MERCURY CONTROL IN THE RTF (U)

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by
R. A. Malstrom
Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

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Savannah River Technology Center
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cc: R.D. Buley, 233-5H
T.R. Davis, 233-25H
A.S. Horen, 233-31H
R.M. Schroder, 232-H
J.R. Dollar
R.L. Rabun, 235-H
C.E. Coffey, 773-A
J.R. Knight
T. Motyka
L.K. Heung
C.W. Jenkins 773-41A

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March 24, 1993

MEMORANDUM

To: R.J. Alexander, 233-6H

From: R.A. Malstrom, 773-A *B6*

Mercury Control in the RTF (U)

SUMMARY

Engineering controls limit the amount of mercury and moisture introduced to the RTF (233-H). These controls include liquid nitrogen chilled gold traps for mercury and zeolite beds for moisture which are installed in-line. All gas transfers between 232-H or 236-H to 233-H will pass through these traps. Barring unforeseen catastrophic failure of the traps, no detectable amounts of mercury will be introduced via this route. However, a small amount of mercury (near

Technical Review: *L.K. Heung* 3/24/93

Classification Review: *T. Motyka* 3/24/93

detection limits) will be introduced via the reservoir recycle stream. This amount is conservatively calculated to be 7 milligrams per year and will have negligible impact on hydride bed performance. In no case will the design agency limits for mercury ($0.3 \mu\text{g/liter}$) be approached, because the reservoir recycle gas is much lower than those limits already, and the hydride beds will amalgamate with any free mercury.

DISCUSSION

The Replacement Tritium Facility was designed so all gas transfers from 232-H and 236-H would have to pass through zeolite beds to remove moisture and liquid nitrogen chilled gold traps to remove mercury. The transfer lines are interlocked with normally-closed valves which shut when the gold traps warm to -75 degrees Celsius. The vapor pressure of mercury at -75 degrees is below detection limits.

The only other way for mercury to enter 233-H would be through the reservoir recycle stream. Reservoirs filled in 234-H will be unloaded in 233-H and small amounts of mercury will be introduced via this route. However, this will not cause any problems because the 234-H process was designed to minimize the amount of mercury loaded in reservoirs. All gas passes through chilled gold traps which remove mercury to 15 times less ($.02 \mu\text{g/liter}$) than the design agency requirements. In addition, mercury vapor tests are performed each month, and after each rupture disk failure, to check for mercury which might be introduced via the rupture disk header.

The primary separator is the first hydride bed exposed to the gas, and it is the bed where any mercury from the recycled reservoirs will first amalgamate. It contains 30 kilograms of palladium coated on kieselguhr. It is estimated that only 7 milligrams of mercury would be introduced each year. Forty years of operation would add less than 0.5 grams of mercury. Comparing this number to the 30 kilograms of palladium, it is clearly insignificant. Experiments have shown that the bed's performance will not be compromised by this amount of amalgamation.¹ Heating the primary separator bed will cause some of the amalgamated mercury to desorb and be amalgamated by subsequent hydride beds. However, this small

¹M.S. Ortman, T.J. Warren and D.J. Smith, "Use of Metal Hydrides for Handling Tritium," Fusion Technology, 8, 2330 (1985).

amount of mercury will not cause any problems with any of the hydride beds.

The initial reservoir recycle gas is below design agency limits for mercury, and the gas is stored on several hydride beds as it passes through the 233-H process. Each of these beds will amalgamate with any free mercury. Therefore, the gas loaded from 233-H will have negligible amounts of mercury, and be well below design agency limits.

Finally, analyzers will be used to check the mix tank piping and compressor feed lines for possible mercury contamination. These tests will be performed on a regular basis (initially after each transfer with a limit of at least quarterly). Any mercury contamination would be discovered at this location before it would be seen at the loading lines, whether it came from the transfer lines or recycle stream.

END

**DATE
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9/20/93