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United States Department of the Interior
GEOLOGICAL SURVEY
BOX 25046 M.S. 974
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY REFER TO

January 21, 1993

Mr. L.J. Callan
Director, DRSS, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

Dear Mr. Callan:

The attached annual report of the U.S. Geological Survey TRIGA reactor facility is submitted in accordance with license conditions. The facility docket number is 50-274.

Sincerely,

Timothy M. DeBey

Timothy M. DeBey
Reactor Supervisor

Enclosure

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U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 1992 - DECEMBER 31, 1992

NRC LICENSE NO. R-113 - DOCKET NO. 50-274

I. Administrative Changes

Dr. Carl Hedge assumed the position of Reactor Administrator in October, 1992. This change occurred because the reactor project was administratively transferred from the Branch of Geochemistry to the Branch of Isotope Geology. Dr. Hedge is the Chief of the Branch of Isotope Geology.

II. Operating Experience

The Geological Survey TRIGA Reactor (GSTR) was in normal operation for the year 1992. No major facility changes were made during the year.

A total of 267 irradiation requests were processed during the year, with the average request representing 57 samples and 11.3 full-power hours of reactor operation. A synopsis of irradiations performed during the year is given below, listed by the organization submitting the samples to the reactor staff:

Organization	Number of Samples
Geologic Division - Geochemistry	11,352
Geologic Division - Isotope Geology	3,301
Geologic Division - Cent. Mineral Res.	1
Geologic Division - Sedimentary Proc.	7
Non-USGS users	589
Total	15,250

A. Thermal power calibrations were performed in February and August, with minor adjustments required.

B. Two new Class I experiments were approved during this period. The Class I experiments involved the activation of a bromine tracer compound and routine argon age-dating experiments. No new Class II experiments were approved during the year.

C. During the report period, 208 daily checklists and 12 monthly checklists were completed in compliance with technical specifications requirements for surveillance of the reactor facility.

D. Tours were provided to individuals and groups during the year for a total visitor count of approximately 150.

E. Five standard fuel elements from the Michigan State reactor were installed in the core during the year. Four of these replaced high-burnup elements and the fifth replaced a leaking instrumented element in the G-ring. A total reactivity gain of about $.50 was achieved. In December, all fuel elements were inspected and found to be within the tolerances specified in the Technical Specifications.

III. Tabulation of Energy Generated

Month	Megawatt Hours	Time Reactor Was Critical	Number of Pulses
January	105.129	107 hours 36 minutes	0
February	120.832	125 hours 47 minutes	0
March	170.323	174 hours 59 minutes	0
April	131.048	134 hours 50 minutes	0
May	136.167	140 hours 10 minutes	0
June	122.278	128 hours 0 minutes	0
July	122.100	123 hours 34 minutes	0
August	121.892	129 hours 42 minutes	0
September	80.193	88 hours 38 minutes	0
October	128.114	129 hours 46 minutes	0
November	92.658	94 hours 48 minutes	0
December	64.546	74 hours 45 minutes	0
Totals	1395.280	1452 hours 35 minutes	0

IV. Unscheduled Shutdowns

Serial No.	Date	Cause
491	1/7/92	Scram due to loss of AC power.
492	1/9/92	CSC watchdog scram due to computer lockup.
493	1/10/92	CSC watchdog scram due to computer lockup.
494	1/30/92	CSC watchdog scram due to computer lockup.
495	2/10/92	CSC watchdog scram due to computer lockup.
496	2/24/92	CSC watchdog scram due to computer lockup.
497	2/27/92	Manual scram due to building evacuation alarm.
498	3/12/92	CSC watchdog scram due to computer lockup.
499	3/25/92	CSC watchdog scram due to computer lockup.
500	4/21/92	CSC watchdog scram due to computer lockup.
501	4/28/92	CSC watchdog scram due to computer lockup.
502	4/29/92	CSC watchdog scram due to computer lockup.
503	5/15/92	CSC watchdog scram due to computer lockup.
504	5/19/92	CSC watchdog scram due to computer lockup.
505	5/19/92	CSC watchdog scram due to computer lockup.
506	6/16/92	CSC watchdog scram due to computer lockup.
507	6/23/92	CSC watchdog scram due to computer lockup.
508	6/24/92	CSC watchdog scram due to computer lockup.
509	7/1/92	CSC watchdog scram due to computer lockup.
510	7/13/92	CSC watchdog scram due to computer lockup.
511	7/14/92	CSC watchdog scram due to computer lockup.
512	7/16/92	N.P1000 hi power scram due to noise spike.
513	7/22/92	CSC watchdog scram due to computer lockup.
514	7/28/92	CSC watchdog scram due to computer lockup.
515	8/20/92	CSC watchdog scram due to computer lockup.

516	8/27/92	Manual scram due to loss of room underpressure.
517	10/20/92	CSC watchdog scram due to computer lockup.
518	10/20/92	CSC watchdog scram due to computer lockup.
519	10/21/92	CSC watchdog scram due to computer lockup.
520	10/22/92	CSC watchdog scram due to computer lockup.
521	11/2/92	CSC watchdog scram due to computer lockup.
522	11/2/92	Scram due to loss of AC power.
523	11/3/92	CSC watchdog scram due to computer lockup.
524	11/10/92	CSC watchdog scram due to computer lockup.
525	11/12/92	CSC watchdog scram due to computer lockup.
526	11/17/92	CSC watchdog scram due to computer lockup.
527	11/17/92	CSC watchdog scram due to computer lockup.
528	11/24/92	NPP hi power scram due to slow square wave response.
529	11/24/92	NPP hi power scram due to slow square wave response.
530	11/24/92	NP hi power scram due to slow square wave response.
531	11/30/92	CSC watchdog scram due to computer lockup.
532	11/30/92	CSC watchdog scram due to computer lockup.
533	12/1/92	Database timeout scram.
534	12/11/92	Database timeout scram.
535	12/14/92	CSC watchdog scram due to computer lockup.
536	12/29/92	Manual scram due to building fire alarm.
537	12/29/92	CSC watchdog scram due to computer lockup.
538	12/30/92	CSC watchdog scram due to computer lockup.

V. Major Maintenance Operations

A leaking instrumented fuel element was detected in June. This element had been in use since May, 1969. Data from the continuous air monitor and subsequent calculations give an estimated release of 54.6 microcuries of activity to the environment. The release occurred over a 15 day period and no 10CFR20 limits were exceeded. Other less significant maintenance items include the replacement of a neutron detector mounting bracket and replacement of the exhaust fan motor, sheave, and belt. Ion exchange resin was replaced three times during the year, in January, June and December.

VI. Summary of 10 CFR 50.59 changes

There was one 50.59 change approved at the facility during this report period. A new neutron detector mounting bracket design was evaluated by the safety committee and approved for use. This mounting bracket is an improved design that greatly simplifies the method for adjusting the position of the in-pool neutron detectors. Although three new mounting brackets will eventually be installed, only one was installed during 1992. The safety committee evaluation of the change made under the provisions of 10CFR50.59 concluded that the new mounting bracket:

(1) does not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report,

(2) does not create the possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report, and,

(3) does not reduce the margin of safety as defined in the basis for any technical specification.

VII. Radioactivity Releases

A. Listed below are the total amounts of radioactive gaseous effluents released to the environs beyond the effective control of the reactor facility.

Month	Argon-41 (Curies)	License (R-113) Allowable (Curies)	Tritium (HTO) (uCuries)	10 CFR 20 Allowable (Curies)
January	0.75	5.8	249.8	0.25
February	1.27	5.8	168.1	0.25
March	1.35	5.8	347.5	0.25
April	1.36	5.8	224.8	0.25
May	0.92	5.8	469.4	0.25
June	0.80	5.8	499.7	0.25
July	0.81	5.8	186.2	0.25
August	0.67	5.8	236.2	0.25
September	0.56	5.8	279.4	0.25
October	0.60	5.8	367.9	0.25
November	0.75	5.8	268.0	0.25
December	0.78	5.8	162.5	0.25
Total	10.29	70.0	3460.5 uCi	3.00
% of allowable	14.7%		0.12%	

Note #1: The argon activities reported are integrated values obtained from the facility's gaseous stack monitor. Calculated values have been substituted for measured values in the few instances when the monitoring system was down for maintenance or repair.

Note #2: The tritium concentrations are estimates based on the amount of water lost by evaporation from the reactor multiplied by the concentration of tritium as HTO. Tritium sample analyses are being performed by Colorado State University.

B. 340 liters of seepage water was pumped from the reactor tank annulus during 1992. In November 0.945 microcuries in 170 liters was diluted to 5.9×10^{-10} microcuries per milliliter. In December 0.267 microcuries in 170 liters of water was diluted to 1.68×10^{-10} microcuries per milliliter.

C. Four 55-gallon drums of low level solid waste and solidified resin were shipped for burial in Nevada during the year.

The total amount of radioactive waste released from the reactor facility during the year is estimated to be approximately 10 mCi.

Note: The principal radioactive waste generated at the reactor facility is the demineralizer resin - used resin with small quantities of rinse water is solidified in 55-gallon drums with Portland cement prior shipment.

VIII. Radiation Monitoring

A. Our program to monitor and control radiation exposures included the four major elements below during the operating year.

1. Fifteen area monitors (14 gammas, 1 neutron) located throughout the Nuclear Science Building. To provide a background signal, a small check source is attached to the scintillation detector. High alarm set points range from 2 mR/hr to 50 mR/hr. High level alarms have been infrequent and due to instrument malfunctions.

2. One Continuous Air Monitor (CAM) sampling the air in the reactor bay. An equilibrium concentration of 3.0×10^{-8} uCi/ml present for two minutes will result in an increase of 400 cpm above background. There are two alarm set points. A low-level alarm is set at 3,000 cpm, and the high level alarm is set at 10,000 cpm.

Reactor bay air is sampled during all reactor operations. The fixed particulate air filter is changed each day of reactor operation and counted on a Gamma Products G4020 Low Level counting system. The charcoal filter, fitted behind the air filter, is changed and counted weekly. In all instances, final sample calculations show less than MPC (10 CFR Part 20, Appendix B, Table 11) concentrations for all isotopes in question in the reactor bay.

3. Contamination wipe surveys and radiation surveys with portable survey instruments are performed at least once a month. All portable instruments are calibrated with a 3-Curie Cs-137 source traceable to NBS and wipes are counted on a Gamma Products G4020 Low Level counting system.

Five areas of contamination were noted during routine wipe surveys. Beta activity ranging from 86 pCi to 868 pCi/100 cm^2 was noted on a table top. Contamination was removed with soap and water. The roof hatch over the reactor bay continues to be roped off and posted as a radiation area (averaging 2.5 mR/hr) during routine 1 MW operations.

4. Personnel, X and gamma, beta and neutron film badges are assigned to all permanent occupants of the Nuclear Science Building. $CaSO_4$:Dy dosimeters have been used at four outdoor environmental stations. Reactor facility visitors are issued L-49 self-reading dosimeters. Reactor staff personnel are issued albedo neutron badges.

Personnel monitoring results are categorized below:

	Rem		
	Deep	Shallow	Neutron
Reactor Staff			
Whole Body Cumulative Dose for Calendar Year (thru 12-14-92)			
Highest	0.165	0.165	0.000
Hands Cumulative Shallow Dose for Calendar Year			
Highest	0.000	0.200	0.000

Reactor Experimenters

Whole Body Cumulative Dose for Calendar Year			
Highest	0.000	0.000	0.000
Hands Cumulative Dose for Calendar Year			
Highest	0.000	0.250	0.000

Reactor Visitors and Occasional Experimenters

No individual reading was greater than 6 mrem.

Environmental Stations

	Rem
Exhaust Stack	0.2790
West	0.0116
Southwest	0.0000
Southeast	0.0000

Note: The "WEST" badge is estimated for a one change period. A correction from our badge supplier will be forthcoming.

IX. Environmental Monitoring

Pursuant to reactor procedures, soil and water samples are collected every second year. Environmental soil and water samples were collected in 1992. Results are attached

There have been no uncontrolled radioactivity releases from the reactor to the present date. Thus, the data on file from past years to the present are considered to be background information.

ENVIRONMENTAL WATER SAMPLES

BARRINGER LABORATORIES, INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

25-Sep-92

Bill Smith
U.S. GEOLOGICAL SURVEY
Mail Stop 424
Bldg. 15, Rm. 150
Denver Federal Center
Denver, CO 80225

Page: 1
Copy: 1 of 2

Attn: Bill Smith
Project:

Received: 2-Sep-92 12:00
PO #: 151010-92

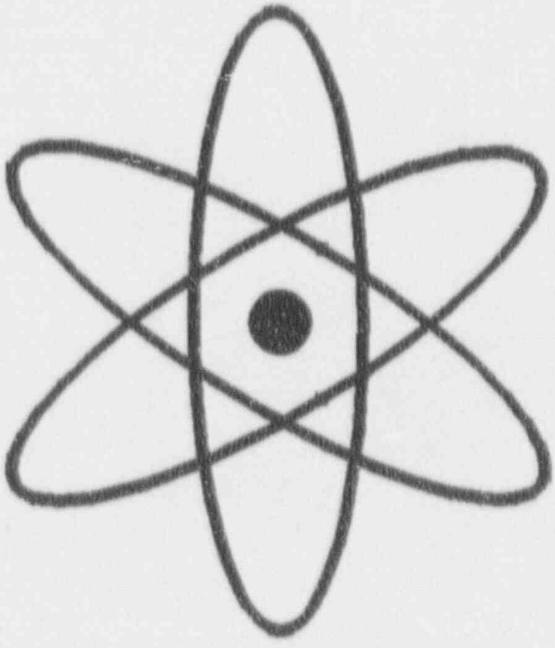
Job: 924896E

Status: Final

Sample Type: Water

Sample	Gross Alpha Error Total pCi/l	2σ	Gross Beta Error Total pCi/l	2σ
W-1	3.8	±2.4	2.0	±1.9
W-2	4.0	±2.8	5.0	±2.0
W-3	1.4	±1.9	2.7	±1.8
W-4	7.5	±3.3	12	±2
W-5	2.3	±2.5	22	±3
W-7	1.1	±2.2	3.5	±1.9

Radionuclide Concentrations in USGS Soil Samples



Sample OS-1		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.02	0.028
Cs-137	0.13	0.032
Th-232	1.2	0.11
Co-60	-0.0032	0.025
Ra-226	0.87	0.060
Fe-59	-0.019	0.056
Mn-54	-0.0034	0.025
Zr-95	-0.015	0.063
mg K-40/g	18.8	0.64
U-238	7.4	0.49

Sample OS-2		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.00071	0.080
Cs-137	0.038	0.082
Th-232	1.8	0.27
Co-60	0.024	0.082
Ra-226	1.1	0.15
Fe-59	-0.096	0.14
Mn-54	0.11	0.081
Zr-95	-0.15	0.17
mg K-40/g	32.4	1.5
U-238	3.4	1.4

Sample OS-3		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.0013	0.017
Cs-137	0.28	0.021
Th-232	1.1	0.067
Co-60	0.0046	0.016
Ra-226	0.70	0.035
Fe-59	0.0062	0.087
Mn-54	0.032	0.017
Zr-95	-0.036	0.038
mg K-40/g	18	0.40
U-238	5.7	0.30

Sample OS-4		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.015	0.019
Cs-137	0.15	0.022
Th-232	0.95	0.074
Co-60	0.0028	0.018
Ra-226	0.66	0.039
Fe-59	0.0025	0.086
Mn-54	0.013	0.019
Zr-95	-0.0056	0.041
mg K-40/g	15	0.42
U-238	5.9	0.33

Sample OS-5		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.00067	0.031
Cs-137	0.17	0.034
Th-232	2.2	0.11
Co-60	0.0095	0.032
Ra-226	1.1	0.058
Fe-59	0.020	0.16
Mn-54	0.0025	0.032
Zr-95	-0.0057	0.066
mg K-40/g	33	0.60
U-238	4.9	0.57

Sample OS-6		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.024	0.071
Cs-137	0.026	0.080
Th-232	1.8	0.026
Co-60	0.024	0.078
Ra-226	1.0	0.14
Fe-59	-0.073	0.14
Mn-54	0.059	0.071
Zr-95	-0.092	0.16
mg K-40/g	38	1.5
U-238	3.8	1.4

Sample OS-7		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.023	0.066
Cs-137	0.54	0.083
Th-232	2.0	0.26
Co-60	-0.025	0.053
Ra-226	1.2	0.13
Fe-59	-0.026	0.11
Mn-54	-0.0087	0.055
Zr-95	0.20	0.22
mg K-40/g	18	1.2
U-238	9.8	1.2

Sample OS-8		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0060	0.016
Cs-137	0.080	0.017
Th-232	1.0	0.062
Co-60	-0.014	0.014
Ra-226	0.066	0.031
Fe-59	0.0091	0.056
Mn-54	-0.0053	0.014
Zr-95	0.019	0.053
mg K-40/g	16	0.35
U-238	60	0.28

Sample OS-9		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.025	0.048
Cs-137	0.0028	0.052
Th-232	2.1	0.18
Co-60	0.026	0.053
Ra-226	0.70	0.085
Fe-59	0.080	0.23
Mn-54	0.0040	0.048
Zr-95	-0.049	0.11
mg K-40/g	37	1.0
U-238	4.1	0.89

Sample OS-10		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0028	0.029
Cs-137	0.51	0.036
Th-232	1.9	0.10
Co-60	0.034	0.031
Ra-226	1.1	0.055
Fe-59	-0.0047	0.053
Mn-54	0.0054	0.029
Zr-95	-0.031	0.062
mg K-40/g	37	0.58
U-238	5.7	0.54

Sample OS-11		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0017	0.019
Cs-137	0.090	0.021
Th-232	1.1	0.073
Co-60	0.015	0.017
Ra-226	0.88	0.040
Fe-59	0.014	0.099
Mn-54	-0.0070	0.016
Zr-95	0.025	0.087
n.g K-40/g	15	0.40
U-238	6.0	0.34

Sample OS-12		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0071	0.013
Cs-137	0.069	0.013
Th-232	1.3	0.051
Co-60	-0.0030	0.012
Ra-226	0.67	0.024
Fe-59	-0.012	0.024
Mn-54	-0.0045	0.011
Zr-95	0.025	0.044
mg K-40/g	21	0.30
U-238	5.9	0.23

Sample OS-13		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.034	0.052
Cs-137	0.12	0.056
Th-232	2.1	0.18
Co-60	0.019	0.055
Ra-226	0.79	0.092
Fe-59	-0.019	0.088
Mn-54	-0.011	0.044
Zr-95	0.13	0.23
mg K-40/g	37	1.0
U-238	4.7	0.92

Sample ON-1		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.025	0.029
Cs-137	0.27	0.035
Th-232	1.6	0.11
Co-60	0.011	0.032
Ra-226	0.097	0.056
Fe-59	0.047	0.082
Mn-54	0.0075	0.029
Zr-95	-0.059	0.063
mg K-40/g	33	0.60
U-238	4.0	0.55

Sample ON-2		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.020	0.021
Cs-137	0.079	0.024
Th-232	1.1	0.081
Co-60	-0.0091	0.019
Ra-226	0.78	0.043
Fe-59	0.031	0.061
Mn-54	0.0040	0.020
Zr-95	0.031	0.060
mg K-40/g	18	1.1
U-238	6.4	0.36

Sample ON-3		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.012	0.035
Cs-137	1.1	0.066
Th-232	1.1	0.15
Co-60	0.022	0.033
Ra-226	0.68	0.076
Fe-59	-0.017	0.072
Mn-54	-0.0069	0.034
Zr-95	0.0049	0.16
mg K-40/g	15	0.81
U-238	7.0	0.64

Sample ON-4		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.0020	0.032
Cs-137	0.041	0.037
Th-232	1.7	0.12
Co-60	-0.0010	0.035
Ra-226	0.96	0.062
Fe-59	-0.027	0.061
Mn-54	0.0031	0.034
Zr-95	-0.042	0.071
mg K-40/g	33	0.66
U-238	4.8	0.61

Sample ON-5		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.022	0.054
Cs-137	0.084	0.062
Th-232	1.1	0.21
Co-60	-0.0018	0.048
Ra-226	0.77	0.11
Fe-59	-0.058	0.11
Mn-54	-0.021	0.049
Zr-95	0.024	0.24
mg K-40/g	15	1.2
U-238	6.5	0.94

Sample ON-6		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.020	0.054
Cs-137	0.30	0.065
Th-232	1.1	0.21
Co-60	0.044	0.047
Ra-226	0.69	0.10
Fe-59	0.11	0.28
Mn-54	0.041	0.053
Zr-95	-0.041	0.11
mg K-40/g	18	1.2
U-238	7.2	0.89

Sample ON-7		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0080	0.031
Cs-137	0.10	0.033
Th-232	1.7	0.11
Co-60	0.022	0.034
Ra-226	0.87	0.055
Fe-59	-0.04	0.056
Mn-54	-0.0055	0.027
Zr-95	-0.037	0.064
mg K-40/g	43	0.65
U-238	4.2	0.54

Sample ON-8		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.010	0.069
Cs-137	0.26	0.086
Th-232	1.5	0.26
Co-60	0.041	0.081
Ra-226	1.0	0.14
Fe-59	-0.077	0.14
Mn-54	-0.020	0.066
Zr-95	0.20	0.30
mg K-40/g	34	1.5
U-238	3.3	1.4

Sample ON-9		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.011	0.036
Cs-137	0.52	0.047
Th-232	1.9	0.14
Co-60	0.015	0.039
Ra-226	1.0	0.072
Fe-59	-0.042	0.070
Mn-54	-0.022	0.034
Zr-95	-0.065	0.081
mg K-40/g	34	0.77
U-238	4.4	0.70
Sample ON-10		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.039	0.074
Cs-137	0.42	0.088
Th-232	2.1	0.26
Co-60	-0.12	0.075
Ra-226	1.1	0.13
Fe-59	0.45	0.36
Mn-54	-0.15	0.064
Zr-95	-0.031	0.15
mg K-40/g	37	1.4
U-238	5.4	1.3
Sample ON-11		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.018	0.025
Cs-137	0.51	0.031
Th-232	2.0	0.087
Co-60	-0.013	0.026
Ra-226	1.1	0.047
Fe-59	-0.013	0.045
Mn-54	0.018	0.024
Zr-95	0.052	0.082
mg K-40/g	37	0.48
U-238	48	0.45

Sample ON-12		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.023	0.039
Cs-137	0.56	0.053
Th-232	1.1	0.15
Co-60	0.011	0.036
Ra-226	0.78	0.079
Fe-59	0.031	0.20
Mn-54	0.024	0.041
Zr-95	0.021	0.17
mg K-40/g	18	0.85
U-238	6.7	0.66

Sample ON-13		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	-0.013	0.040
Cs-137	1.2	0.076
Th-232	1.2	0.17
Co-60	0.026	0.037
Ra-226	0.78	0.087
Fe-59	-0.019	0.082
Mn-54	-0.0079	0.039
Zr-95	0.0020	0.19
mg K-40/g	17	0.93
U-238	8.1	0.74

Sample ON-14		
Nuclide	Conc. (pCi/g)*	±1.96σ
Cs-134	0.0050	0.045
Cs-137	1.0	0.072
Th-232	1.1	0.18
Co-60	0.016	0.043
Ra-226	0.83	0.092
Fe-59	0.19	0.25
Mn-54	-0.0098	0.038
Zr-95	0.0075	0.20
mg K-40/g	21	1.0
U-238	7.2	0.77

* All concentrations are expressed in pCi/g, except that of K-40, which is expressed in mg K-40/g.