

Eager Lab Assistants
 Food Results
 2014-

Gamma spectroscopy tests were performed on the following samples using a 2.8" x 1.2" sodium-iodide, thallium-doped NaI(Tl) detector with a GS1100A multi-channel analyzer and PRA8.0 software. The detector was calibrated with a Cobalt-60 check source and a NIST standard Cesium-137 check source. All samples were measured for possible Cs-137 presence. Those yielding statistically significant counts in the 661 keV range are listed as detections of Cesium-137 below in Becquerels per kilogram including all known uncertainties with 95% confidence. Upper limits were mathematically calculated for measurements of that range found not statistically significant and are listed as "less than" numbers. These values serve as limits on potential presence under conditions of uncertainty or other processes and should be considered as non-detections. If performed, calculation of energy levels used to determine presence of radionuclides other than those used for calibration were performed with the use of a calibration curve and reported the notes section.

2015 Food Sample Notes: While many of the samples were purchased from a farmer's market in Berks County, Pennsylvania, several of those were not grown on site and shipped from Lancaster County according to the vendor. FDF7-Pear, FDF8-Apple, FDF9-Plums, FDF3-Red Raspberries and FDF2-Strawberries are grown at the same site in Berks County while those marked with an asterick and coming from Lancaster County are presumed. Note other samples also come from other sites in Berks County.

Dairy			Received	Tested	Inspector	Cs-137 (Bq/kg)
FDD9	Yogurt	Berks Co., Pennsylvania	10/13/15	2/5/16	37.2	<4.3
Same type as FDD7. Th232 activity in all major areas, U238 <87.3 Bq/kg, .5% U235 using limits. Other detections: 766.3, 834.6, 477.5, 583.3, 144.0						
FDD10	Vit. D Milk	Reading, PA distributor	5/3/2016	5/3/2016		6.0 Bq/L +/- 0.4
Wet tested (note more attenuation), no sealing time. measured for Cs-137, Cs-134, I-131 and B140, the latter 3 producing non-detections.						
FDD5	Ice Cream	Pennsylvania	3/8/2015		38.6	
Notes: *Inadvertently left out of batch. Scheduled for retest. ...sorry, got bzzzy;)						
FDD7	Yogurt	Pennsylvania	2/11/2015	4/8/2015	32.5	<7.3
FDD8	Sour Cream	US	2/11/2015	4/7/2015	35.4	<8.3
FDD6	Sour Cream	US	2/11/2015	4/10/2015	38.7	<7.9
FDD4	Ice Cream	US	2/11/2015	4/9/2015	36.1	<10.1
FDD3	Cheddar	US	1/6/2014	1/28/2014	37.6	<10.2

	Cheese					
FDD2	Butter	Wisconsin	11/15/2013	1/22/2014	47.5	13.1 +/- 0.8
FDD1	Butter	Pennsylvania	11/15/2013	1/22/2014	57.2	9.4 +/- 0.6

Fruits			Received	Tested	Inspector cpm	Cs-137 (Bq/kg)
FDF2	Strawberries	Berks Co., Pennsylvania	6/5/15	2/3/16	36.3	<4.1
Th232 not detected, U238 <99.9 Bq/kg, .7% U235 using 63keV limit and 186 detection. Other detections: 1566.6, 401.1, 353.3, 185.5						
FDF10	Elderberries	Sinking Spring, Pennsylvania	7/23/15	2/2/16		<9.2 Bq/kg
Th232, U238 <154.9 Bq/kg, .5% U235 using limits. Other detections: 1620.8						
FFF8	Clementine	Morocco	12/3/15	2/6/16	38.7	4.8 Bq/kg +/- 0.3
Th232, U238 <119.2 Bq/kg, .4% U235 using limits. Other detections: 660.8, 163.5, 4.6, 583.6, 968.6, 1566.8						
FDF5	Tomato	*Lancaster Co., Pennsylvania	7/16/15	2/6/16	38.1	<6.6
<p>Th232, U238 <104.4 Bq/kg, .7% U235 using 63keV limit and 186keV detection. Other detections: 186.4, 131.7, 477.3, 1173.7, 1333.0.</p> <p>It appears indications of being watered or rained on by effluent. Thought these studies were interesting in light of the significant detections in this sample: "The uptake of ⁶⁰Co in the vicinity of the Hanford Reach of the Columbia River (near the DOE's Hanford site) was measured for several types of wild plants and farm crops.50 The wild plants were the mulberry tree, willows, and reed canary grass. The ⁶⁰Co concentrations were about 0.03 pCi/g (0.001 Bq/g) in the mulberry foliage and ranged from 0.02 to 0.1 pCi/g (0.0007 to 0.004 Bq/g) in the fruit. Of the farm crops collected in the survey (asparagus, pumpkin, and tomatoes), only tomatoes had measurable concentrations of ⁶⁰Co. The nuclide concentration for this vegetable was approximately 0.02 pCi/g (0.0007 Bq/g), which would result in an estimated dose of 3 x 10⁻⁵ mrem (3 x 10⁻⁷ mSv) if 1 kg were consumed." http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/27/029/27029603.pdf and "Studies on the impact of uptake mode show that overall deposition on the aboveground parts of the plant (spraying on leaves) is by far the most conservative as it increases transfer factors (expressed in Bq/kg of plant per Bq/m² of cultivated soil) by a factor of 102 to 103 compared with root uptake of the same equivalent surface activity (Colle et al., 1991). These results are consistent with those of Sabbarese et al., (2002), who compared the specific activity of tomatoes grown using spray irrigation and corrugation irrigation methods: the ratio is about 6.5 for the fruit, 6.2 for the stems, 5.3 for the leaves and 2 for the roots." http://www.irsn.fr/EN/Research/publications-documentation/radionuclides-</p>						

	sheets/environment/Pages/Cobalt-60-environment.aspx					
FDF3	Red Raspberries	Berks Co., Pennsylvania	6/20/15	2/6/16	37.4	<5.8
	Th232, U238 not detected <104.4 Bq/kg, .75% U235 using limits. Other detections: 277.7, 185.5, 46.6, 143.4, 621.7, 1173.2					
FDF4	Cantaloupe	*Lancaster Co., Pennsylvania	7/16/15	2/9/16	39.4	<8.8
	Th232, U238 114.0 Bq/kg, .2% U235 using 63keV detection and 186 keV limit. Other detections: 1618.5, 62.8, 165.4, 661.9, 622.4, 440.8, 835.2					
FDF9	Plums	Berks Co., Pennsylvania	10/13/15	2/13/16	38.1	5.2 +/- 0.3 (6.1%)
	Th232 and U238 present, .4% U235 using limits. Other detections: 970.1, 277.4, 1002.0, 401.7, 1461.4, 661.3, 477.5					
FDF8	Apple	Berks Co., Pennsylvania	10/13/15	2/12/16	35.7	<5.5
	Th232 and U238 present, .7% U235 ratio using limit and detection. Other detections: 1461.4, 130.2, 1332.4, 1173.0(sum peak), 185.4, 238.8, 46.9. May be worthy to note 834 and 29keV would be statistically significant if slight correction were made and are visually present. Possible Co-60.					
FDF7	Pear	Berks Co., Pennsylvania	10/13/15	2/12/16	34.4	<7.4
	Th232 ~40 Bq/kg, U238 not detected (at 63keV) <74.5 Bq/kg, .7% U235. Other detections: 1460.7, 186.0, 86.9, 911.1					
FDF1	Strawberries	Florida	1/6/2014	11/10/2014	39.9	<7.2
FFF1	Grapes	Peru	1/6/2014	11/11/2014	55.8	<7.1
FFF2	Banana	Columbia	1/6/2014	11/8/2014	45.3	<5.8
FFF3	Cantaloupe	Guatemala	1/6/2014	11/8/2014	35	<11.0
FFF4	Pineapple	Costa Rica	1/6/2014	11/7/2014	38.9	<11.4
FFF5	Avocado	Mexico	1/15/2014	1/28/2014	41.9	<7.0
FFF6	Coconut liquid	Dominican Republic	10/1/2014	11/7/2014	35	<15.1
FFF7	Clementine	Spain	2/11/2015	4/4/2015	39	<7.9

Grains			Received	Tested	Inspector	Cs-137
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					cpm	(Bq/kg)
FFGR1	Red Rice	Bhutan	3/18/2013	4/11/2015	37.8	<10.0
FDG2	White Rice	US	3/8/2015	4/10/2015	34.0	<1.1
FFG3	Red Quinoa	Peru	1/6/2014	4/13/2015	45.4	<12.6
Notes: Indications of lead and radium contamination.						
FDG1	Corn Masa	US	1/15/2014	4/18/2015	37.6	<12.1
FFG2	Farro	Italy	1/6/2014	4/16/2015	38.8	<11.6

Health			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
FDH1	Slippery Elm Bark Powder	US	2/3/2013	1/24/2014	No data	<47.4
FFH1	Chlorella	China	June 2011	4/14/2015	No data	20.1 +/- 1.2

Meats			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
FDM5	Albacore Tuna	Pacific	7/16/15	2/5/16	36.4	Cs-137 4.7 +/- 0.3 Cs-134 ~4.0
Caught off Oregon coast. Th232 activity, U238 <163.4 Bq/kg, .3% U235 using limits. Other detections: 46.5, 1460.7, 662.0, 563.7, 605., 796.1, 462.3, 636.0, 723.0, 1566.9, possible Sb125. I131, Re184, Nb94, Ag110m, Ag108 areas were measured due to significant detections in FDM4Salmon in addition to this spectrum and all were non detections.						
FDM4	Chinook salmon	Pacific	7/16/15	2/4/16	35.9	<7.8
Caught off Oregon coast. Th232 possible, U238 <97.4 Bq/kg, .2% U235 using limits. Other detections: 402.2, 1461.4, 1173.1, 904.1, 646.3, 393.3, 703.3, 871.7, 1115.3, 439.2, 585.0, 30.2, 811.7. Possible Re184, Os185, Zr88, Nb94, Zn65, Eu150. Note Nb94 does not travel far from sites; however, fish do.						
FFM1	Shrimp-raw	Indonesia	11/24/2014	11/25/2014	38.4	<9.5
Notes: Mostly, if not all natural thorium or ~<20 Bq/kg Th232; ~5 Bq/kg of natural uranium with good U238/U235/U234 ratios. Statistically significant peaks include 1460.1keV (K40 @ 1460.8), 511.7 keV, 969.2 keV (Ac228 @ 969.0), 29.4 (I129 @ 29.4), 583.0 keV (Tl208 @ 583.2) and 636.1. While not impossible, the latter doesn't appear to be from any I131 contribution or Sb125 but the width and shape of the peak indicates it's from a gamma-ray. There are several indications of alpha presence in the spectrum however sample was fresh and not kept for retesting.						

FFM2	Shrimp-dry	Ecuador	2/11/2015	4/4/2015	37.6	<26.1
<p>Notes: This sample was exported from Ecuador to The Netherlands where it was reported by the purchaser as initially reading 55cpm on an Inspector Geiger counter on or about 1/14/2015 both before and after drying. The sample was subsequently shipped to the United States where it tested just over background at 37.6cpm on 2/11/2015 indicating something short-lived decayed.</p> <p>~<40Bq/kg Th232 with an abundance of bismuth probably attributed to absorption properties. ~<350 Bq/kg U238, lacks equilibrium with Ra226; presence of Fe59 (44 day half-life), possibly raised in recently contaminated sediments with lead and iron and other heavy metals. Detections: 363.9, 28.8, 238.1, 1621.0, 277.4, 295.8, 609.9, 1332.1, 1100.2, 1290.8, Cs137 <26.1 Bq/kg. See http://www.as.ua.edu/home/extracting-uranium-with-shrimp/ for an interesting report on chitin, a compound found in shrimp shells used for uranium cleanups – and http://archimer.ifremer.fr/doc/00107/21866/19457.pdf for an analysis on uranium and thorium redistribution. Both may potentially explain the disruption in the Th and U series.</p>						
FDM1	Alaskan Cod	Alaska	11/24/2014	11/25/2014	34.7	<7.1
<p>Notes: ~<20 Bq Th232 with abundance of Bi212, 102.0 Bq/kg U238 in partial equilibrium with Ra226; Activity at 1001 keV with absence of Bi214 indicating partial processed U contribution. Very high uranium content. Detections: 401.9, 63.4, 860.1, 29.4</p>						
FDM2	“Albacore” Tuna	Pacific	11/24/2014	11/25/2014	40.0	<6.2
<p>Notes: K40 levels inconsistent with product labeled as “albacore” and is likely mislabeled. Upon further investigation, it was discovered that ~1% of US seafood imports (of which about 90% of the US seafood market is comprised of) is checked for fraud and about 59% of tuna is either mismarked or not tuna at all so this result is not surprising. http://foodpoisoningbulletin.com/2013/oceana-uncovers-nationwide-seafood-fraud/</p> <p>~<20Bq/kg natural Th232, ~8.7 Bq/kg U238, partial equilibrium with Ra226, some activity at 1001. No significance at 661keV for cesium but upon sight alone, cobalt-60 is obvious and subsequently was measured and resulted in a statistically significant detection with 95% confidence at 24.7 Bq/kg.</p> <p>Detections: 1174.0, 1333.0, 511.7, 433.3, 428.4, 1460.1, 29.4, 1434.9 (a sign of He3 bombardment of Fe52 from tritium decay? is that possible? Some process is here..)</p> <p>Ag110m - not significant but definite peaks at 657.1, 884.6, 937.3, 1384.3 including an accompanying sum peak at 1542 - all close to ~3.7 Bq/kg (have only seen this on a couple of soil samples out of >100)</p> <p>Another interesting read on metal uptake in sea life etc...published in 1975 has detailed info on what lands where and what picks it up when there. Download the whole book for free here: https://books.google.com/books?id=My5CAAAAIAAJ&dq=tuna+cobalt-60&source=gbs_navlinks_s</p> <p>While it's possible this sample contains contributions from the meltdowns at Fukushima, the lack of cesium suggests it more likely comes from another source as there are known leaking drums near where tunas migrate (* take note the sample may not be tuna). For an example, this particular site has 100,000 of them needing replacement every 15 years or so and sits not far above sea level. There've been detections of Co60 and Cs137 since 2009 outside the facility. http://www.taiwannews.com.tw/etn/news_content.php?id=1772736</p>						

Minerals			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
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FFMS1	Himalayan Pink Salt	Pakistan	3/18/2013	4/20/2015	No data	<5.1

Nuts & Seeds			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
FDN4	Almonds	US	11/15/2013	1/26/2014	38.4	<13.2
FDN5	Cashews	US	11/15/2013	1/26/2014	42.1	<11.5
FDN1	Walnuts	US	4/9/2013	1/27/2014	No data	<22.8
FDN3	Peanuts	US	11/15/2013	1/27/2014	40.5	<10.2
FDN2	Pistachios	California	10/28/2013	1/24/2014	46.1	8.5 +/-0.5
FDN6	Sunflower Seeds	US	1/6/2014	4/15/2015	39.3	8.7 +/- 0.5
FDN7	Pumpkin Seeds	US	1/6/2014	4/21/2015	38.3	<27.6

Oils			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
FFO1	Coconut Oil	Philippines	3/18/2013	1/25/2014	No data	13.8 +/- 0.9
FFO2	Olive Oil	Mediterranean	11/15/2013	11/5/2014	38.6	<7.9

Vegetables			Received	Tested	Inspector (cpm)	Cs-137 (Bq/kg)
FFV2	Yam	Japan	8/17/15	2/4/16	36.6	<10.3
	Th232 not detected, U238 226.6 Bq/kg, .2% U235 using 63keV detection and 186keV limit. Other detections: 1622.1, 64.5, 30.2, 722.9					
FDVL5	Lettuce	*Lancaster Co., Pennsylvania	10/13/15	2/8/16	39.1	<11.4
	Th232, U238 <114.8 Bq/kg, .2% U235 using limits. Other detections: 1621.0, 277.7, 312.6, 609.6, 1763.2, 143.7, 440.3, 795.5					
FDV1	Green Pepper	*Lancaster Co., Pennsylvania	10/13/15	2/11/16	41.3	8.6 +/- 0.5
	Th232, U238 not detected, .7% U235 using limits. Other detections: 1460.1, 45.7, 609.2, 911.1, 662.0. Note with slight correction 277, 477 and 721 would also be significant. Cs-134 not detected.					
FDV6	Carrot	*Lancaster	10/13/15	2/10/16	37.6	<5.5

		Co.,Pennsylvania				
	Th232 not detected, U238 not detected <212.1, .7% U235 using limits. Other detections: 402.2, 185.2, 1000.9, 131.1, large 511 peak.					
FDV3	Onion	*Lancaster Co.,Pennsylvania	10/13/15	2/10/16	38.7	<6.7
	Th232 not detected, U238 not detected <99.8 Bq/kg, .3% U235 using limits. Other detections: 660.6, 1332.1, 477.4.					
FDV4	Green Beans	*Lancaster Co., Pennsylvania	10/13/15	2/10/16	34.8	<13.5
	Th232 and U238 visible but not significant, .4% U235 using limits. Other detections: 912.5, 969.9, 584.1, 860.9, 312.8, 609.1, 1462.1, 131.7, 662.2, 1332 (sum), 1567.6, 1764.3. --662, 605 and 795 are visible but not statistically significant					
FDV5	Radish	*Lancaster Co., Pennsylvania	10/13/15	2/13/16	37.2	<11.3
	Th232 present, U238 not detected <108.2, .4% U235 using limits. Other detections: 131.9, 1461.5, 401.3, 1763.3, 59.5, 584.1, 968.9. With little background correction, both 1173 and 1332 become significant, interestingly, the same amount as the FDF5-Tomato. See also notes for 2016 Pennsylvania foods above.					
FDV2	Potato	Pennsylvania	10/13/15	2/14/16	38.7	<7.7
	Th232 and U238 present but not significant, except Pb214 at 238.3 keV. .8% U235 using limits.					
FFV1	Broccoli	Guatemala	1/6/2014	11/6/2014	42.2	16.0 +/- 1.0
FDVL4	Lettuce/Spinach Mix	US/Mexico	2/11/2015	4/8/2015	35.0	<19.3