Milk Sampling Results

UCB Milk Sampling Results

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The following are results for milk samples obtained from a Bay Area organic dairy where the farmers are encouraged to feed their cows local grass. We have detected I-131, Cs-134, and Cs-137 and are tracking their levels.

Potassium in Milk:

Milk Sample	K-40 Activity (Bq/L)	potassium content(g/L)
Sample M8	49	1.58
USDA standard(2%)	48	1.55
USDA standard(fat free)	50	1.62

4/13/2011: Major revision note: *We just performed a major revision of our preliminary milk measurements. Our activity measurements for milk with a "best by" date after 4/4/2011 were accidentally calculated for the "best by" date itself, rather than an earlier date such as the purchase date. Since milk can be on the shelves starting almost 18 days before the "best by" date, our numbers after 4/4/2011 did not accurately reflect the maximum activity that the radioisotopes could have at the time of purchase. Incidentally, our first two milk measurements were not corrected at all and therefore reflect the activity at the time of measurement. The original numbers are at the bottom of the page for reference.*

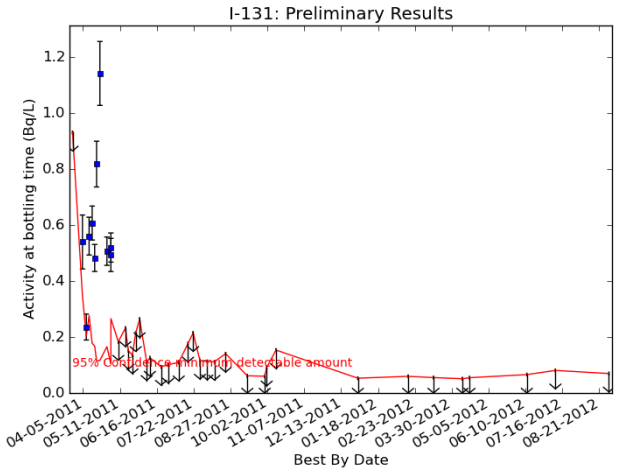
In order to make a valid comparison between all milk samples, we decided to correct all milk samples to represent the activity at their time of bottling -- this is 18 days before the "best by" date. This revision does not change the Cs-134 or Cs-137 numbers since they have long radioactive half-lives. The I-131 activity increases by factors of 2 to 5 because of its 8 day half-life. Please note that though all I-131 activities have increased due to this revision, the levels are still very low -- one would have to consume at least 1,900 liters of milk to receive the same radiation dose as a cross-country airplane trip.

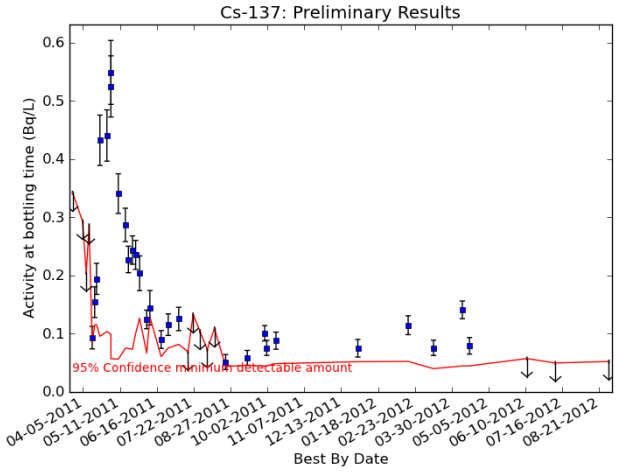
In the table below the plot, we are providing two numbers for each of the isotopes. The first is a standard concentration unit of Becquerel per liter (Bq/L) which describes the number of particles decaying over the period of one second. For the general public, we have converted this number to an exposure dose per liter of milk consumed. The number in parentheses is the number of liters of milk that one would need to consume to equal the radiation exposure of a single round trip flight from San Francisco to Washington D.C. (0.05 mSv). For more information on how this equivalent dose is calculated, the details are here: How Effective Dose is Calculated

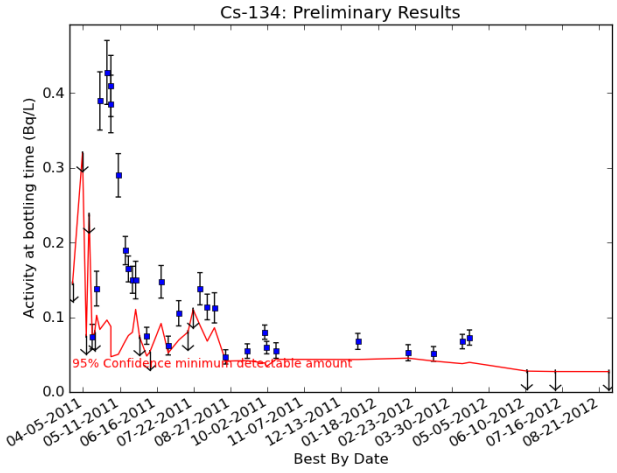
In the table, MDA stands for Minimum Detectable Activity. This is the lowest level of measurement where we can confidently report results. To find out more about how the MDA is calculated, please visit How we calculate MDA.

Because the "best by" date on milk is approximately 17-19 days after the milk has been bottled, our milk sample with a date of 3/25 represents milk bottled on approximately 3/5. Since this is before the Fukushima crisis, we do not expect to see any fission product radioisotopes and do not see any within our sensitivity. Our first sample of milk showing any signs of radioisotopes has a date of 4/4, which means it was bottled around 3/18. This is approximately when the trace radioactive isotopes were first seen in the Bay Area.

The first two milk measurements were done with the same setup as the Rainwater Collection Experiment, except that the milk is not distilled first before counting it with the germanium detector. Many of the remaining measurements were performed with a mechanically-cooled germanium detector on loan from ORTEC and AMETEK. The mechanically-cooled detector was larger than the previous detector, and we were able to fit almost an entire gallon of milk in the Marinelli beaker (previously, we could measure only one quart of milk). This led to an improvement in overall sensitivity to radioactive isotopes.







Pasteurized, Homogenized Milk

Best By Date	Sample Volume	I131	I132	Cs134	Cs137	Te132	Data
	Liters	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	
03/25/2011 20:31	0.946	less than MDA [MDA=0.93]	less than MDA [MDA=27.73]	less than MDA [MDA=0.15]	less than MDA [MDA=0.34]	less than MDA [MDA=12.65]	data
04/04/2011 12:00	1	0.54±0.10 [MDA=0.35] (5.0e+03)	less than MDA [MDA=1.99]	less than MDA [MDA=0.32]	less than MDA [MDA=0.29]	1.46±0.29 [MDA=1.16] (1.7e+04)	data

04/08/2011 06:14	3.45	0.24±0.05 [MDA=0.20] (1.1e+04)	less than MDA [MDA=2.43]	less than MDA [MDA=0.08]	less than MDA [MDA=0.20]	less than MDA [MDA=0.66]	data
04/11/2011 00:00	3.45	0.56±0.07 [MDA=0.28] (4.8e+03)	less than MDA [MDA=0.94]	less than MDA [MDA=0.24]	less than MDA [MDA=0.29]	less than MDA [MDA=0.57]	data
04/14/2011 00:00	3.45	0.61±0.06 [MDA=0.18] (4.5e+03)	less than MDA [MDA=0.50]	0.07±0.02 [MDA=0.07] (3.3e+04)	0.09±0.02 [MDA=0.08] (2.9e+04)	less than MDA [MDA=0.25]	data
04/16/2011 10:53	3.45	0.48±0.05 [MDA=0.17] (5.6e+03)	less than MDA [MDA=0.51]	less than MDA [MDA=0.08]	0.15±0.03 [MDA=0.12] (1.8e+04)	less than MDA [MDA=0.27]	data
04/18/2011 07:18	3.45	0.82±0.08 [MDA=0.11] (3.3e+03)	less than MDA [MDA=0.31]	0.14±0.02 [MDA=0.10] (1.8e+04)	0.19±0.03 [MDA=0.12] (1.4e+04)	less than MDA [MDA=0.11]	data
04/21/2011 12:51	3.45	1.14±0.11 [MDA=0.12] (2.4e+03)	less than MDA [MDA=0.29]	0.39±0.04 [MDA=0.08] (6.2e+03)	0.43±0.04 [MDA=0.10] (6.3e+03)	less than MDA [MDA=0.19]	data
04/28/2011 09:21	3.45	0.51±0.05 [MDA=0.17] (5.3e+03)	less than MDA [MDA=0.50]	0.43±0.04 [MDA=0.10] (5.7e+03)	0.44±0.04 [MDA=0.10] (6.1e+03)	less than MDA [MDA=0.32]	data
05/02/2011 06:22	3.45	0.52±0.05 [MDA=0.10] (5.2e+03)	less than MDA [MDA=0.39]	0.39±0.04 [MDA=0.09] (6.3e+03)	0.55±0.05 [MDA=0.10] (4.9e+03)	less than MDA [MDA=0.10]	data
05/02/2011 06:40	3.45	0.49±0.06 [MDA=0.27] (5.5e+03)	less than MDA [MDA=4.68]	0.41±0.04 [MDA=0.05] (5.9e+03)	0.52±0.05 [MDA=0.06] (5.1e+03)	less than MDA [MDA=2.63]	data
05/09/2011 12:00	3.45	less than MDA [MDA=0.18]	less than MDA [MDA=2.58]	0.29±0.03 [MDA=0.05] (8.4e+03)	0.34±0.03 [MDA=0.06] (7.9e+03)	less than MDA [MDA=1.02]	data
05/16/2011 09:32	3.45	less than MDA [MDA=0.23]	less than MDA [MDA=1.45]	0.19±0.02 [MDA=0.07] (1.3e+04)	0.29±0.03 [MDA=0.08] (9.4e+03)	less than MDA [MDA=0.64]	data
05/19/2011 08:20	3.45	less than MDA [MDA=0.15]	less than MDA [MDA=2.34]	0.16±0.02 [MDA=0.08] (1.5e+04)	0.23±0.02 [MDA=0.07] (1.2e+04)	less than MDA [MDA=0.85]	data
05/23/2011 07:26	3.45	less than MDA [MDA=0.13]	less than MDA [MDA=1.13]	0.15±0.02 [MDA=0.08] (1.6e+04)	0.24±0.02 [MDA=0.07] (1.1e+04)	less than MDA [MDA=0.74]	data
05/26/2011 11:03	3.45	less than MDA [MDA=0.21]	less than MDA [MDA=4.63]	0.15±0.03 [MDA=0.11] (1.6e+04)	0.24±0.02 [MDA=0.10] (1.1e+04)	less than MDA [MDA=1.12]	data
05/30/2011 07:26	3.45	less than MDA [MDA=0.26]	less than MDA [MDA=2.69]	less than MDA [MDA=0.07]	0.20±0.03 [MDA=0.13] (1.3e+04)	less than MDA [MDA=0.64]	data
06/06/2011 05:55	1.24	less than MDA [MDA=0.11]	less than MDA [MDA=1.29]	0.08±0.01 [MDA=0.05] (3.2e+04)	0.12±0.02 [MDA=0.07] (2.2e+04)	less than MDA [MDA=0.23]	data
06/09/2011 08:24	1.24	less than MDA [MDA=0.13]	less than MDA [MDA=0.74]	less than MDA [MDA=0.05]	0.14±0.03 [MDA=0.13] (1.9e+04)	less than MDA [MDA=0.33]	data
06/20/2011 06:52	1.24	less than MDA [MDA=0.09]	less than MDA [MDA=0.93]	0.15±0.02 [MDA=0.09] (1.6e+04)	0.09±0.02 [MDA=0.06] (3.0e+04)	less than MDA [MDA=0.32]	data
06/27/2011 05:53	1.24	less than MDA [MDA=0.10]	less than MDA [MDA=0.58]	0.06±0.01 [MDA=0.05] (3.9e+04)	0.12±0.02 [MDA=0.08] (2.3e+04)	less than MDA [MDA=0.28]	data

07/07/2011 11:43	1.24	less than MDA [MDA=0.11]	less than MDA [MDA=1.79]	0.11±0.02 [MDA=0.07] (2.3e+04)	0.13±0.02 [MDA=0.08] (2.2e+04)	less than MDA [MDA=0.45]	data
07/16/2011 12:55	1.24	less than MDA [MDA=0.18]	less than MDA [MDA=3.09]	less than MDA [MDA=0.08]	less than MDA [MDA=0.07]	less than MDA [MDA=1.15]	data
07/21/2011 13:25	1.24	less than MDA [MDA=0.21]	less than MDA [MDA=0.97]	less than MDA [MDA=0.11]	less than MDA [MDA=0.13]	less than MDA [MDA=0.61]	data
07/28/2011 05:37	1.24	less than MDA [MDA=0.12]	less than MDA [MDA=0.63]	0.14±0.02 [MDA=0.09] (1.8e+04)	less than MDA [MDA=0.10]	less than MDA [MDA=0.44]	data
08/04/2011 08:30	1.24	less than MDA [MDA=0.11]	less than MDA [MDA=0.61]	0.11±0.02 [MDA=0.07] (2.1e+04)	less than MDA [MDA=0.07]	less than MDA [MDA=0.41]	data
08/11/2011 08:26	1.24	less than MDA [MDA=0.11]	less than MDA [MDA=0.59]	0.11±0.02 [MDA=0.09] (2.2e+04)	less than MDA [MDA=0.11]	less than MDA [MDA=0.42]	data
08/22/2011 07:18	1.66	less than MDA [MDA=0.14]	less than MDA [MDA=2.61]	0.047±0.010 [MDA=0.041] (5.2e+04)	0.052±0.013 [MDA=0.044] (5.2e+04)	less than MDA [MDA=1.84]	data
09/12/2011 10:43	1.81	less than MDA [MDA=0.062]	less than MDA [MDA=0.300]	0.055±0.010 [MDA=0.042] (4.4e+04)	0.059±0.013 [MDA=0.046] (4.6e+04)	less than MDA [MDA=0.219]	data
09/29/2011 11:04	1.81	less than MDA [MDA=0.060]	less than MDA [MDA=0.121]	0.080±0.010 [MDA=0.039] (3.0e+04)	0.101±0.013 [MDA=0.045] (2.7e+04)	less than MDA [MDA=0.107]	data
10/01/2011 09:39	1.81	less than MDA [MDA=0.091]	less than MDA [MDA=0.353]	0.059±0.008 [MDA=0.034] (4.1e+04)	0.076±0.013 [MDA=0.045] (3.6e+04)	less than MDA [MDA=0.300]	data
10/10/2011 11:43	1.81	less than MDA [MDA=0.153]	less than MDA [MDA=2.19]	0.056±0.010 [MDA=0.044] (4.4e+04)	0.088±0.015 [MDA=0.049] (3.1e+04)	less than MDA [MDA=2.02]	data
12/29/2011 07:54	1.81	less than MDA [MDA=0.053]	less than MDA [MDA=0.131]	0.068±0.011 [MDA=0.044] (3.6e+04)	0.075±0.015 [MDA=0.052] (3.6e+04)	less than MDA [MDA=0.126]	data
02/16/2012 10:55	1.81	less than MDA [MDA=0.060]	less than MDA [MDA=0.159]	0.052±0.011 [MDA=0.045] (4.6e+04)	0.115±0.016 [MDA=0.053] (2.4e+04)	less than MDA [MDA=0.228]	data
03/12/2012 06:22	1.8	less than MDA [MDA=0.055]	less than MDA [MDA=0.154]	0.051±0.010 [MDA=0.041] (4.8e+04)	0.076±0.013 [MDA=0.040] (3.6e+04)	less than MDA [MDA=0.196]	data
04/09/2012 09:27	1.8	less than MDA [MDA=0.051]	less than MDA [MDA=0.106]	0.068±0.010 [MDA=0.038] (3.6e+04)	0.141±0.015 [MDA=0.045] (1.9e+04)	less than MDA [MDA=0.123]	data
04/16/2012 08:43	1.8	less than MDA [MDA=0.055]	less than MDA [MDA=0.221]	0.073±0.010 [MDA=0.040] (3.3e+04)	0.079±0.014 [MDA=0.045] (3.4e+04)	less than MDA [MDA=0.129]	data
06/11/2012 08:25	1.8	less than MDA [MDA=0.066]	less than MDA [MDA=0.209]	less than MDA [MDA=0.028]	less than MDA [MDA=0.057]	less than MDA [MDA=0.202]	data
07/09/2012 06:14	1.8	less than MDA [MDA=0.081]	less than MDA [MDA=0.291]	less than MDA [MDA=0.027]	less than MDA [MDA=0.050]	less than MDA [MDA=0.166]	data
08/30/2012 12:22	1.8	less than MDA [MDA=0.070]	less than MDA [MDA=0.243]	less than MDA [MDA=0.027]	less than MDA [MDA=0.052]	less than MDA [MDA=0.238]	data

** The number in parentheses is the number of liters of milk that one would need to consume to equal the

radiation exposure of a single round trip flight from San Francisco to Washington D.C. (0.05 mSv). To see how we calculate these numbers, please visit our explanation of the equivalent dose calculation.

Original Data (pre-4/13/2011):

	I131	I132	Cs134	Cs137	Te132	Data
Best By Date	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	Bq/L (liters**)	
Estimated Minimum Detectable Activity (MDA) for samples ending 4/4	*0.14*	*0.23*	*0.14*	*0.18*	*0.10*	
3/25/2011	less than MDA	less than MDA	less than MDA	less than MDA	less than MDA	data
4/4/2011	0.70 ± 0.27 (3,800)	less than MDA	less than MDA	less than MDA	less than MDA	data
Estimated Minimum Detectable Activity (MDA) for samples starting 4/8	*0.04*		*0.05*		*0.03*	
4/8/2011	less than MDA	less than MDA	less than MDA	less than MDA	less than MDA	data
4/11/2011	0.14 ± 0.08 (18,900)	less than MDA	less than MDA	less than MDA	less than MDA	data
4/14/2011	0.10 ± 0.04 (26,300)	less than MDA	0.11 ± 0.04 (22,100)	less than MDA	less than MDA	data
~~4/16/2011~~ 4/18/2011	0.22 ± 0.04 (12,200)	less than MDA	0.10 ± 0.04 (24,000)	0.22 ± 0.08 (12,000)	less than MDA	data