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MONSANTO RESEARCH CORPORATION — Inter-Office Correspondence

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SUBJECT : Trip to Pinellas Peninsula Plant on June 14 - 15, 1961

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TO : Dr. John F. Eichelberger - Research Director

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STACK EFFLUENT CONTROL SYSTEM

Introduction

A trip was made to Pinellas Peninsula Plant to discuss their experience with the recovery of tritium from a gas stream, in consideration of the fact that a "Stack Effluent Control System" has been in operation at the site since September, 1960. Those making the trip were G. L. Deniston, Engineering Division and D. R. Spangler, Research Division. The discussion was principally with H. McLeland, Engineering.

The design of their "Stack Effluent Control System" was explained to us in detail and prints of the equipment were provided. The system is designed to remove tritium from the exhaust stream of process pumps before being expelled to the stack. The Health Physics Department at Pinellas Peninsula Plant stated that the system has reduced the amount stacked by a factor of 400 to 500.

Collection System

A rather complicated system of equipment is used to collect the exhaust from process vacuum pumps. It is designed to prevent undue pressure from a build-up in the manifold leading from the pumps and is almost entirely automatic. At present, they do now know the concentration of tritium in their exhaust from vacuum pumps. However, the stream usually contains about .1% water, .1% total hydrogens, and the remainder largely air.

To assure that no explosive mixture will exist in the collection tanks, they have purchased a gas chromatograph from the Beckman Company. This will analyze for the total amount of hydrogen isotopes present and other gases in the stream.

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Copper Oxide Reactor

From the collection system, the gas is pumped through the copper oxide reactor to convert any tritium in the stream to water. The reactor is 42 inches long and 2-7/8 inches in diameter. It is filled with reagent grade copper oxide and heated to 750°C. A "heavy duty" furnace is used to maintain the temperature. They believe that 750°C may be too high a temperature since sintering has resulted in one reactor.

Drying Column

From the copper oxide reactor, the stream flows into the drying column. This removes most of the tritiated water vapor in the stream. Pinellas columns are 4 feet long and 4-1/2 inches in diameter. Two are used in series. They are filled with 18 pounds of Linde molecular sieve 4A. The pressure in this part of the system is about 250 millimeters mercury and the flow does not exceed 5 liters per minute. They believe the columns remove all but a few parts per million of water.

They make no attempt to regenerate the columns or remove any residual moisture in the molecular sieve material before use. The columns are changed about every 3 months and are then buried at SRP. Pinellas is interested in the possibility of Mound recovering the tritium from the columns. They have no idea of the amount or concentration of tritium in a column.

MISCELLANEOUS

Titanium Beds

The shipment of titanium tritide beds to Mound for recovery was discussed with M. Palmerie. In the next few months there will be an increased number of beds shipped to Mound. After this, the rate will be greatly reduced. Soon, we will probably receive a new quartz bed that is very much like the present bed, only shorter. A ceramic bed is being designed to replace the quartz bed. It is made of high density alumina with a kovar metal top and is practically unbreakable. It will contain about 3 grams of titanium salt.

Their spent beds are shipped to Mound when they contribute less than 50 millimeter pressure at 750°C in a 2 liter system.

Calorimetry

They are pleased with the preformance of the Mound calorimeters they are operating. N. Parsons, in charge of calorimetry, has sent Mound a sample that he has run and desires Mound to verify his results. N. Parsons requested that, if possible, the results be telephoned to him.

Neutron Counting

Each complete "zipper" manufacturer at Pinellas is pulsed and the emitted neutrons counted. About 20% are rejected. A 8 micro second-pulse at 150 KV is applied to the tube. Neutron scintillation counting is used and the total neutrons emitted during the pulse are measured.

Health Physics

This discussion was held with M. Applegate of their Health Physics Department. They sample their stack at the top and draw a sample through their analysis system. This continuous sample is first drawn through an American Instrument Company "Humidity and Temperature Indicator", and the output recorded. The sample then passes through cooling coils which are maintained a little above 0°C. The resulting water that condenses is scintillation-counted. This determines the concentration of tritium in the water vapor of the stack gas. The dried air is then drawn through a Kanne system and the reading recorded. From the above recorded data and appropriate correction factor, the amount of tritium in the form of water vapor and gas can be calculated. On an average, their stack effluent contains about 2.5×10^{-5} microcuries per cc tritium gas. The water collected contains about 4.3×10^{-7} microcuries per cc. The bulk of the tritium that they stack is in the form of water.

Uranium Beds

Some uranium pellets have been ordered from Mound for experimental use in pressure control in a system containing hydrogen. They have considered the use of uranium instead of titanium beds, but at the moment have no intention of making the change.

Donald R. Spangler
Research Division

DRS: kh

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