivity out of RCAs (Radiation Control Areas).

At Hanford nuclear reservation in Washington state, rabbits, mice, wasps, flies, and gnats have become contaminated. In 2009, 33 contaminated animals or animal materials (such as droppings) were reported on the site.

A new water well is not being checked for DU.

Dr. Cherry of the Army said they will do their best to check for DU in exploratory water wells planned for Pohakuloa—but project manager Don Thomas says he's not doing that. [my notes from 7-12-12 Army/ NRC meeting; my correspondence with Thomas about 2012]

…….

Profiles

Stephen Allen PhD, assistant professor of chemistry, Hawai'i Pacific University

Rosalie Bertell member of International Physicians for Humanitarian Medicine, laureate of United Nations Environmental Programme Global 500 Roll of Honor

Marshall Blann PhD, consultant at Los Alamos and Lawrence Livermore National Laboratories, Physics Directorate at Livermore, professor at University of Rochester

Lorrin Pang former Army doctor, consultant to the World Health Organization, head of Maui Department of Health (but speaking on DU as a private citizen)

Michael Reimer PhD in geology, 25 years at U.S. Geological Survey working on radiation in the natural environment, National Academy of Science postdoctoral fellowship at the National Institute for Science and Technology, research professor at Colorado School of Mines