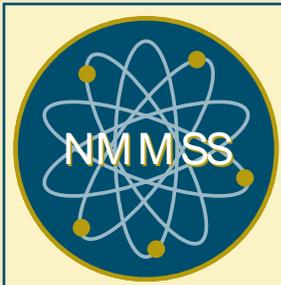


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Precision and its Mostly Adverse Impacts on Reporting

Barry Cooney

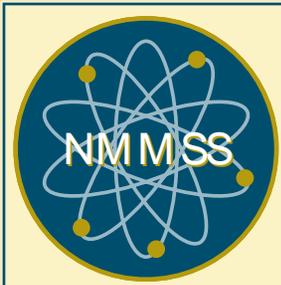
Westinghouse Nuclear Fuel



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Two Related but Different Topics

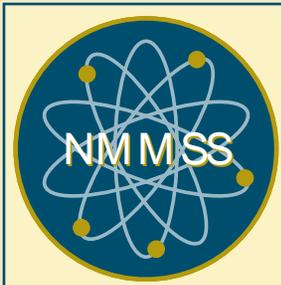
- Precision issue with depleted uranium
- Impacts of carrying finer than gram precision



Depleted Uranium

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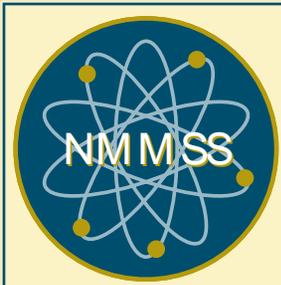
- Some stage setting - two examples:
Example 1
 - Type 10 BIN = 0
 - Two assemblies deplete below 0.711 w/o
 - ED, OBL 32, 2499 grams element
 - ED, OBL 92, 2499 grams element



Depleted Uranium

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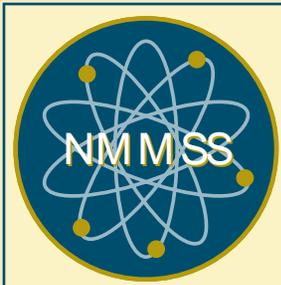
- Example 1
 - Sum of Type 20 ED = 4998 grams
 - Sum of Type 10 ED = 4 kg
 - Type 10 EIN = 5 kg
 - Type 10 rounding adjustment = 1 kg



Depleted Uranium

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- Example 2
 - Type 10 BIN = 0
 - Ship 50 assemblies,
 - each with between 1000 and 1500 grams U235
 - average = 1300 grams
 - all depleted uranium

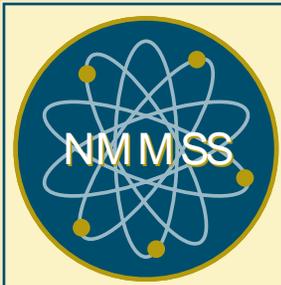


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- Example 2
 - Type 10 reported transfer = 50 x 1 kg
 - Type 10 actual transfer = 50 x 1.3 kg
 - Type 10 EIN = 65 kg
 - Type 10 rounding adjustment = 15 kg

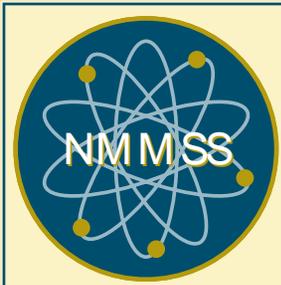
Element rounding adjustment will likely be smaller and may even have opposite sign



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- Problem occurs for two reasons:
 - We're all engineers and we like precision
 - There's no regulatory guidance on how to account or reconcile

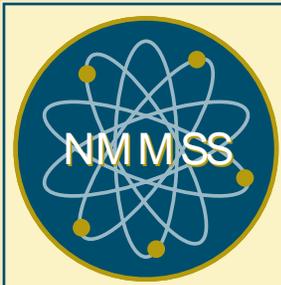


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Potential Solution

- Continue to report type 10 as kg, but with three decimal place precision
- Change would be made consistent with NMMSS upgrade (in 2008)
- Requires move to XML



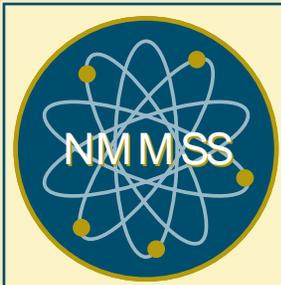
Depleted Uranium

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Impacts

- Software changes
 - XML (80 column doesn't support)
 - Revised processing
- Initial reconciliation (kg to grams)
- Transfer management (if shipper and receiver use different precisions)

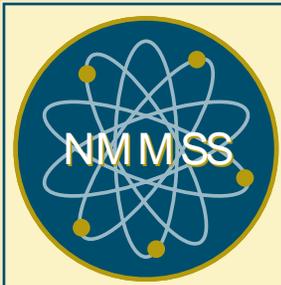
Change not required (integer kg still acceptable)



Depleted Uranium

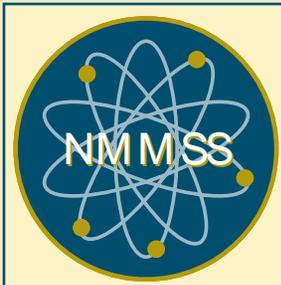
Open Discussion (if the horse is still twitching)

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Finer than Gram Precision

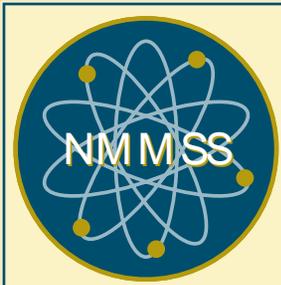
- Because we're all engineers, we like having nanogram precision on metric ton amounts
- SNM reporting precision, however, is a few orders of magnitude more coarse
- Difference can lead to some issues



Finer than Gram Precision

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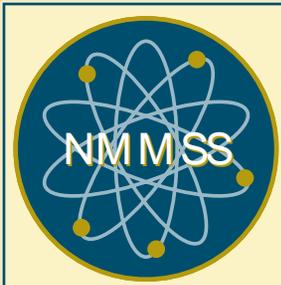
- Example – Spent Fuel Shipment
 - $\text{Pu}^{239} = 2410.18 \text{ g}$
 - $\text{Pu}^{240} = 1275.94 \text{ g}$
 - $\text{Pu}^{241} = 602.44 \text{ g}$
 - $\text{Pu}^{242} = 351.88 \text{ g}$



Finer than Gram Precision

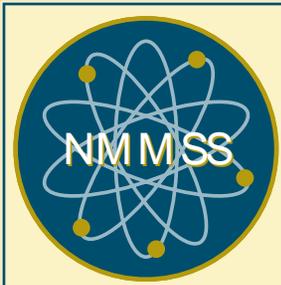
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- Data Management Requirement
 - All isotopes must be tracked separately
 - ‘Isotope’ report value is $\text{Pu}^{239} + \text{Pu}^{241}$
 - ‘Isotope’ w/o value is Pu^{240}
 - Pu^{241} must be maintained for decay
 - Inventory change and transfer 741 must balance



Finer than Gram Precision

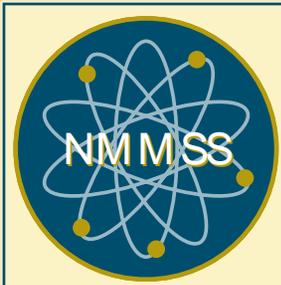
- 741 values
 - Element: 4640 g
 - Isotope: 3013 g
- Inventory Transferred
 - Element: 4640.44
 - Isotope: 3012.62



Finer than Gram Precision

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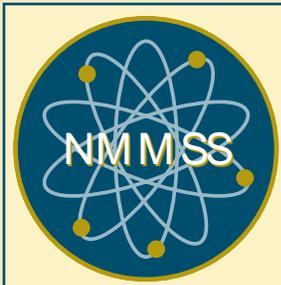
- Issue: one assembly has introduced almost a half-gram of rounding adjustment (actually two half-grams, in opposite directions)
- Issue: 100 assemblies, spread across obligations, can get pretty messy



Finer than Gram Precision

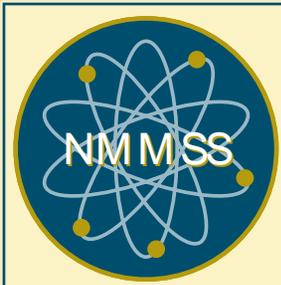
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- Question of the Moment:
 - Does NRC care about potentially significant rounding adjustments (tens of grams, usually representing non-physical conditions) when they're real?



Finer than Gram Precision

- Possible Solution
 - Limit stored precision to reporting units
- Impacts
 - Requires non-trivial software changes (probably throughout the industry)
 - Initial implementation will cause a step change in inventory (several cases indicate tens of grams)



Finer than Gram Precision

Open Discussion (depending, again, on the state of the horse)

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