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**PAST EXPOSURE PROBLEMS IN
ROOM 242, 234-5 BUILDING**

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PAST EXPOSURE PROBLEMS IN ROOM 242, 234-5 BUILDING

Introduction

This report has been prepared to help complete the record of exposure problems in room 242, 234-5 Building. The studies were made during production of Model 130; however, it is felt the information presented here will apply reasonably well to other multisurfaced models such as the 110 model. This report is a supplement to HW-32493, HW-32494, HW-40468, and HW-43345.

Summary

Exposures per operation are presented for each operation in this room as well as a breakdown between operators for one operation.

Discussion

All exposures were originally calculated on the basis of a surface dosage rate of 250 mrem/hr and were recalculated to conform with the latest best estimate of the surface dosage rate from coated plutonium, 355 mr/hr (see HW-43448).

Exposure per Operation

1. Soot Removal, Whisker Removal, Polishing and Preliminary Testing.

If all observations are pooled regardless of the operator, the following statement can be made regarding the exposure for this operation:

The probability is 95% that the average exposure per piece for this operation lies between 74.9 mrem and 131.8 mrem with a most likely value of 99.4 mrem.

However, a closer examination of the data reveals that there is a significant difference between operators. Therefore, the following statement can be made:

For Operator A the probability is 95% that the average exposure per piece for this operation lies between 51.8 mrem and 113.2 mrem with a most likely value of 76.6 mrem.

For Operator B the probability is 95% that the average exposure per piece for this operation lies between 95.7 mrem and 194.3 mrem with a most likely value of 136.4 mrem.

Operator A has worked in this room for many years and has had a great amount of experience, while Operator B has only had several months experience. This suggests that a more positive method of exposure accountability be devised for relatively inexperienced operators, which in turn, suggests the use of the Dosage Rate Integrator.

It is of interest to compare the average exposure for Operator A (for this operation) with the average exposure for Operator A and another very qualified operator as determined in the summer of 1954.

	Average Exposure Per Piece
Operator A, 1956, Model 130	76.6 mrem
Operator A plus another, 1954, Model 110	79.7 mrem

This is one of the reasons the writer feels that exposure estimates for Models 110, 130 and similar models are all approximated closely by the exposure estimates given in this report.

(The identity of these operators will be made known to the proper persons for the purpose of estimating total exposure.)

It is known that in the past, certain parts of this operation were performed on shift. Therefore the following breakdown is presented to more easily calculate exposures.

Step	Exposure per Piece*		
	Average	Upper 95% C.L.	Lower 95% C.L.
1. Pick up piece, survey, decontaminate when necessary.	1.7 mrem	3.0 mrem	0.9 mrem
2. Remove soot from all surfaces, perform crude buffing.	18.4 mrem	22.3 mrem	14.8 mrem
3. Remove whiskers, tripod marks, etc.	35.9 mrem	66.3 mrem	19.5 mrem
4. Polish all surfaces, check diameter, test with Go-No Go Rings, Inspect.	27.2 mrem	38.1 mrem	19.3 mrem
5. Transfer to alpha counter, transfer and weigh, transfer to storage.	2.3 mrem	2.9 mrem	1.8 mrem

*Pooled data, regardless of operator.

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The steps generally performed on shift were Steps 1, 2, 3 and 5; however, occasionally only Steps 1, 2 and 5 were performed depending on available time or severity of whisker formation.

Electrolytic Testing

Only two observations were made of electrolytic testing, each observation consisting of two pieces being run simultaneously. The exposures were found to be 21.3 mrem and 26.3 mrem for an average of 23.8 mrem for two pieces. Therefore, one may assume that the average exposure is 11.9 mrem. Both of these observations were performed by Operator B. Referring to the original data for HW-32494 and correcting the estimates to 355 mr/hr SDR, one observes that the average exposure (for experienced operators) is 7.5 mrem with 9.3 and 6.1 mrem being the 95% confidence limits. A satisfactory compromise between these two values would be 10.0 mrem per piece.

Mating

Operator A was the only person observed performing the mating operation. The probability is 95% that the average exposure per assembly for this operation lies between 24.6 mrem and 42.7 mrem with a most likely value of 32.4 mrem.

Final Polishing

During the course of this study Operator A was the only person observed performing the final polishing operation, and he was observed only twice. At the time of the first observation he polished only one assembly with an exposure of 42.7 mrem. The second time he polished six assemblies on a "production line" basis and received a total of 147.1 mrem for the entire six, or an average of 24.5 mrem per assembly. Pooling the seven observations and averaging, one obtains 32.4 mrem, which is probably as good an estimate as can be given at this time.

General Notes on Calculating Long Term Exposures

A 95% confidence interval might be defined as: I am willing to give 19 to 20 odds that the true value lies between these intervals. Also, it states that should another sample of the same size be drawn from the same population, the average might lie anywhere between these intervals. Therefore, in keeping with plant policy of "conservatism" regarding radiation exposure, it is recommended that long term exposure calculations be based on the upper 95% confidence limit.

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