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 OF
 SCIENTIFIC AND INDUSTRIAL
 INSTRUMENTS

Variation of Tc-99 Sources
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In response to various concerns from customers, and also to anomalies seen by Ludlum Measurement calibrators, a study was undertaken to review the efficiency and crosstalk of the Ludlum Measurement Tc-99 sources. These sources are used by Ludlum Measurements for the beta calibration of its two inch beta or alpha-beta sample counters.

About the Sources: These sources are all NIST-traceable plated sources in the 1.25 to 2 inch diameter size, and had been purchased from different sources. The backing material was either nickel or stainless steel. The age of the Tc-99 sources measured range from new to twenty-seven years old. The efficiencies and crosstalk (into the alpha channel) were measured primarily with a single Model 3030P S/N 266676. Another Model 3030P and a Model 3030 were used to confirm the data.

About the Electronics: The Ludlum Model 3030P is a sample counter that is widely used in the industry to count up to two inch samples or wipes for contamination levels of alpha or beta radiation. It uses pulse-height separation to distinguish between beta and alpha radiation. The radiation detector is a solid-state silicon detector that requires no fragile light-tight window and uses a low bias voltage. One key point of the Model 3030P is that crosstalk from the beta into the alpha channel is very low, allowing detection of alpha contamination even in the presence of high amounts of beta contamination.

The Data: Data was taken with each source, with count times sufficient to create statistical accuracy; several hours in the cases of the smaller sources. The data is presented below, sorted by increasing crosstalk, and then by increasing beta efficiency:

Crosstalk	DPM Size	Beta Eff		Crosstalk	DPM Size	Beta Eff
0.00%	124000	13.73%	•	0.39%	2060	12.95%
0.00%	134000	13.81%	•	0.96%	9160	13.00%
0.00%	3165700	15.66%	•	0.00%	124000	13.73%
0.00%	224219	20.36%	•	0.00%	134000	13.81%
0.01%	20600	19.23%	•	0.06%	3970	15.24%
0.04%	22600	19.52%	•	0.00%	3165700	15.66%
0.06%	3970	15.24%	•	0.27%	33078	18.81%
0.19%	93240	19.81%	•	0.01%	20600	19.23%
0.22%	28860	19.81%	•	0.04%	22600	19.52%
0.22%	2664	20.86%	•	0.19%	93240	19.81%
0.24%	22900	20.04%	•	0.22%	28860	19.81%
0.27%	33078	18.81%	•	0.24%	22900	20.04%
0.39%	2060	12.95%	•	0.00%	224219	20.36%
0.96%	9160	13.00%	•	0.22%	2664	20.86%

Summary: The data shows a considerable variation for both Tc-99 efficiency and crosstalk. The efficiency and crosstalk seem to be fairly independent from each other, independent of source size, and independent of source age. Further talks with the source manufacturer indicate that the most likely cause of variation is the deposition depth.

What To Do: Several of the in-house sources at Ludlum Measurements will have to be retired from active use. In order to have consistent results in the calibration of new equipment, Ludlum Measurements has arranged to purchase Tc-99 sources that meet specific efficiency and crosstalk levels of 18% and 0.02%. These sources will have an acceptance test, using a Model 3030P, at Ludlum Measurements. These sources are approximately 100 nCi, or 222,000 dpm in size, and will be sold to our customers as part number 01-5846. Use of these sources will help both Ludlum Measurements and their customers maintain a high level of consistency in calibration and QC checks.

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