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GOODYEAR ATOMIC CORPORATION

INTERNAL CORRESPONDENCE

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Subject: ASSESSMENT OF NEUTRON EXPOSURE POTENTIAL FOR URANIUM MATERIAL HANDLERS

The necessity for providing personal neutron dosimeters to D-829 personnel has been evaluated. The following assessment is based on current work practices for handling, sampling and weighing five-inch product cylinders in the X-326 HASA as described by R. M. Robinson, D-829 General Foreman.

Highly enriched uranium in the chemical form of UF_6, produces neutrons primarily through the F-19 (alpha, n) Na-X reaction which effectively yields one to three neutrons depending upon the final product (Na-20, Na-21 or Na-22). Since the specific alpha activity of VHE is 200 times greater than that at natural assay, one would expect higher neutron dose rates from highly enriched product cylinders. Due to specific activity, self-absorbtion, and geometry differences, neutron dose rates from five-inch product cylinders are typically six times greater than those from 14-ton feed cylinders (3 mrem/h versus less than 0.5 mrem/h at the cylinder surface as measured with an Eberline NRD).

To assess neutron exposures to UMH personnel from highly enriched uranium, those working in HASA were selected as having the greatest exposure potential. Since, at distances exceeding one meter from a full five-inch cylinder, neutron dose rates are typically <0.1 mrem/h and approach background levels at distances of several meters, it is conservatively assumed that a worker in the immediate vicinity of a full five-inch cylinder receives 0.5 mrem/h from neutron exposure (0.5 mrem/h was the maximum neutron dose rate measured at one meter from a grouping of six full five-inch cylinders stored in the X-326 PW vault; GAT-102-86-111).

Uranium Material Handlers are in the immediate vicinity of full five-inch cylinders during sampling and weighing operations; these operations require approximately three manhours per week. If these operations were performed by a single individual, his annual neutron dose equivalent would be:

$$\text{Deq.} = 0.5 \text{ mrem/h} * 50 \frac{\text{weeks}}{\text{year}} * 3 \frac{\text{h}}{\text{week}}$$

$$= 75 \text{ mrem.}$$

Based on the conservative assumption that all work is performed by a single person, the calculated annual neutron dose equivalent is only 75 mrem, 1.5% of the radiation protection standard (5000 mrem/year). Since three persons currently perform sampling and weighing operations at HASA, and assuming that each individual shares in this work, the annual average neutron dose equivalent

for these three workers is more likely on the order of 25 mrem/year. Based on these facts and assumptions, it is reasonable to conclude that neutron dosimetry should not be required for UMH workers. Further, R. M. Robinson has informed me that neutron exposure potential will be reduced when the X-345 HASA is on-line. During sampling operations in the new facility, cylinders will be heated in autoclaves, thus reducing employee neutron exposures.

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Neutron Survey Results

Location	Description	Readings Fast (mrem/hr)	Readings Thermal (mrem/hr)	Comments
H Portal		0	0	Readings taken outside portal
X-103	Background Reading	0	0	
X-342 North Cylinder Lot	Full 10-Ton Cylinders	0.47	0.34	Readings taken between 2 full cylinders, approx. 1 foot from each cylinder
X-342 North Cylinder Lot	Full 2.5-Ton "Blue" Urenco Cylinder	11.3	7.8	Readings taken approx. 1 foot from middle of cylinder
X-326 PW	Full 5-Inch VHE Cylinder		2.5-3	Readings taken on contact with cylinder
X-345 Center Vault	Full 5-Inch VHE Cylinder in Overpack		1.0-1.5	Readings taken on contact with overpack

AHJ
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