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[redacted]ound Laboratory, Miamisburg, Ohio

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[redacted] Discussion of the Accountability Problem Due to Tritium Adsorption in Stainless Steel Process Systems (DELETED VERSION)

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Distribution

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DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
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Introduction: In response to a request by Mr. D. D. DeBord for an analysis of the accountability problem involved in tritium stainless steel process systems, the following has been written.

Controlled experiments have been made by reservoir surveillance personnel to determine the degree of tritium adsorption in stainless steel under a variety of conditions of pressure and temperature. As a result of these experiments several conclusions can be drawn with regard to accountability losses of tritium that are adsorbed in the metal of stainless steel process systems.

I.

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Discussion of the Accountability Problem Due to Tridium Adsorption in Stainless Steel Process Systems.

I.

II. If the pressure is only 15 to 30 psi, as is the case with most process equipment and storage tanks, and the temperature is normal (0 - 50°C) the expected surface concentration will be on the order of 1.0×10^3 microcuries per gram and will diminish by a factor of 10 for each 0.001 depth. In this case it would take about 1000 cm^2 of surface area to constitute a cubic centimeter of stainless steel which would contain tritium at a level of 1.0×10^2 microcuries per gram. This would be 1.0×10^4 microcuries per cubic centimeter of stainless steel or 1.0×10^4 microcuries per 1000 square centimeters of surface area.

III. The above two examples are given at room temperature. Since the diffusion of tritium increases drastically with an increase in temperature the concentration of tritium in the entire bulk of the metal would approach the surface concentration if the temperature were maintained at several hundred degrees (300°C - 700°C) for only a few days. Under these circumstances the entire bulk of the stainless steel would be expected to contain about 1.0×10^3 microcuries per gram in the low pressure example described above, and 1.0×10^5 microcuries per gram in the high pressure example.

IV. Thus a reactor constructed of one-half inch stainless steel pipe six inches in diameter and one foot long would weigh about 15,000 grams. If this reactor were maintained at an elevated temperature of 300°C to 700°C for several days with a pressure of 15 to 30 psi, it would adsorb a total of about 1.5×10^7 microcuries or < 0.002 grams of tritium.

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From the above examples we can conclude that the total amount of tritium retained in process equipment is very small even under the most difficult conditions, and although it is detectable by sensitive counting techniques it can be disregarded for accountability purposes.

K. F. Chaney

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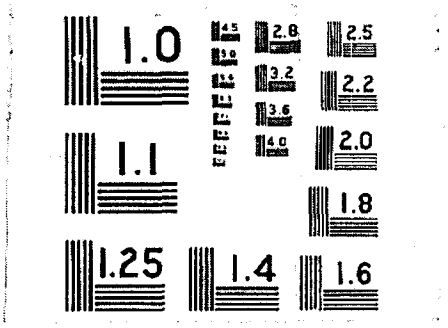
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