

U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV

Docket Nos. 50-313/81-02
50-368/81-02

License Nos. DPR-51
NPF-6

Licensee: Arkansas Power and Light Company
P. O. Box 551
Little Rock, Arkansas 72203

Facility Name: Arkansas Nuclear One (ANO), Units 1 and 2

Inspection at: ANO Site, Russellville, Arkansas

Inspection Conducted: January 13-15, 1981

Inspectors:

R. J. Everett
R. J. Everett, Radiation Specialist

3/19/81
Date

J. B. Nicholas
J. B. Nicholas, Radiation Specialist

3/19/81
Date

Approved by:

G. D. Brown
G. D. Brown, Chief, Technical Inspection Branch

3/19/81
Date

Inspection Summary

Inspection conducted during the period of January 13-15, 1981
(Report Nos. 50-313/81-02 & 50-368/81-02)

Areas Inspected: Routine, announced inspection of the licensee's radiochemistry measurements program including sample collection, treatment and analysis, analytical procedures and quality controls. The Region IV mobile laboratory was utilized for on site comparisons of sample results. In addition, the circumstances surrounding a 2.72 rem exposure and an inadvertent shipment of LSA material were reviewed. The inspection involved 24 onsite hours by two NRC inspectors.

Results: One violation was identified; an improper radioactive shipment (See paragraph 4).

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DETAILS

1. Persons Contacted (AP&L)

- *J. P. O'Hanlon, ANO General Manager
- *G. H. Miller, Engineering and Technical Support Manager
- *D. D. Snellings, Technical Analysis Superintendent
- *G. Fiser, Radiochemistry Supervisor
- *D. Glenn, Health Physics Supervisor
- *M. Frala, Assistant Radiochemistry Supervisor
- *D. Wagner, Assistant Health Physics Supervisor

*Denotes those present at the exit interview.

2. Status of Previous Inspection Findings

(Closed) open item (50-313/79-18/2): This item identified a need for a documented QC program in the radiochemistry counting laboratory and the undesirable environment of the radiochemistry counting laboratory as a result of its location in a radiation control area and lack of adequate temperature control to maintain laboratory instrument performance. The QC program and Procedure 1604.19 were reviewed and the radiochemistry counting laboratory has been moved to a location which is considered acceptable. This item is considered closed.

3. Significant Radiation Exposure

A NRC inspector reviewed the circumstances surrounding the exposure of an AP&L employee to about 2.72 rem whole body on December 22, 1980. An inexperienced engineer was under escort in order to inspect components of the Makeup and Purification System of Unit 1. The T-36B tank room was surveyed (1-2 R/h) by the health physics technician, who was acting as the escort, and he withdrew from the tank room leaving the engineer in the area. The engineer, not under visual contact and not having been instructed otherwise, proceeded to the adjacent room (T-36A tank room) where radiation levels were 300-400 R/h. Upon exiting both areas, the engineer noted that both of his pocket dosimeters had discharged off-scale. Subsequent reading of the engineer's TLD indicated a dose of about 2.72 rem. The NRC inspector's findings are as follows:

- a. There was poor communications between the health physics technician and the engineer as to what areas were to be visited and the radiation levels associated with each area.
- b. The health physics technician conducted the escort and inspection under a general RWP rather than an applicable SWP.

- c. The health physics technician was unfamiliar with the plant lay-out, in particular, the makeup tank rooms.
- d. The postings at the access to these high radiation areas did not reflect the higher radiation levels in T-36A tank room.
- e. There appears to be a need for guidance on what the term "escort" means at the ANO site.

The licensee conducted a SRC management audit of the event on December 29, 1980. Several deficiencies and proposed corrective actions were identified. The licensee has agreed to provide guidance on "escort" responsibilities. It was agreed that an escort would maintain visual contact with the person he is escorting in most cases. However, the escort should consider his own exposure and take advantage of available shielding if possible. Before withdrawing from temporary visual contact, the escort should assure himself that all accessible areas and sources have been surveyed and that there has been effective communication with the person being escorted. The NRC inspector stated that until such time as the corrective actions described in the management audit and those items identified by the NRC inspector have been implemented, the event would be considered an open item (50-313/81-02/1).

4. Radioactive Waste Shipment

A NRC inspector investigated the events and practices that led to an inadvertent shipment of low specific activity material from ANO on December 17, 1980. The shipment in question (RSR-43-80) consisted of six LSA wooden boxes containing noble gas, halogen, and metal oxide activities on charcoal. The shipment was sent to Nuclear Consulting Services, Inc., in Columbus, Ohio. Upon arrival in Columbus, the boxes were surveyed and one box (80-76) was found to have radiation levels on the outside surface of 12 mR/h. The recipient notified the NRC Region III office of the initial findings. The regional office advised the recipient to open the box, survey the contents, and report the findings. The box was found to contain radioactive waste (metal, plastic, and paper items) at levels up to 30 mR/h. AP&L personnel were notified of the shipment discrepancy and dispatched a man to Columbus, Ohio, to re-package the waste and charcoal and ship it back to the ANO site.

The radioactive shipment record prepared by ANO personnel on December 17, 1980, indicated surface radiation levels of 0.2 mR/h and an activity content of 1.08 millicuries. Radiation levels for the loaded sole use vehicle were recorded as <0.1 mR/h on the external surface of the vehicle and <0.1 mR/h 6 feet from the external surface of the vehicle. As noted above the radiation level measured on box 80-76 in Columbus was 12 mR/h at contact and up to 30 mR/h inside. Based on these readings it was apparent that the activity content of the box was much greater than

1.08 millicuries. A survey taken of the vehicle used for the return shipment of the box prior to leaving Columbus, Ohio, revealed readings of 3.0 mR/h at the vehicle external surface and 0.3 mR/h at 6 feet from the external surface of the vehicle.

The licensee stated that the shipment had been loaded on about December 16, 1980, by Bechtel employees and apparently they had located and loaded the wrong box (80-76). The ANO Radioactive Waste Coordinator was on site the date of the shipment and signed the RSR certifying that all shipping requirements had been met. Since the radiation surveys in question were not properly documented, it is not known whether the survey was actually performed. The NRC inspector identified the following items as contributors to the inadvertent shipment.

- a. Radiation surveys of radioactive shipment boxes and vehicles were not properly documented.
- b. Boxes, crates, and other containers stored in the waste storage building were not identified properly as to their contents.

The NRC inspector stated that the failure to properly identify the contents of radioactive shipments and the activity content of each container was an item of violation. However, it should be noted that the box in question was properly packaged, labeled, and shipped and radiation levels present were within regulatory requirements for LSA shipments.

This is a Severity Level IV violation (Supplement V.D).

5. Radiochemistry Quality Control

The NRC inspectors visited the radiochemistry counting laboratory facility and reviewed the radiochemistry QC program. Procedure 1604.09, "Quality Control Guidelines and Acceptance Criteria," Revision 4, issued October 20, 1979, was reviewed along with trend charts and other documentation of instrument performance. The NRC inspectors noted that the QC program and procedures had been revised and the radiochemistry counting laboratory relocated; therefore, closing open item (50-313/79-18/2).

Samples of health physics surveys, a plant gas decay tank, a plant liquid radioactive waste tank, and Unit 1 reactor coolant were collected for analysis by the Region IV mobile laboratory. Analytical comparisons are reported in paragraph 6.

No items of violation were identified.

6. Analytical Measurements

a. Confirmatory Measurements

Confirmatory measurements were performed on the following samples in the mobile laboratory at the ANO site during the inspection:

1. Health Physics Particulate Filter
2. Health Physics Charcoal Cartridge
3. Gaseous Waste
4. Liquid Waste
5. Reactor Coolant from Unit No. 1
6. RESL Charcoal Cartridge Standard
7. RESL Particulate Filter Standard

The confirmatory measurements tests consist of comparing measurements made by the licensee, NRC's mobile laboratory, and NRC's reference laboratory, Radiological and Environmental Sciences Laboratory (RESL) in Idaho Falls, Idaho. RESL's and the NRC's mobile laboratory measurements are referenced to the National Bureau of Standards by laboratory intercomparisons. Confirmatory measurements are made only for those nuclides identified by the mobile laboratory or RESL as being present in concentrations greater than 10% of the respective isotopic values for liquid and gas concentrations as stated in 10 CFR Part 20, Appendix B, Table II, and above the Lower Limit of Detection (LLD) for stack samples. Stack charcoal cartridge and stack particulate filter comparisons are based on established Lower Limits of Detection (LLD) for total activity per sample.

Attachment No. 1 contains the criteria used to compare results.

Attachment No. 2 lists the LLD's for stack samples.

The following tables show the various sample comparisons:

- a. Health Physics Particulate Filter (collected 0157, January 14, 1981, during the head pull on Unit No. 1)

Nuclide concentrations identified by Region IV mobile laboratory were less than LLDs. No comparison made.

- b. Health Physics Charcoal Cartridge (collected 0157, January 14, 1981, during the head pull on Unit No. 1)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
¹³¹ I	1.75±0.14E-10 uCi/cc	2.02±0.20E-10 uCi/cc	Agreement

(1) Analytical results as reported by the health physics counting facility.

- c. Gas (Waste Gas Decay Tank, T-18, collected 1130, January 14, 1981)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
¹³³ Xe	2.55±0.001E+00 uCi/cc	2.63±0.001E+00 uCi/cc	Agreement
^{133m} Xe	5.00±0.34E-03 uCi/cc	5.58±0.11E-03 uCi/cc	Agreement
^{131m} Xe	3.00±0.10E-02 uCi/cc	3.00±0.12E-02 uCi/cc	Agreement
⁸⁵ Kr	6.98±0.21E-02 uCi/cc	7.37±0.32E-02 uCi/cc	Agreement

(1) Analytical results as reported by the radiochemistry counting facility.

- d. Liquid (Monitor Tank, T-16A, collected 1450, January 14, 1981)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
tritium	(2)	4.83±0.02E-02 uCi/ml	(3)
gross beta	2.24±0.09E-04 uCi/ml	2.76±0.08E-04 uCi/ml	Agreement
⁸⁹ Sr	(2)	1.40±0.02E-06 uCi/ml	(3)
⁹⁰ Sr	(2)	1.37±0.35E-07 uCi/ml	(3)
⁵¹ Cr	3.63±0.35E-05 uCi/ml	3.93±0.99E-05 uCi/ml	(4)
⁵⁴ Mn	1.71±0.35E-06 uCi/ml	1.87±0.98E-06 uCi/ml	(4)
⁵⁸ Co	2.97±0.01E-04 uCi/ml	3.81±0.03E-04 uCi/ml	Disagreement
⁵⁹ Fe	2.35±0.09E-05 uCi/ml	3.77±0.25E-05 uCi/ml	Possible Agreement
⁶⁰ Co	7.97±0.09E-05 uCi/ml	1.04±0.02E-04 uCi/ml	Possible Agreement

⁹⁵ Zr	3.12±0.61E-06 uCi/ml	5.34±1.66E-06 uCi/ml	(4)
⁹⁵ Nb	9.76±0.44E-06 uCi/ml	9.49±0.99E-06 uCi/ml	(4)
⁹⁷ Nb	4.80±0.35E-06 uCi/ml	Not Reported	(4)
⁹⁹ Mo	9.80±2.43E-06 uCi/ml	1.03±0.64E-05 uCi/ml	(4)
^{99m} Tc	1.98±0.05E-05 uCi/ml	1.44±0.08E-05 uCi/ml	(4)
¹⁰³ Ru	7.31±0.48E-06 uCi/ml	1.02±0.15E-05 uCi/ml	(4)
^{110m} Ag	4.62±0.34E-06 uCi/ml	7.16±1.34E-06 uCi/ml	Agreement
¹³¹ I	3.59±0.01E-04 uCi/ml	4.42±0.03E-04 uCi/ml	Possible Agreement
¹³⁴ Cs	1.08±0.05E-05 uCi/ml	1.30±0.14E-05 uCi/ml	Agreement
¹³⁷ Cs	2.10±0.04E-05 uCi/ml	2.70±0.12E-05 uCi/ml	Possible Agreement
¹⁴⁰ La	7.86±0.09E-05 uCi/ml	1.02±0.02E-04 uCi/ml	Possible Agreement

- (1) Analytical results as reported by the radiochemistry counting facility.
- (2) Analytical results were not available at time of report. Formal documentation of these analyses will appear in the next radiological inspection report.
- (3) Analytical results were not available at time of report; therefore, no comparison is made.
- (4) Activity concentration identified by NRC was less than 10% of the isotopic value as stated in 10 CFR Part 20, Appendix B, Table II, therefore, no formal comparison is made.

e. Reactor Coolant Liquid from Unit No. 1 (collected 0845, January 14, 1981)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
⁵¹ Cr	5.50±1.06E-03 uCi/ml	3.51±2.01E-03 uCi/ml	Agreement
⁵⁴ Mn	1.00±0.12E-03 uCi/ml	7.25±1.41E-04 uCi/ml	Agreement
⁵⁷ Co	2.45±0.68E-04 uCi/ml	Not Reported	Disagreement

⁵⁸ Co	3.01±0.01E-01 uCi/ml	2.30±0.01E-01 uCi/ml	Disagreement
⁶⁰ Co	1.33±0.02E-02 uCi/ml	9.55±0.21E-03 uCi/ml	Disagreement
⁹⁷ Nb	3.49±0.16E-03 uCi/ml	2.41±0.18E-03 uCi/ml	Possible Agreement
⁹⁹ Mo	2.05±0.10E-02 uCi/ml	2.69±0.16E-02 uCi/ml	Agreement
^{99m} Tc	6.20±0.03E-02 uCi/ml	9.50±0.07E-03 uCi/ml	Disagreement
¹⁰⁹ Cd	2.01±0.51E-02 uCi/ml	2.85±0.46E-02 uCi/ml	Agreement
^{110m} Ag	3.06±0.16E-03 uCi/ml	2.33±0.19E-03 uCi/ml	Agreement
¹²² Sb	1.56±0.04 E-02 uCi/ml	1.01±0.02E-03 uCi/ml	Disagreement
¹²⁴ Sb	3.69±1.54E-04 uCi/ml	Not Reported	Disagreement
¹³¹ I	6.88±0.03E-02 uCi/ml	7.49±0.05E-02 uCi/ml	Agreement
¹³² Te	4.48±0.14E-04 uCi/ml	Not Reported	Disagreement
¹³⁴ Cs	1.17±0.004E-01 uCi/ml	1.40±0.007E-01 uCi/ml	Possible Agreement
¹³⁶ Cs	1.64±0.02E-02 uCi/ml	2.09±0.06E-02 uCi/ml	Possible Agreement
¹³⁷ Cs	1.62±0.01E-01 uCi/ml	1.73±0.01E-01 uCi/ml	Agreement
¹³⁹ Ba	Not Reported	6.36±1.05E-02 uCi/ml	(2)
¹⁴⁰ Ba	7.40±0.51E-03 uCi/ml	5.13±0.78E-03 uCi/ml	Agreement
¹⁴⁰ La	1.20±0.08E-03 uCi/ml	1.50±0.12E-03 uCi/ml	Agreement
²³⁹ Np	4.43±0.17E-03 uCi/ml	4.76±0.39E-03 uCi/ml	Agreement

(1) Analytical results reported by the radiochemistry counting facility.

(2) Activity had decayed to below lower level of detectability at time of sample analysis by NRC; therefore, no comparison is made.

f. RESL Charcoal Cartridge Homogenous Standard (standardized 0900, March 19, 1980)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
⁵⁷ Co	2.28±0.09E-02 uCi/ml	1.76±0.01E-02 uCi/ml	Agreement
⁶⁰ Co	1.73±0.07E-01 uCi/ml	1.37±0.01E-01 uCi/ml	Agreement
⁸⁵ Sr	7.54±0.30E-02 uCi/ml	5.42±0.16E-02 uCi/ml	Possible Agreement
⁸⁸ Y	2.92±0.12E-01 uCi/ml	2.39±0.02E-01 uCi/ml	Agreement
¹¹³ Sn	5.75±0.02E-02 uCi/ml	2.44±0.04E-02 uCi/ml	Disagreement
¹³⁷ Cs	1.29±0.05E-01 uCi/ml	9.48±0.03E-02 uCi/ml	Possible Agreement
²⁴¹ Am	3.19±0.13E-02 uCi/ml	Not Reported	Disagreement

(1) Analytical results as reported by the radiochemistry counting facility.

g. RESL Particulate Filter Standard (standardized 0900, March 19, 1980)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
⁵⁷ Co	2.28±0.09E-02 uCi/ml	2.73±0.05E-02 uCi/ml	Agreement
⁶⁰ Co	1.73±0.07E-01 uCi/ml	2.04±0.02E-01 uCi/ml	Agreement
⁸⁵ Sr	7.54±0.30E-02 uCi/ml	7.74±0.92E-02 uCi/ml	Agreement
⁸⁸ Y	2.92±0.12E-01 uCi/ml	3.56±0.08E-01 uCi/ml	Agreement
¹¹³ Sn	5.75±0.02E-02 uCi/ml	4.82±0.23E-02 uCi/ml	Agreement
¹³⁷ Cs	1.29±0.05E-01 uCi/ml	1.50±0.02E-01 uCi/ml	Agreement
²⁴¹ Am	3.19±0.13E-02 uCi/ml	Not Reported	Disagreement

(1) Analytical results as reported by the radiochemistry counting facility.

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽²⁾	<u>Decision</u>
⁵⁷ Co	2.28E-02 uCi/ml	3.31E-02 uCi/ml	Possible Agreement
⁶⁰ Co	1.73E-01 uCi/ml	2.34E-01 uCi/ml	Possible Agreement

^{85}Sr	7.54E-02 uCi/ml	1.16E-01 uCi/ml	Possible Agreement
^{88}Y	2.92E-01 uCi/ml	3.80E-01 uCi/ml	Agreement
^{113}Sn	5.75E-02 uCi/ml	5.26E-02 uCi/ml	Agreement
^{137}Cs	1.29E-01 uCi/ml	1.75E-01 uCi/ml	Possible Agreement
^{241}Am	3.19E-02 uCi/ml	Not Reported	Disagreement

(2) Analytical results as reported by the health physics counting facility.

No items of violation were identified.

b. Previous Confirmatory Measurements

Confirmatory measurements were performed on samples of gaseous waste and liquid waste during an inspection (Report Nos. 50-313/79-18 and 50-368/79-16) conducted in August 1979. The following tables show the various sample comparisons:

1. Gas (collected 1130, August 15, 1979)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
^{85}Kr	1.50 \pm 0.01E-02 uCi/cc	1.90 \pm 0.02E-02 uCi/cc	Agreement

(1) Analytical results as reported by the radiochemistry counting facility.

2. Liquid (collected 0925, August 14, 1979)

<u>Nuclide</u>	<u>NRC Measurement</u>	<u>Licensee Measurement</u> ⁽¹⁾	<u>Decision</u>
gross beta	4.4 \pm 0.20E-04 uCi/ml	5.8 \pm 0.10E-04 uCi/ml	Agreement
tritium	3.7 \pm 0.02E-03 uCi/ml	3.7 \pm 0.06E-03 uCi/ml	Agreement
^{90}Sr	1.6 \pm 0.10E-07 uCi/ml	7.7 \pm 2.50E-08 uCi/ml	Disagreement
^{54}Mn	2.4 \pm 0.10E-05 uCi/ml	3.6 \pm 0.08E-05 uCi/ml	Possible Agreement
^{58}Co	2.3 \pm 0.01E-04 uCi/ml	3.2 \pm 0.02E-04 uCi/ml	Possible Agreement
^{59}Fe	7.3 \pm 1.70E-06 uCi/ml	5.7 \pm 1.20E-06 uCi/ml	Agreement

^{60}Co	$3.3 \pm 0.09\text{E-}04 \text{ uCi/ml}$	$4.9 \pm 0.02\text{E-}04 \text{ uCi/ml}$	Possible Agreement
^{65}Zn	$1.9 \pm .15\text{E-}05 \text{ uCi/ml}$	Not Reported	Disagreement
^{95}Zr	$1.5 \pm 0.14\text{E-}05 \text{ uCi/ml}$	$2.1 \pm 0.12\text{E-}05 \text{ uCi/ml}$	Agreement
$^{110\text{m}}\text{Ag}$	$1.8 \pm 0.12\text{E-}05 \text{ uCi/ml}$	$2.3 \pm 0.10\text{E-}05 \text{ uCi/ml}$	Agreement
^{124}Sb	$2.1 \pm 0.40\text{E-}06 \text{ uCi/ml}$	$3.3 \pm 0.40\text{E-}06 \text{ uCi/ml}$	Agreement
^{125}Sb	$3.3 \pm 0.20\text{E-}05 \text{ uCi/ml}$	$4.5 \pm 0.20\text{E-}05 \text{ uCi/ml}$	Possible Agreement
^{131}I	$1.2 \pm 0.20\text{E-}05 \text{ uCi/ml}$	$7.5 \pm 0.50\text{E-}06 \text{ uCi/ml}$	Agreement
^{134}Cs	$3.3 \pm 0.20\text{E-}05 \text{ uCi/ml}$	$3.8 \pm 0.09\text{E-}05 \text{ uCi/ml}$	Agreement
^{137}Cs	$5.1 \pm 0.30\text{E-}05 \text{ uCi/ml}$	$5.9 \pm 0.07\text{E-}05 \text{ uCi/ml}$	Agreement

(1) Analytical results as reported by the radiochemistry counting facility.

No items of violation were identified.

7. Exit Interview

At the conclusion of the inspection on January 15, 1981, the inspection findings were discussed with the AP&L personnel denoted in paragraph 1. The NRC inspectors reviewed the scope of the inspection and the inspection findings.

ATTACHMENT NO. 1

Criteria for Comparing Analytical Measurements

The following is the criteria used in comparing the results of capability tests and verification measurements. The criteria are based on an empirical relationship established through prior experience and this program's analytical requirements.

In these criteria, the judgement limits vary in relation to the comparison of the resolution.

$$\text{Resolution} = \frac{\text{NRC Value}}{\text{NRC Uncertainty}}$$

$$\text{Ratio} = \frac{\text{Licensee Value}}{\text{NRC Value}}$$

Comparisons are made by first determining the resolution and then reading across the same line to the corresponding ratio. The following table shows the acceptance values.

RESOLUTION		RATIO		
	Agreement	Possible Agreement A	Possible Agreement B	
3	0.4 - 2.5	0.3 - 3.0	No comparison	
4 - 7	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0	
8 - 15	0.6 - 1.66	0.5 - 2.0	0.4 - 2.5	
16 - 50	0.75 - 1.33	0.6 - 1.66	0.5 - 2.0	
51 - 200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.66	
200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33	

"A" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is greater than 250 Kev.

Tritium analyses of liquid samples.

Iodine on adsorbents.

"B" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is less than 250 Kev.

⁸⁹Sr and ⁹⁰Sr Determinations.

Gross Beta where samples are counted on the same date using the same reference nuclide.

ATTACHMENT NO. 2

LLDs for Nuclides on Particulate and Charcoal Filters

<u>Nuclide</u>	<u>LLD (uCi/sample)</u>
51Cr	1E-04
54Mn	1.5E-05
58Co	1.5E-05
59Fe	3E-05
57Co	2E-05
60Co	3E-05
65Zn	3E-05
89Sr	1E-05
90Sr	2E-07
131I	2E-05
134Cs	2E-05
137Cs	2E-05
140Ba	2E-05
140La	4E-05
141Ce	2E-05
144Ce	1E-04