State of Utah

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DIVISION OF WASTE MANAGEMENT
AND RADIATION CONTROL

Douglas J. Hansen
Director

February 27, 2023

Vern C. Rogers, Director of Regulatory Affairs
Energy*Solutions*, LLC
299 South Main Street, Suite 1700
Salt Lake City, UT 84111

RE: Federal Cell Facility Application Requests for Information (RFI);
Addendum to RFI **O-29.**

Dear Mr. Rogers:

The Division of Waste Management and Radiation Control (Division) hereby provides an Addendum to RFI **O-29** provided to Energy*Solutions* in a letter dated January 25, 2023, regarding the Federal Cell Facility Application dated August 4, 2022.

More specifically, this Addendum is intended to provide additional clarity with respect to a table referenced in RFI **O-29**. As the Division is requesting that Energy*Solutions* consider the mentioned table to assess GDP Clean DU Uranium distributions, this Addendum provides the context and rational associated with the derivation of the table discussed in RFI **O-29**.

If you have any questions regarding this letter, please call Otis Willoughby at (801) 536-0220.

Sincerely,

Douglas J. Hansen, Director
Division of Waste Management and Radiation Control

DJH/OHW/wa

Enclosure: Addendum to Request for Information O-29

c: Jeff Coombs, EHS, Health Officer, Tooele County Health Department
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Addendum to Request for Information O-29

Since the SRS DU sampling results are not to be used to represent GDP Clean DU, a literature search was performed to identify an alternative data source. Table 1 shows the U-234, U-235, and U-238 concentrations in depleted uranium with several different U-235 weight percentages that were identified during search. In Table 1 the U-234 and U-238 concentrations are linked to the U-235 composition, e.g., if 0.25% U-235 is specified, then the U-234 and U-238 compositions are 0.0005% and 99.7495%, respectively.

Table 1: Depleted Uranium Composition and Concentration

Uranium Isotope	10CFR 20, App B, footnote 3[a]	Leggett & Meck 2018	OEDC 2001	IAEA 2022[a]	10CFR 20, App B, footnote 3[a]	
	wt%	wt%	wt%	wt%	wt%	atom%
U-235	0.2	0.25	0.3	0.45	0.711	0.720
U-234	0.0003	0.0005	0.001	0.0025	0.0052	0.005
U-238[b]	99.7997	99.7495	99.699	99.5475	99.2838	99.275
	Concentration (pCi/g)					
U-235	4.33E+03	5.41E+03	6.49E+03	9.74E+03	1.54E+04	
U-234	1.88E+04	3.14E+04	6.27E+04	1.54E+05	3.26E+05	
U-238	3.37E+05	3.37E+05	3.37E+05	3.36E+05	3.35E+05	
Total	3.6E+05	3.74E+05	4.06E+05	5.0E+05	6.77E+05	

[a] 10CFR 20, App B, footnote 3 and IAEA 2022 U-234 and U-238 percentages were calculated for this study from the provided U-235 assay and the total DU concentration.

[b] This study calculated the U-238 composition by subtracting the U-235 and U-234 percentages from 100. This may differ somewhat from the source document values, which may have been rounded.

Uranium composition can be given in either weight percentage or atom percentage. The right two top columns of Table 1 present the two approaches for natural uranium and show that because all three uranium isotopes have nearly identical atomic masses, there is not much difference between the two approaches. In Table 1 all the DU compositions are presented as weight percentages.

In Table 1 the U-235 concentration in the 0.2 wt% column is 3.56 times smaller than its concentration in the 0.711 wt% column, as expected since 0.711 wt% / 0.2 wt% = 3.56. However, the U-234 concentration in the 0.2 wt% column is 17.3 times smaller than its concentration in the 0.711 wt% column, while the U-238 concentration is virtually unchanged, i.e., 0.995.

Figure 1 show the breakdown of the inventory of DOE DU as a function of U-235 weight percent.

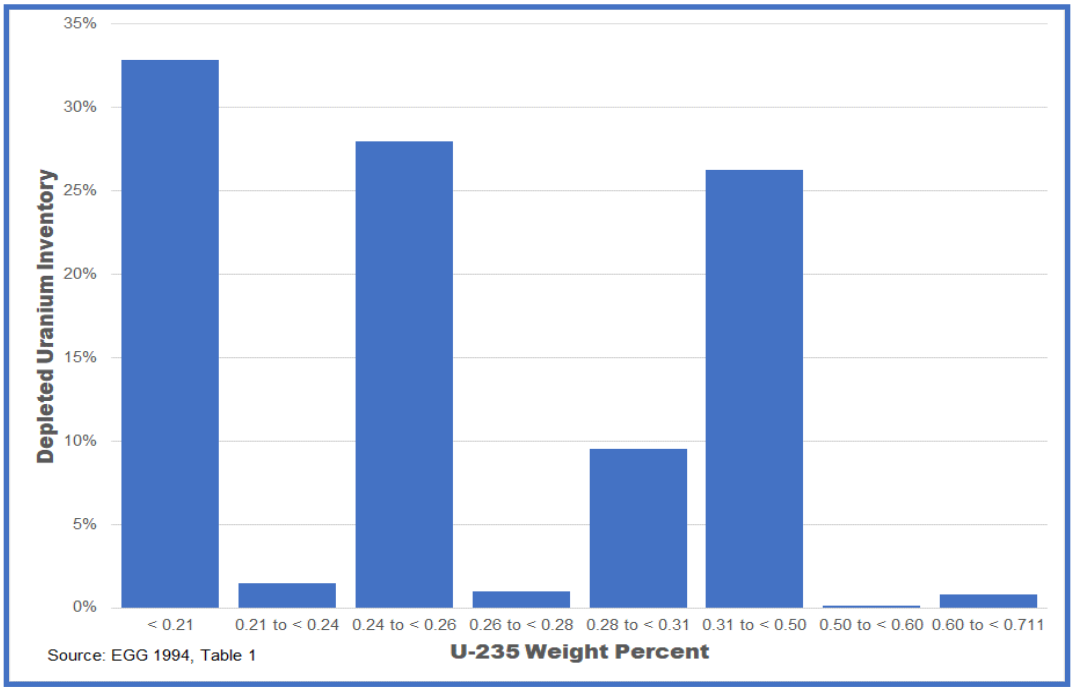

Figure 1: DOE Depleted Uranium Inventory as a Function of U-235 Weight Percent

NAC-0023_R5, Table 1 indicates the 686,500 Mg (in 57,122 cylinders) of DU is available for disposal at the three GDPs. Table 1 also indicates that only 48,362 cylinders would be disposed of at Clive. Table 2 provides three estimates of Clive-disposed DU distribution by U-235 weight percent; the first follows the Figure 1 distribution, the second assumes that all the Clive DU is at lower end of the Figure 1 distribution, while the third assumes that all the Clive DU is at higher end of the Figure 1 distribution.

Table 2: GDP Clean DU Distribution and U-235 Weight Percent

U-235 wt% Range	DOE (Mg)	Disposed at Clive (Mg)		
		DOE	Low	High
< 0.21	225,666	191,059	225,666	120,387
0.21 to < 0.24	10,014	8,478	10,014	10,014
0.24 to < 0.26	192,002	162,557	192,002	192,002
0.26 to < 0.28	6,617	5,602	6,617	6,617
0.28 to < 0.31	65,406	55,376	65,406	65,406
0.31 to < 0.50	180,265	152,620	81,516	180,265
0.50 to < 0.60	961	814	0	961
0.60 to < 0.711	5,568	4,714	0	5,568
Total	686,500	581,221	581,221	581,221
Average U-235 Weight Percent				
Range Low	0.19	0.19	0.16	0.22
Range Middle	0.25	0.25	0.22	0.28
Range High	0.32	0.32	0.28	0.33

As shown at the bottom of Table 2 the Average U-235 Weight Percent was a calculated value. For the DOE case, the U-235 wt% Range mid-points were used, for the Low case the U-235 wt% Range low-points were used, and for the High case the U-235 wt% Range high-points were used. As expected, the bottom of Table 2 shows that the smallest case is the Low-Low at 0.16 wt%, the DOE-Middle is in the middle at 0.25 wt%, and the largest case is the High-High at 0.33 wt%. The corresponding U-234, and U-238 Weight Percentages and Concentrations were calculated interpolating the Table 1 values, and are shown in Table 3.

Table 3: Recommended GDP Clean DU Uranium Distributions

Uranium Isotope	Weight Percentage				
	Low-Low	DOE-Middle	High-High		
U-235	0.16	0.25	0.33		
U-234	0.00024	0.0005	0.00129	NAC-0023_R5, Mean	
U-238	99.8398	99.7495	99.6687	Table 2	Corrected
	Concentration (pCi/g)				
U-235	3.46E+03	5.41E+03	7.14E+03	2.97E+03	3.57E+03
U-234	1.50E+04	3.14E+04	8.10E+04	3.31E+04	3.98E+04
U-238	3.373E+05	3.370E+05	3.367E+05	2.72E+05	3.27E+05

For ease of comparison, Table 3 also provides the mean uranium concentrations from NAC-0023_R5 both as they appear in Table 2 and corrected from "(pCi/g of DUO_3 waste)" to "(pCi/g of DU waste)", as discussed above.

The Table 3 concentrations could be used to form a distribution, e.g., uniform, triangular. However, if this is done, then specifying the U-235 Weight Percent determines not only the U-235 concentration but also the concentrations of U-234 and U-238.