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ROCKY FLATS ENVIRONMENTAL MASTER FILE

THE DEPOSITION OF PARTICULATES
IN AIR SAMPLING TUBES

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ABSTRACT

An investigation was performed to define particulate deposition in exhaust air sampling tubes for plutonium areas. Twelve sampling tubes were washed with nitric acid. Residues from wash solutions were counted for total alpha activity. Results indicate negligible sample loss due to particulate deposition in sample delivery tubes.

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INTRODUCTION

The sampling of process, room, or building air exhaust streams is affected by many variables. In order to treat the sampling results as truly representative of the larger air stream from which the sample was derived, as many as possible of the variables must be defined and characterized. Sampling must then be accomplished in a manner to achieve best representation for the conditions of the air and sampling streams.

Among the parameters that merit consideration in sampling an air stream for particulates is the degree of particulate loss in the sampling train prior to collection. At Rocky Flats there is widespread use of a particulate sampling technique which utilizes isokinetic probes facing into the exhaust stream. The sharp-edged probe or sampling tube typically has a "gentle" 90° bend (at least 4-inch radius of curvature) and proceeds through the duct wall to an in-line filter which is then connected to an airflow measuring device and a source of vacuum. The sampling tube is continuous to the filter holder and a typical size range is between 0.30- and 0.43-inch inside diameter. The length of sampling tube between point of sampling and point of collection varies from about 15 inches to about 10 feet. Most are less than 5 feet.

This study seeks to quantify the experience in particulate deposition that has occurred in sampling lines. A spectrum of sampling systems were examined. All of these systems are utilized to sample exhaust air streams in plutonium process buildings.

PROCEDURES AND DISCUSSION

Sample delivery tubes were taken out of service, one or two at a time, and transported to the Health Physics Research Environmental Control laboratory for washing. In all cases, except for two, one wash with 8N nitric acid was made. The washing was accomplished by two flushings of the tube with 8N nitric acid followed by two washings with distilled water. The wash solution was prepared for counting by the procedure described for water samples in "Liquid Scintillation Counting for Plutonium in Environmental Samples." (1)

For two of the sample delivery tubes repeated washings were made to determine efficiency of a 1-wash technique. These tubes were from Main Exhaust System sampling points in Building 776 where highest deposition values were found. One tube, Main No. 1, showed complete removal of deposits with one wash. The other, Main No. 2, indicated 11.2 dpm, or about 20 percent of that recovered in the first wash, was removed in a second wash. Unfortunately, a third wash was not made on this tube.

In all, 12 sample delivery tubes were studied for particle deposition. Table 1 describes the sample tubes. It should be noted that item 4 for Building 707 is an extreme case consisting of two 9-ft sample delivery lines. These lines were cut into nine 2-ft section for washing, with wash collections combined for a total analysis.

(1) Bokowski, D.L., "Liquid Scintillation Counting for Plutonium in Environmental Samples," U.S. AEC Report RFP-2037 (1973)

TABLE I
Description of Sample Delivery Tubes

<u>Sampling System</u>		<u>Penetration into Exhaust Duct (inches)</u>	<u>Inside Diameter of Tube (inch)</u>	<u>Tube Length (total inches)</u>	<u>Sampling Rate (m3/min.)</u>
<u>Building 771</u>					
Main 1		31.5	0.305	33	0.040
Main 2		58.5	0.305	60	0.040
Main 3		31.5	0.305	33	0.040
<u>Building 776</u>					
Main 1		15.5	0.402	19.25	0.059
Main 2		27.5	0.402	31.75	0.057
Main 3		21.5	0.402	25.75	0.058
Main 4		21.5	0.402	25.25	0.055
Main 5		9.5	0.402	14.0	0.059
<u>Building 707</u>					
Plenum 47	1	9	0.430	10	0.0413
	2	9	0.430	10	0.0413
	3	9	0.430	10	0.0413
	4	-	0.430	18 (feet)	0.0413

All sampling tubes are from ventilation systems which exhaust air through two or more stages of HEPA filters before release to the atmosphere. The sampling is accomplished after filtration.

RESULTS AND CONCLUSIONS

The amount of particle deposition is reported in terms of gross alpha activity which is assumed to be plutonium. These data are reported in Table II.

In all cases sampling tubes had been in service for at least 1 year. Times of installation were documented in all cases except for Main Nos. 1, 2, and 3 in Building 776. These installation times were known to be more than 2 years ago. An in-service time of 2.5 years was assumed for these two cases. Sample flow rates are all known and carefully controlled. Based on this information the amount of sample tube deposition also is expressed as an activity concentration over the period of service.

All sampling tubes checked by this procedure indicate a negligible amount of sample loss due to deposition losses in the tubes. The average activity concentrations are in the region of one-tenth or less of the concentration results from the filters at the end of the sample delivery tubes.

The degree of deposition appears to be a function of particle sizes to be expected in the exhaust streams. Even though the sample tubes in Building 776 were replaced after the 1969 fire, modification and upgrading work on this plenum has produced occasions during the sampling period where small leakages around HEPA filters were not preventable and did occur.

Further study of this nature is planned to add to these data and to investigate the time relationship for deposition.

TABLE II
Alpha Activity Washed from Exhaust Duct Sampling Tubes

<u>Sampling System</u>		<u>Alpha Activity Washed from Tube (dpm)</u>	<u>Total Time Tube was in Service</u>	<u>Total Air through Sample Tube (m3)</u>	<u>Activity Conc. (average pCi/m3)</u>
<u>Building 771</u>					
Main 1		5.93	1 year	21,024	0.00013
Main 2		2.30	1 year	21,024	0.00005
Main 3		4.62	1 year	21,024	0.00010
<u>Building 776</u>					
Main 1		11.45	2-3 years	77,526	0.00007
Main 2		57.18 + 11.20	2-3 years	74,898	0.00041
Main 3		53.94	2-3 years	76,212	0.00032
Main 4		12.80	292 days	23,126	0.00025
Main 5		56.12	292 days	24,808	0.0010
<u>Building 707</u>					
Plenum 54	1	3.89	16 months	28,546	0.00006
	2	1.45	16 months	28,546	0.00002
	3	< det.	16 months	28,546	< det.
	4*	4.23	16 months	28,546	0.00007

*This comprises two 9-ft. lengths of tube which existed between sample probes 1 and 2, and their respective sample filter holders. Better identification was lost during sectioning.

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