OFFICIAL USE ONLY DOCKET NO. 70-820

EXTRA

UNITED NUCLEAR
CORPORATION
DEVELOPMENT DIVISION

087

RD - 2780

5 NEW STREET
WHITE PLAINS, NEW YORK 10601
WHITE PLAINS 8-5800

9 December 1964

Dr. Marvin M. Mann
Asst Director of Regulation, Nuclear Safety
U. S. Atomic Energy Commission
Washington 25, D.C.

Dear Marvin:

Les Allison of the Fuels Division is now in the process of publishing the report on the physics aspects of the accident at Wood River Junction. I am writing to bring you up to date prior to your receiving the official document.

Our understanding of the incident has not changed significantly since the report which was sent to you through Herb Kouts on 5 October. Our interpretation of the activation analyses and our understanding of the health physics aspects has improved since that time, and I am enclosing four (4) tables which summarize the results relating to dose estimates. The estimates of the dose received by [redacted] are consistent except for those based on the activation of the metal parts of the film badge holder; that is, the blood sodium, hair, and indium foil activations agree.

The estimates of the doses received by [redacted] and [redacted] agree except for those based on hair activation, which are an order of magnitude higher. I am at a loss to explain this. I recall that you advised me at one time not to expect too much from this analysis.

For a while we were at a loss as to how to readily compare the data. The activations were complicated by the fact that [redacted] and [redacted] were exposed at a distance of 15 feet at a place where there was considerable enhancement of the thermal flux by reflection. We finally decided to refer everything back to the total (i.e., integrated over all energies), incident, uncollided current density. This shows in the first column of the tables.

Reaching this point has been one of the most frustrating technical jobs that I have undertaken in a long time. Almost every important item of data has been first reported incorrectly, sometimes by an order of magnitude. I don't know why it should be so difficult to

087 087

Reg.
12-11-64
1:30

C-78

OFFICIAL USE ONLY

get the right answer from neutron activation analysis the first time. Maybe the answer is really very simple - like chemists can't do arithmetic.

Incidentally, the flux values obtained from the Health and Safety Division at Idaho Falls have changed since their report issued on 17 September. Their values seem to be consistently high. (See *attached memo, Nakache to Shapiro.) We are presently involved* in a three-way round robin analysis with Oak Ridge and Idaho Falls and our Pawling Laboratory. Auxier at ORNL had some silver coins exposed at the HPRR (Health Physics Research Reactor). We and Oak Ridge have analyzed them and I am sending them on to Idaho Falls.

The final report never contains all of the pertinent material and certainly not all of the false starts and all the logic pertaining to hypotheses which have been discarded. I would be glad to go into anything in the final report in more detail with you.

Thanks for your help in this difficult job.

Sincerely,

Mathew M. Shapiro
Manager, Research Ops.

Encls (5)

2. PRINCIPAL RESULTS OF INVESTIGATION

1. Total Yield

The present evidence indicates that two excursions took place. The fissions estimated are:

First Excursion	$1.0 - 1.1 \times 10^{17}$
Second Excursion	$.3 - .2 \times 10^{17}$
Total Fissions	$1.3 \pm .25 \times 10^{17}$

2. Doses

Activation of blood sodium gives reliable estimates of the doses. They are presented below based on the Na^{24} activation in the body.

a) Dose received by Operator:

Neutron:	first collision	3100 rad
	maximum	5100 rad
Gamma:		5500 rad

b) Dose received by the Supervisor:

Neutron:	first collision	3.3 rad
	maximum	5.4 rad
Gamma:		55.0 rad

c) Dose received by the Superintendent:

Neutron:	first collision	1.5 rad
	maximum	2.4 rad
Gamma:		50.0 rad

TABLE V-1

Dose Received by the Operator

	Total uncollided incident current density J_s, n/cm^2	"First Collision" neutron dose $D_n^{(1)}$, rads	Maximum Neutron dose $D_n^{(max)}$, rads	Gamma dose D_γ, rads	$D_n^{(1)}+D_\gamma$	$D_n^{(max)}+D_\gamma$
a^{24} in blood	2.07×10^{12}	3,110	5,100	5,430	8,540	10,530
ubic hair	4.18×10^{12}	6,300	10,200	11,000	17,300	21,000
ead hair	1.01×10^{12}	1,500	2,500	2,700	4,200	5,200
ndium foil (on chest pocket)	1.42×10^{12}	2,150	3,500	3,750	5,900	7,250
ilm Badge* (on chest pocket)						
clip	4.30×10^{12}	6,500	10,500	11,300	17,800	21,800
spring	5.58×10^{12}	8,400	13,700	14,700	23,100	28,400
pin	6.05×10^{12}	9,100	14,800	15,900	25,000	30,800

*Results based on the film badge iron 54 activation are not consistent and reliable.

Doses Received by the Superintendent during Second Excursion

Item	Total incident uncollided current density J_S, (n/cm^2)	First collision neutron dose $D_n^{(1)}$ rad	Maximum neutron dose $D_n^{(max)}$, rad	Gamma dose D_γ, rad	$D_n^{(1)}+D_\gamma$ rad	$D_n^{(max)}+D_\gamma$ rad
le body 24 activation	9.8×10^8	1.5	2.4	2.0	3.5	4.4
dium foil resumed)	$.5 \times 10^8$	.75	1.2	1.0	1.75	2.2
lver coins right nd trouser cket						
UNC dime (average)	2.25×10^9	3.3	5.4	4.5	7.8	9.9
UNC silver dollar	1.56×10^9	2.3	3.8	3.1	5.4	6.9
AEC-ID silver dollar	2.24×10^9	3.4	5.5	4.5	7.9	10.0
ORNL silver dollar	1.90×10^9	2.8	4.6	3.8	6.6	8.4
lver coin left p trouser pocket						
UNC-P dime	1.85×10^9	2.8	4.5	3.7	6.5	8.2
AEC-ID dime	3.47×10^9	5.2	8.5	7.0	12.2	15.5
ORNL dime	1.63×10^9	2.5	3.9	3.3	5.8	7.2
ir						
pubic	2.47×10^{10}	37	61	65	102	125
head	$.79 \times 10^{10}$	12	19	21	33	40

TABLE VI-7

Doses Received by the Supervisor During Second Excursion

Item	Total incident current density J_S (n/cm^2)	First collision neutron dose $D_n^{(1)}$, rad	Maximum neutron dose $D_n^{(max)}$, rad	Gamma dose D_γ, rad	$D_n^{(1)}+D_\gamma$ rad	$D_n^{(max)}+D_\gamma$ rad
Whole body Na^{24} activation	2.2×10^9	3.3	5.4	4.4	7.7	9.8
Indium foil	8.1×10^8	1.2	2.0	1.6	2.8	3.6
Cr^{51} activity in watch case	2.34×10^9	3.5	5.7	4.7	8.2	10.4
Chest and pubic hair	3.36×10^{10}	50.0	82.0	88.0	138.0	170.0

UNITED NUCLEAR
CORPORATION
DEVELOPMENT DIVISION

To: M. M. Shapiro
From: F. Nakache , F.N.
Subj: ORNL ANALYSES OF THE SUPERINTENDENT's SILVER COINS
Date: 20 November 1964

REF: Auxier's letter to M.M. Shapiro, dated 11/11/64

Experimental results for the subject coins, obtained at ORNL, are compared to those from UNC-Pawling and AEC-Idaho Falls. The comparison is made using the activated to target atoms, $\frac{N^*}{N}$, in the following table.

Item	Laboratory	Ratio of Activated to Target Atoms, $[N^*/N] \times 10^{24}$
silver dollar	ORNL	$[6.55 \pm 0.65] \times 10^9$
	UNC-P	$[5.42 \pm 0.55] \times 10^{9+}$
	AEC-ID	9.84×10^9
		$7.78 \times 10^{9*}$
dime	ORNL	$[7.07 \pm 0.69] \times 10^9$
	UNC-P	$[8.06 \pm 0.81] \times 10^{9+}$
	AEC-ID	19.0×10^9
		$15.0 \times 10^{9*}$

* Experimental results reduced by 31% to account for contribution of high energy gamma.

\+ Uncertainty of experimental results is estimated to 10%

The conclusions are:

1. There is a good agreement between UNC and ORNL results.

2. The AEC-ID measurement of the dime activation is definitely unreliable.