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HW-29230

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1. H. M. Parker
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August 25, 1953

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By H. R. [illegible] Date 7/1/54

RADIOLOGICAL SCIENCES DEPARTMENT INVESTIGATION
RADIATION INCIDENT, CLASS I, NO. 299

Nature of Incident

Deposition of large fragments of radioactive material in the Redox area during the period August 7 to 18, 1953.

Description of Incident

Routine surveys performed by Radiation Monitoring (Separations) on August 14, 1953 and by Regional Survey (Radiological Sciences) on August 17, 1953 revealed the presence of large fragments or chunks of radioactive material on the ground surrounding and extending generally in a direction southeast of the Redox stack as shown in the attached sketch.

Laboratory analyses indicated, that the bulk of the material was essentially ammonium nitrate and that the radioactivity was due primarily to ruthenium though some rare earths were detected. Some of the fragments were observed to be several inches in width and length, up to $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick, and gray to white in color. Some of them were observed to be concave - convex in shape as if they may have been formed on a circular base such as the inside of a pipe or the stack. The size and general activity level of the particles released during this incident far exceeded that of either of the two previously reported incidents. (1) A maximum exposure rate of 15 rep/hr including 300 mr/hr uncorrected for source size, was observed on one fragment.

(1) HW-27447, HW-27431

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Discussion of Incident

The exact day on which these large particles were first released from the stack is not known though it is believed that they were not present prior to 8-7-53, as a routine survey performed in the area that day did not reveal any more than the usual number of particles that have been found routinely since the discovery of this condition in April, 1952. (Routine weekly surveys of filter frames positioned around the stack have indicated that there has been a more or less constant rate of deposition of approximately one particle/sq ft/month in the east section of the Redox area since April, 1952.) As these large particles are quite soluble and as a measurable amount of rain fell late on the 7th, it is quite likely that the large particles were released from the stack between the 8th and 14th of August, 1953. Additional large particles were observed coming out of the Redox stack on the 18th of August.

No unusual operation is known to have been in progress in the process building at the time the large particles were observed coming from the stack on the 18th. It is theorized that these large particles and the majority of the small ones are the result of crystal formation by reaction between the NH_3 ion released in the jacket removal step and the oxides of nitrogen released in the dissolving step. It is believed that this reaction might take place in the main stack during mixing of off-gases from two dissolvers which may be operating concurrently at the two process steps mentioned. It is quite possible that the reaction might occur even if the two operations were not performed simultaneously as it is quite probable that any liquid in the off-gas lines or on the stack liner is always saturated with one or the other of the components and the ultimate presence of the second component will likely result in the formation of an ammonium nitrate crystal.

The exact source of the ruthenium which ultimately coats the crystals of ammonium nitrate is not at present quite so well known, though it quite likely enters the stack by the vessel vent system off-gas lines. The ruthenium scrubber, H-5 tank, may also occasionally pass ruthenium through to the stack.

Discussion of Exposure

Though there has been no reported extended exposure of personnel to this activity, it cannot be unequivocally stated that no inhalation of this contamination by personnel occurred. Air samples taken east of the stack on the 18th revealed a particle concentration of approximately 140 particles/cu meter of air. Normal concentrations in this vicinity are expected to run considerably less than one particle/cu meter of air.

The number and average activity of particles that can be associated with this incident and that were found in the vicinity of the 200-W area southwest fence line (adjacent to a major construction area) indicate that there is little possibility of their having contributed any significant exposure to any personnel working in this area.

Cause of Incident

1. Lack of adequate facilities to remove ruthenium from the building exhaust system.
2. Lack of adequate facilities to inhibit the formation and/or release of particulate material in the building exhaust system.

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DECLASSIFIEDComment on the Incident

In view of the serious potential that exists for internal exposure from inhalation of radioactive particles steps should be taken by the concerned operating group to prevent recurrence of this condition. The Radiological Engineering and Biophysics groups of the Radiological Sciences Department may be consulted for assistance on the problem.

D. F. Ebright

D. F. Ebright
RADIOLOGICAL SCIENCES DEPARTMENT

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GM Meter Reading
 < 500 c/m

1/3 Particle/sq. ft.
 G.M. meter reading
 up to 1000 c/m

1-2 particles/sq. ft.
 G.M. meter reading up
 to 3,000 c/m

2-4 particles/sq. ft.
 Average exposure rate
 300 - 600 mrep/hr at
 surface, uncorrected
 for source size

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GROUND SURFACE MONITORED BY
 RADIOLOGICAL SC
 AUGUST 17 - 1953

END

DATE
FILMED
6/09/92