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**RESULTS OF SAMPLING**

12/09/91

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LETTER



Department of Energy  
Fernald Environmental Management Project  
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DEC 9 1991

DOE-310-92

Mr. Melvin Knollman



Dear Mr. Knollman:

The purpose of this letter is to provide you with the results of the beef sampling conducted by Westinghouse Environmental Management Company of Ohio (WEMCO). In December 1990, liver, bone, and meat samples were collected from three animals which had been sent to slaughter. Two of the animals sampled were raised on farms located greater than twenty miles from the Fernald Site and provided the background samples. The third animal, raised on your property, provided the local indicator samples. Results of the analysis are reported below in pico-Curies per kilogram (pCi/kg) of sample, a standard unit of measurement for environmental samples.

For comparison, the results of a separate study conducted on beef cattle from a single New York farm are included. The concentrations found in the tissues of the animals from this study are typical of those found in both the indicator or control samples. These results are useful because they demonstrate uranium concentrations exist in animals not within the range of influence of a uranium facility. The animals in the New York study ingested much of the uranium in their diet from a feed supplement which had high concentrations of naturally occurring uranium. The results also demonstrate that a range of results are possible, even with animals raised in the same location and with the same diet.

When reviewing the results, please note that several measurements have 95% confidence limits (the  $\pm$  value given for each measurement) which are nearly as large or larger than the actual measurement. Reporting results at the 95% confidence level, sometimes called the two sigma level, is a standard practice used in many laboratory and technical reports. The relatively large confidence limits reported for the samples are not the result of poor lab work, but rather are the product of trying to measure very small amounts of a substance, which are near the lower limits of measurement instruments in the lab. As an illustration of this,

M. Knollman

-2-

consider the uranium-234 concentration for the ground beef indicator sample reported as  $0.0 \pm 0.056$  pCi/kg of sample. The result should be interpreted to read that the laboratory is 95% confident that the true uranium-234 concentration lies between 0.0 pCi/kg and 0.056 pCi/kg. The limitations of the methods and instruments used for the measurement do not allow a more precise measurement.

If you have any questions regarding the results in this letter or any aspect of our environmental monitoring program, please contact Wally Quaider by phone (738-6160) at your convenience.

Sincerely,

Wally Quaider  
R. E. Tiller  
Manager for

FO:Quaider

M. Knollman

-3-

## Uranium Concentrations in Beef Samples

	Local Indicator (pCi/kg)	Background 1 (pCi/kg)	Background 2 (pCi/kg)
Ground beef			
Uranium-234	0.0 ± 0.056	0.059 ± 0.049	0.016 ± 0.038
Uranium-235	0.003 ± 0.027	0.0 ± 0.018	0.001 ± 0.019
Uranium-238	0.048 ± 0.056	0.0 ± 0.023	0.011 ± 0.026
Uranium-234	0.102 ± 0.089		
Uranium-235	0.0 ± 0.031	(1)	(1)
Uranium-238	0.052 ± 0.065		
Liver			
Uranium-234	0.211 ± 0.128	0.101 ± 0.144	0.059 ± 0.107
Uranium-235	0.028 ± 0.050	0.062 ± 0.083	0.0 ± 0.023
Uranium-238	0.212 ± 0.117	0.074 ± 0.103	0.0 ± 0.041
Femur			
Uranium-234	4.45 ± 0.532	3.72 ± 0.477	0.237 ± 0.131
Uranium-235	0.203 ± 0.080	0.179 ± 0.084	0.015 ± 0.038
Uranium-238	4.18 ± 0.506	3.057 ± 0.415	0.147 ± 0.098
Rib			
Uranium-234	4.049 ± 0.516	1.924 ± 0.456	0.191 ± 0.255
Uranium-235	0.270 ± 0.106	0.117 ± 0.123	0.076 ± 0.152
Uranium-238	3.993 ± 0.509	2.231 ± 0.485	0.172 ± 0.202

1. Two ground beef samples were collected from the indicator location, only one ground beef sample was collected from each control location.

M. Knollman

-4-

## Plutonium Concentrations in Beef Samples

	Local Indicator (pCi/kg)	Background 1 (pCi/kg)	Background 2 (pCi/kg)
Ground beef			
Plutonium-238	0.003 ± 0.013	0.005 ± 0.009	0.0 ± 0.009
Plutonium-239	0.0 ± 0.009	0.0 ± 0.006	0.0 ± 0.006
Plutonium-238	0.0 ± 0.012	(1)	(1)
Plutonium-239	0.005 ± 0.011		
Liver			
Plutonium-238	0.017 ± 0.035	0.002 ± 0.037	0.0 ± 0.014
Plutonium-239	0.004 ± 0.018	0.031 ± 0.036	0.2 ± 0.052
Femur			
Plutonium-238	0.027 ± 0.035	0.0 ± 0.022	0.004 ± 0.031
Plutonium-239	0.008 ± 0.021	0.0 ± 0.015	0.022 ± 0.031
Rib			
Plutonium-238	0.0 ± 0.050	0.025 ± 0.036	0.069 ± 0.083
Plutonium-239	0.026 ± 0.058	0.023 ± 0.033	0.044 ± 0.060

1. Two ground beef samples were collected from the indicator location, only one ground beef sample was collected from each control location.

M. Knollman

-5-

Thorium Concentrations in Beef Samples

	Local Indicator (pCi/kg)	Background 1 (pCi/kg)	Background 2 (pCi/kg)
Ground beef			
Thorium-228	0.167 ± 0.038	0.131 ± 0.036	0.303 ± 0.045
Thorium-230	0.026 ± 0.016	0.017 ± 0.017	0.032 ± 0.017
Thorium-232	0.005 ± 0.011	0.0 ± 0.013	0.023 ± 0.011
Thorium-228	0.232 ± 0.039		
Thorium-230	0.041 ± 0.018	(1)	(1)
Thorium-232	0.018 ± 0.012		
Liver			
Thorium-228	1.396 ± 0.135	4.259 ± 0.308	5.313 ± 0.367
Thorium-230	0.448 ± 0.069	0.397 ± 0.074	0.088 ± 0.04
Thorium-232	0.062 ± 0.025	0.091 ± 0.035	0.046 ± 0.029
Femur			
Thorium-228			
Thorium-230	(2)	(2)	(2)
Thorium-232			
Rib			
Thorium-228			
Thorium-230	(2)	(2)	(2)
Thorium-232			

1. Two ground beef samples were collected from the indicator location, only one ground beef sample was collected from each control location.
2. Laboratory data not reported due to difficulties with thorium analysis of bones. The laboratory attempted to analyze the entire bone sample, but large amount of mineral material in the bones interfered with the extraction of thorium from the bone. In the future, only a fraction of the bone sample will be analyzed.

M. Knollman

-6-

Uranium Concentrations in New York Farm Beef Samples<sup>1</sup>

	Animal 1 (pCi/kg)	Animal 2 (pCi/kg)	Animal 3 (pCi/kg)
Flesh (ground beef)			
Uranium-234	0.044 ± 0.006	0.016 ± 0.003	0.020 ± 0.004
Uranium-238	0.036 ± 0.005	0.014 ± 0.003	0.021 ± 0.003
Liver			
Uranium-234	(2)	0.120 ± 0.010	(2)
Uranium-238		0.110 ± 0.010	
Rib			
Uranium-234	3.792 ± 0.421	5.955 ± 0.794	1.794 ± 0.146
Uranium-238	4.214 ± 0.421	5.955 ± 0.794	1.720 ± 0.109

1. Data taken from study "Transport pathways of Th, U, Ra, and La from Soil to Cattle Tissues" reported in the *Journal of Environmental Radioactivity*, 10(1989), 115-140.

2. Sample not collected from animal.