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January 13, 1955

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ITEMS FOR OVER-ALL REDOX CONTAMINATION IMPROVEMENT

In view of contamination difficulties within the Redox operation, a number of items are being considered to improve this situation. It is the objective of this document to list and describe seven items which it is felt would contribute most toward improvement. It is also an objective to present for RDS-D-12 Group consideration the recommendations of representatives from Manufacturing, Technical, and Design in these matters with the expectation that a project proposal written in genral terms for over-all contamination improvement would be prepared.

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I. In-Cell Tail-End Ozonization

A. Recommendation

As an early step in the over-all Redox contamination improvement program, the representatives recommend the installation of in-cell, tail-end, ozonization facilities as proposed in the scope document, HW-34163, "Redox E-Cell Ozonization", 12/20/54 by E. Doud, C. A. Rohrmann, and E. D. Waters.

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B. Description

This installation will consist of:

1. Ozone generating facilities installed in the Hivox Room of the Redox Plant.

2. An ozonization vessel installed in E-Cell in the E-13 position now occupied by the uranium rework tank.

3. A ruthenium scrubber in E-Cell in the E-7 position now occupied by the cross-over oxidizer.

It is proposed that a stepwise fabrication and installation be adopted so that this ozonization facility may be provided at the earliest possible date and so that economies may be realized, if some of the installation is determined to be unnecessary for the adequate handling of the Ru problem.

Phase I

1. Install the existing ozone generating facilities in the Hivox Room in the plant. (This room was provided originally to house ozone generating equipment which was purchased but never installed because of a late change in the process. This room was subsequently converted to office and storage space. Relocation of personnel and material to other space is assumed.)

2. Revise a spare vessel and install in the E-13 spot. This will be the ozonizer and will include:

   a. A pump
   b. An agitator
   c. Heating coil
   d. Sparge coil
   e. De-entrainment tower
   f. Reflux condenser
   g. Appropriate jumpers including an air jet for delivery of vent gas directly to the air tunnel.
   h. Appropriate instrumentation as required.

3. Present, contaminated equipment in the E-13 spot would be decontaminated and held in storage as spare.

This phase of the program will provide an operable, ozone, tail-end facility. No ruthenium scrubber or filter will be provided to remove the relatively small amount of ruthenium or entrainment expected in the off-gas. Neither is it proposed to provide a means of "killing" the ozone in the vent gas. It is concluded that dilution in the air tunnel will be adequate to prevent any undesirable transport of ruthenium already held up in the sand filter. About one curie of ruthenium per day would be delivered to the sand filter by Phase I

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operation. However, this amount would be only about 10 percent of that now delivered presumably by the vessel vent system. The possibility of a hexone-ozone reaction is considered sufficiently remote in this, hot, aqueous system to present no concern at this point in the process or in this cell in the plant.

Phase II

If it is established that a scrubber system is required in combination with the facilities of Phase I to minimize ruthenium emission, then additional equipment should be provided. In addition to the items 1, 2, and 3 of Phase I, the following revisions would be required:

1. Add the currently unused tower (T-140) to the E-7 vessel and connect tower and pump to provide a caustic scrubber.

2. Provide appropriate jumpers and routing for vent gas from E-13 to E-7 and from the E-7 tower to the air tunnel.

3. Provide appropriate instrumentation.

No further additions would be proposed for this facility which, at present, is intended to operate until an outside installation is provided. The cost of the installation (Phases I and II) as presently proposed will range from about $260,000 to $285,000 (exclusive of transferred capital property). The installation is expected to be completed within six months after authorization.

C. Justification

As long as the present head-end process which puts a major, radioactive, fission product (ruthenium) in the volatile (and escapable) form is operated, there is a potential for repetition of the release of multicurie quantities of activity through failures such as that which occurred early in January of 1954. Furthermore, equipment maintenance on the highly contaminated facilities associated with this head-end operation is considered to be the major source of general canyon and crane contamination. However, if the present head-end process is to be abandoned, other facilities will have to be provided in order to assure adequate decontamination of the final products. The so-called "tail-end" ozonization process is proposed.

The urgency for the elimination of the present head-end process and to minimize canyon contamination to avoid the possibility of further inadvertant releases of multicurie quantities of hazardous activity requires that the most rapid and immediate solution of the problem be found. It is concluded that equipment revision within the Redox Plant is the only method which can be depended upon to solve the problem in minimum time. It is proposed that the stepwise resolution of the problem be done as described above. These facilities are expected to afford satisfactory decontamination of uranium. Since most of the ruthenium will be discharged with the wastes from the extraction columns, the build-up and retention of multicurie quantities of this activity in equipment will also be avoided by adoption of this tail-end treatment process.

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C. Justification (Cont'd)

It is recognized that these facilities assure satisfactory decontamination of the uranium stream only. Other means can be taken to assure satisfactory decontamination of the plutonium stream. Alternate methods include (1) adoption of the precycle flowsheet which requires only six jumpers, (2) operation of 231 Building on two decontamination cycles with attendant capacity and operating problems or (3) provision of a special tail-end treatment for the plutonium stream. The latter would be expected to involve a long-range solution including development work. Alternate (2) is objectionable from an operating standpoint. It is, therefore, assumed that jumpers will be provided to permit routine operation of the precycle flowsheet.

II. Ozonization Facilities Outside the Redox Plant

A. Recommendation

The representatives recommend that the preparation of a scope document on outside ozonization facilities be continued.

B. Description

The installation of outside ozonization facilities will comprise:

1. A new building in the U-Area to treat Redox material only but which can also be readily expanded to accommodate equipment for treating TBP and/or Purex material, if and when necessary.
2. Ozone generating equipment.
3. Ozonization contactors.
4. A condenser and gas cooler.
5. A ruthenium scrubber.
6. Adequate heating, ventilation and air filtration facilities.
7. Means for disposal of process waste gas to the U-plant, sand filter and stack.
8. Means for disposal of liquid wastes.

Since the scope of an outside installation has not been completed, an estimate of the cost has not been obtained. However, in view of the complexity of these facilities including a new building with provision for remote maintenance of some of the equipment, waste disposal, and tie-in with the U-Plant, ventilation filter the cost may be about $1,000,000 and may require about two years to design, fabricate and install even under an expedited schedule.

[redacted]

C. Justification

Although the in-cell ozonization proposal has been selected for immediate installation because of the attractive cost and timing features, the outside facilities may be required to avoid capacity restrictions or intolerable crane maintenance or service limitations which may develop because of these added operations within the plant. The reality and magnitude of these potential deficiencies of the in-cell installation must await results from actual plant operation.

III. Removal and Disposal of Contaminated Equipment

A. Recommendation

As another step in the over-all, Redox, contamination, improvement program the representatives recommend that equipment which (1) will be made obsolete by abandonment of the permanganate head-end process, (2) is highly contaminated by accumulations of ruthenium resulting from this process and (3) is no longer expected to be a point of ruthenium accumulation under the dichromate head-end process be discarded and, where necessary, replaced with new equipment.

B. Description

The following equipment is expected to be highly contaminated with active ruthenium derived from volatilization in the permanganate head-end process and may be discarded:

1. The H-4 oxidizer.
2. The H-4 oxidizer tower.
3. The vapor line from the H-4 tower to the H-5 scrubber.
4. The H-5 ruthenium scrubber.
5. The vapor line from the H-5 scrubber tower to the H-6 condenser.
6. The H-6 condenser.
7. The vapor line from the H-6 condenser to the pipe tunnel wall.
8. The vapor line from the pipe tunnel wall (from H-6) to the J-2 scrubber.
9. The J-2 scrubber.
10. The vapor line from the J-2 scrubber to the J-3 filter.
11. The J-3 filter.
12. The vapor line from the J-3 filter to the air tunnel.

[redacted]

B. Description (Cont'd)

Of the above equipment, items 1 through 8 would be replaced and revised routings should be provided for continued operation with the dichromate head-end process: (It is assumed that permanganate head-end or any other head-end which utilizes ruthenium volatilization as a method of decontamination will never be re-instituted.) Item 8 should be replaced with a line which would deliver off-gas to the J-3 filter or to a replacement filter in the J-1 position. No replacement of the J-2 scrubber is proposed.

In addition to the above, intensive effort should be applied to decontaminate such fixed piping as the vent line from the H-6 condenser to the J-1 position.

C. Justification

With the installation of the ozonization facilities and operation of the dichromate head-end process, certain items of head-end equipment will be made obsolete. It would seem that such equipment could be by-passed and left undisturbed. However, it is expected that the extremely large quantities of activity which are present in this equipment will present a continued potential for leak-out of intolerable amounts of such activity regardless of the steps taken to isolate and seal these vessels. It is planned, therefore, as a step in the over-all canyon clean-up program, to eliminate such activity sources by discard of the obsoleted and contaminated equipment including the H-4 oxidizer, H-5 ruthenium scrubber, J-2 back-up scrubber, H-6 condenser, and the J-3 filter as well as connecting vapor lines. The cost of equipment discard (not including replacement) is estimated to be about $5,000 per vessel and the same for the balance of discarded vapor lines and jumpers, or $30,000. It is assumed that a new H-4 pot and tower, H-5 vessel, H-6 condenser and possibly a new J-1 filter will be provided.

A figure of $100,000 should be considered for a start on this over-all cell clean-up program. It should be recognized that a large portion or even all equipment in certain cells may be so badly contaminated that replacement may be required to achieve the desired clean-up. It is conceivable that certain of the equipment may not be as contaminated as expected and even much less contaminated than equipment in other parts of the plant. In such cases replacement or removal should be reconsidered. Since substantial and probably intolerable shutdown time may be required, it is felt that initially the program should be limited to the amount indicated above. The desirability of further efforts should await results from this initial work.

IV. Ventilation Increase

A. Recommendation

The representatives recommend that the preparation of a scope document on a method for ventilation improvement based on results of the pending mock-up test be continued at high priority.

[redacted]

B. Description

Up to the present time, two methods of ventilation increase have been studied. There is insufficient basis at this time to recommend either method. Both methods involve increaseing the air supply capacity as well as the exhaust capacity. A new stack and filter operating in parallel with the existing stack and filter would be provided. One method would be operated continuously, the other method would be operated intermittently as cell covers are removed. Both methods are described in document, "Redox Ventilation Study - Increased Canyon Air Flow", January 5, 1955 by E. Doud.

C. Justification

In order to assure down-flow of air at all times, a substantial increase in canyon ventilation air flow is required. The proposals which are being considered would increase the air throughput to about six times the present volume.

It is recognized that the air flows in the Redox ventilation system are not sufficiently vigorous to assure flows in a single direction at all times. Particularly, the flow is not sufficient to oppose the thermal turbulence in the air from the warm, contaminated cells whenever cover blocks are removed. Up to the present, it has been possible to cool the equipment and cell walls to some extent before opening the cells for necessary maintenance, however, this has been done at the sacrifice of production time. An alternate which has been suggested but not as yet demonstrated would involve operation with the ventilation air at a higher temperature, approaching that of the cell temperature to minimize the potential for thermal turbulence.

A "mock-up" test to obtain data on air flows required to oppose thermal turbulence is under construction. Final scope design of the proposed facilities must await the results of tests in the mock-up facilities. On the assumption that satisfactory ventilation improvement can be obtained by conventional methods, the cost for the expanded ventilation system is estimated to amount to about $2,750,000 and will take about two years to install.

V. Facilities For Canyon Clean-up

A. Recommendation

The representatives recommend study and preparation of the scope for equipment to be permanently installed and used for periodic clean-up by washdown of the interior canyon surfaces including walls, deck, and possibly the roof trusses.

B. Description

The descriptive scope of this facility has not been initiated. The expectation is that an automatic water spraying system will be designed for washing the walls, deck, crane cabway, and possibly the roof trusses. Such wash-down would be done by sections.

[redacted]

B. Description (Cont'd)

Protection will have to be provided for the crane to prevent moisture difficulties with the electrical facilities. In addition, consideration will have to be given to the problem of the removal and disposal of the waste water. The work will most likely involve considerable piping, pumping, and valving with control instrumentation.

C. Justification

These facilities are needed to remove, most economically, existing accumulation of activity as well as for routine removal of current accumulation so that ventilation air contamination as well as drift and redeposition on the crane will be minimized.

In November of 1953, the interior of the canyon was washed down manually in an effort to reduce over-all canyon contamination. Substantial reduction in air contamination resulted as well as a significant reduction in general contamination of canyon surfaces. This proposed installation may require work under SWP conditions. An estimate of $300,000 has been suggested as the cost of these facilities. Extended shutdown (more than seven days) of the plant is not anticipated for this installation which is expected to take less than six months. It is conceivable that it may be possible to install these facilities even without a plant shutdown.

VI. Pre-Condenser For J-6 Vent System

A. Recommendation

In order to avoid condensation within the J-6 condenser vent filter and thus assure the continued effectiveness of the filter in removing activity prior to delivery of the off-gas to the sand filter, the representatives recommend that a condenser be provided.

B. Description

It is proposed to provide a condenser and gas cooler in the gas stream prior to entrance into the J-6 condenser vent filter. Although the scope of this facility has not been completed, equipment suitable for gas cooling and condensing can be readily conceived. A water-cooled, shell and tube condenser of a design which will fit in the J-6 position is assumed. The design must take into account such things as capacity, extent of cooling, gas composition, pressure drop and source and disposal of cooling water. In addition some heat should be added to the cooled gas to maintain it definitely above the dew point during passage through the filter.

[redacted]

C. Justification

A review of J-6 filter performance has shown poor decontamination effectiveness since January, 1954. This malfunctioning is attributed to failure caused by wetting. It is known that wetting has occurred; such wetting could have resulted in sufficient increase in pressure-drop to cause gross disturbance of the continuity of the filter layer with resultant channelling. It has also been observed that condensation is normally occurring in this filter and that condensate amounting to about 100 gallons per day has been collected even under conditions of increased cooling water flows to all plant condensers. A substantial portion of the condensate from this filter is observed to be hexone. The provision of a condenser will allow potential savings of at least $40/day in recovered hexone as well as substantial reduction in raw water consumption at other condensers. However, the principal reason for a condenser prior to the J-6 filter is to prevent the filter from getting wet and thus assuring its effectiveness as a remover of contamination from the condenser vent stream.

It is estimated that a condenser can be installed for about $30,000 within about four months on an expedited schedule.

VII. Improvement in the Vessel Vent System

A. Recommendation

The representatives recommend study and development of equipment and methods for reducing contamination originating from facilities tied into the vessel vent system. This program should include improvements in gasketting, flanges, jumpers, jets, centrifuge shroud, vessel venting and the like.

B. Description

The improvements involved in this program have not been precisely defined. It is recognized that substantial amounts of activity are building up in the sand filter and that a large fraction of this activity enters through the vessel vent system. Most of this activity originates at the centrifuge. This source should be somewhat reduced after abandonment of the permanganate, head-end process. However, there will be still other sources such as leaks in flanges or vessels which become pressurized. Such leaks contribute activity to the cells. Such activity by-passes the vessel vent filter. That which does not deposit on cell equipment goes directly to the sand filter.

This program will involve such items as identification and correction of the major leaks, improved equipment design and improved control or instrumentation. Mock-up evaluation of improvements will be made. The design of a satisfactory centrifuge shroud is considered an item of immediate importance.

[redacted]

C. Justification

Improvements obtained by this program are justified by reduction in coil, crane and ventilation system contamination and assurance of longer life for the sand filter.

It is not possible at this time to clearly define the extent of the program. It could apply to a few critical points in the plant and if satisfactory results were assured there, it could be extended to cover the whole plant over a prolonged period of time. For example, improved gasketting would probably be done only during periods of equipment replacement or maintenance. It would take years to cover the entire plant in this way. Major improvements are expected to be made in six to twelve months. The cost of these should not exceed $50,000.

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