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HISTORY OF AIRBORNE CONTAMINATION AND CONTROL - 200 AREAS

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April 1, 1958

R. E. Tomlinson, Acting Manager
PRODUCTION OPERATION

HISTORY OF AIRBORNE CONTAMINATION AND CONTROL - 200 AREAS

Summarized below in narrative outline form is a brief history of significant air contamination problems experienced in the 200 Areas together with the action taken to improve and/or correct the conditions.

200 AREAS

All instances of significant airborne contamination originating in the 200 Areas have been associated with the emission of radioactive contaminants from the effluent stacks. These contaminants have been defined as Particulate Matter, Iodine, Ruthenium, and Plutonium.

I. Particulate Matter

A. Problem

The occurrence of contamination in the form of discrete active particles on the ground in the separations plants was detected in late September, 1947(1). At the time of detection, it was thought that the phenomenon might have existed for several months. By mid-October it had been established that the carrier particles were corrosion products from black iron in the stack fan ductwork. Particles were emitted at a rate of approximately 10^7 to 10^8 particles/month/each of two plants and observed deposition was 1 to 10% of the emission. Highest observed surface concentration was 50 psf (particles per square foot) in isolated areas with activity ranging from 0.1 to 3 uc and an effective half-life of about 300 days. Principle contaminants were defined as cerium, yttrium, strontium, ruthenium, and cesium in that order.

B. Corrective Action

Soon after discovery of the condition and during the period when the defective equipment was being replaced, personnel were provided with individual respirators which were monitored after each work day. During one period 12,000 respirator surveys by Geiger Counter methods revealed two contaminated masks. One of these had four particles on the inner face of the filter pad; however, there was considerable doubt as to whether the particles arrived there by breathing. The other had a legitimate capture of a particle on the outer face. In another survey 2,000 filters were checked with a more sensitive radioautograph method and nineteen specks were found. Activity of these was not in excess of one millimicrocurie each.

Although the large, and more serious, particles were eliminated by the equipment replacements, numerous smaller particles continued to be emitted. This condition was successfully overcome by installing and diverting the stack effluent through a sand filter prior to discharging to the atmosphere. The filters had a collection efficiency of >99.5% and were installed on 10-15-48 at T Plant and on 10-30-48 at B Plant(2). Subsequently, fiberglas filters which were smaller, cheaper, and more efficient, were installed on 10-26-50 at B Plant and on 12-12-50 at T Plant. The Purex Plant, which followed in 1956, has also been equipped with the improved filter. ?

II. Iodine

A. Problem

I^{131} emission from the separations plants was anticipated from the start. The major problem has been one of maintaining controlled release of the activity to avoid creating an environmental hazard.

Average daily I^{131} emissions on a quarterly basis are presented in Table I.

B. Corrective Action

In the early days of operation, the data obtained from Oak Ridge on the evolution of I^{131} during dissolving was used as a basis for estimating the dilution necessary to reduce effluent gaseous activity from the stacks to less than tolerance levels. Because of the war emergency cooling periods were of relatively short duration and, thus, I^{131} emissions were appreciable (an estimated 70% of the dissolved I^{131} was emitted). Subsequently, even with low production rates and adherence to favorable weather forecasts for maximum dilution, deposition rose to undesirable levels. For example, typical vegetation analyses in December, 1945 were as follows:

Location	uc I^{131}/gram
100-B	3.0×10^{-4}
300	2.3×10^{-4}
Richland Y	1.0×10^{-3}
Kennewick	3.0×10^{-4}
Sunnyside	3.4×10^{-5}

Although the accepted tolerance limit at that time was 2×10^{-4} uc/gram of vegetation it was later revised to the present value of 1×10^{-5} uc/gram.

Installation of water scrubbers in 1948 removed an estimated 85% of the I^{131}. These were replaced by silver reactors (10-26-50 at B Plant and 12-12-50 at T Plant), which had an I^{131} removal efficiency of >99% when processing longer aged feed(3). Installation of the reactors together with longer cooling and process improvements have successfully held average I^{131} emissions to approximately 15 curies/week total except for infrequent occasions when a reactor failed and had to be recharged. An indication of the control exercised is evident from the vegetation surveys made in 1957 which showed average I^{131} deposition to be (5 to 16) $\times 10^{-6}$ uc/gram for off-project and (1 to 4) $\times 10^{-5}$ uc/gram for on-project(4). Both values reflect deposition from external causes as well as Hanford sources.

III. Ruthenium

A. Problem

At least nine specific incidents or periods involving ruthenium emission have occurred since start-up of the Redox Plant in January, 1952(5). In addition, there are indications that ruthenium particles were released almost continuously until about early summer of 1954. Surveys inside the Redox exclusion area revealed contamination in the range of 200 c/m to 800 mrads/hr. near the base of the stack and, in most instances, ammonium nitrate crystals were associated with the activity.

Average daily ruthenium emissions on a quarterly basis are presented in Table II.

B. Corrective Action

Process equipment changes were effected in the summer of 1954 which prevented significant ruthenium emissions.

IV. Plutonium

No mention of the Pu stack emission from entrainment in PR cage. (1954?)

Incidents of atmospheric contamination by plutonium emission have been successfully averted since start-up of HAPO in late 1944 by the use of

efficient filters in the ventilation effluent systems of those buildings handling the more concentrated plutonium solutions. Tests prior to start-up with methylene blue smoke indicated an efficiency of about 99.9%; however, subsequent performance during plant operations showed an efficiency of 99.99%. There have been some within-building incidents of plutonium air contamination but all have been of short duration and the contamination of surrounding environs has never been threatened.

Waste Planning and Scheduling
PRODUCTION OPERATION

RE Roberts:vb

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(1) HW-9259, "Review of the Stack Discharge Active Particle Contamination Problem," H. M. Parker, March 22, 1948.

(2) HDC-978, "200 Area Stack Contamination - Interim Report - October 12, 1948 - January 24, 1949," G. E. Lapple, January 25, 1949

(3) HW-20332, "Decontamination of Dissolver Vent Gases at Hanford," A. G. Blazewitz et al, February 16, 1951

(4) HW-52803, "Radioactive Contamination In The Hanford Environs For The Period April, May, and June, 1957," M. W. McConiga and J. K. Soldat, October 28, 1957

(5) HW-32473, "A History of the Redox Ruthenium Problem," D. P. Ebright, July 16, 1954

I^{131} DISCHARGED FROM SEPARATIONS PLANTS*

Year	Quarter	Average Curies/Day	Year	Quarter	Average Curies/Day
1946	1st	44	1952	1st	2.2
	2nd	50		2nd	4.2
	3rd	26		3rd	2.8
	4th	28		4th	1.4
1947	1st	28	1953	1st	1.9
	2nd	26		2nd	1.9
	3rd	2.6		3rd	2.5
	4th	0.6		4th	1.7
1948	1st	0.6	1954	1st	1.7
	2nd	0.3		2nd	1.3
	3rd	0.7		3rd	1.4
	4th	0.7		4th	1.5
1949	1st	1.4	1955	1st	7.9
	2nd	1.2		2nd	2.3
	3rd	1.2		3rd	1.7
	4th	47 (Green Run, Dec.)		4th	1.0
1950	1st	1.3	1956	1st	0.24
	2nd	1.2		2nd	2.0
	3rd	14		3rd	0.28
	4th	6.9		4th	1.5
1951	1st	5.0	1957	1st	1.4
	2nd	110 (Silver Reactor failed in April)		2nd	0.8
	3rd	85 (Silver Reactor failed in July)		3rd	1.0
	4th	5.0		4th	0.9

Average emission for the last 10 years - 8.2 curies/day

Average emission for last 10 years, omitting 4th Quarter, 1949 and 2nd and 3rd Quarter, 1951 - 2.3 curies/day.

*Estimated prior to December, 1949

RUTHENIUM DISCHARGED FROM S PLANT

Year	Quarter	Average Curies/Day
1952	1st	0.06
	2nd	<0.1
	3rd	0.2
	4th	<0.1
1953	1st	<0.01
	2nd	0.2
	3rd	2.7
	4th	0.94
1954	1st	6.3
	2nd	<0.69
	3rd	0.23
	4th	<0.023
1955	1st	<0.05
	2nd	<0.01
	3rd	<0.01
	4th	<0.01 (0.12 curie emitted on 12-12-55; no other positive measurements)
1956	1st	<0.01
	2nd	<0.01
	3rd	<0.01
	4th	<0.01
1957	1st	<0.01
	2nd	<0.01
	3rd	0.01
	4th	0.04

Presumably collapse of burial box lid at burial ground. H-4 tube bundles.