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DECLASSIFICATION REVIEW
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AUTHORITY: ☒ ADC ☐ ADD
NAME: Buzz Dammer
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AUTHORITY: ADD
NAME: JBriggs WHC.CO.

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1,2,3. AEC-Hoo, Attn: DF Shaw
4. WE Johnson
5. AB Greninger
6. OH Greager
7. RH Beaton
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9. VD Nixon - JM Frame
10. 700 Files
11. Yellow

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Richland, Washington
November 3, 1952

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U.S. Atomic Energy Commission
Hanford Operations Office
Richland, Washington

APPROVED FOR PUBLIC RELEASE
JBriggs 1/24/96

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Attention: Mr. D. F. Shaw, Manager

Gentlemen:

PROJECT CA-513
FEED MATERIAL COOLING PERIOD

Ref.: (1) HAN-46970, DF Shaw to WE Johnson, "Purex Facility (CA-513) - Feed Material Cooling Period," dated 10/10/52.
(2) HAN-46451, JE Travis to RW Cook, "Purex Facility - Feed Material Cooling Period," dated 9/10/52.

Reference letter (1) listed above raised four questions, answers to which will be of aid to the Atomic Energy Commission in consideration of the cooling period for feed material to be processed in the Purex Separations Plant now being scoped. As requested, answers to each of these questions are given below, in the order originally listed.

1. To design a plant on a basis firm enough to assure successful processing of 60-day-cooled material, assuming this might be proven feasible from a technical standpoint, would require the establishment of a Chemical Flowsheet based on pilot plant data from extended runs with 400 to 600 MWD feed material cooled no longer than 60 to 65 days. This would have to include a continuous solvent and acid recycle to determine effects on process yields and decontamination.

It is known that iodine is quite soluble in the TBP-hydrocarbon solvent of the Purex Process. It is also known that radiation has a deleterious effect on this solvent. Successful operation with continuous recycle of solvent containing the quantities of radioactive iodine which might build up when operating on 60-day-cooled feed could well prove impossible. Development of an iodine removal step either in the head-end of the process or in the solvent treating system would then be required.

Some SPRU pilot plant data exist to indicate that an MnO_2 precipitation may remove iodine from 60-day-cooled feed material to an extent which makes it equivalent to 90-day-cooled feed material in this respect. However, until

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exact flowsheet conditions could be set by more extensive pilot plant operations, design cannot provide equipment which would assure successful operation of such a process step.

Operation with 60-day-cooled feed may also have other effects on the process as now established which are today unrecognized because of lack of experimental data. As of today, neither the SPRU nor the ORNL pilot plants are equipped to run at full Hanford activity with continuous (6 to 8 hr. turn-over rate) solvent and acid recycle, and it is somewhat doubtful as to whether or not either could be safely operated under such conditions. Assuming, however, that the operating contractors of these facilities would agree to conduct the necessary test work, it is estimated that a development program of from six of eighteen months might be required, depending on the extent of the troubles encountered and the difficulties involved in overcoming them.

The development program for ORNL which was established at the October 10, 1952 meeting at Oak Ridge will provide some additional information on the problems which may be encountered with 60-day-cooled feed material, but this program is not designed to give conclusive data upon which to base an assured flowsheet.

2. It is known that lag storage of the uranium product stream to allow U^{237} decay before transfer to the UO_3 Plant would be required for processing 60-day-cooled feed material. The additional storage required for this purpose, beyond that presently contemplated, would cost approximately $300,000. There would be no significant effect on design or construction schedules.

The present head-end flowsheet could be expanded to include additional centrifugation capacity and provisions for removal of volatile fission products (iodine, ruthenium). It is estimated this would increase capital expenditures by approximately $2,000,000 and annual operating costs by about $80,000.

In addition, facilities could be provided in the 202-A Building for a silica-gel adsorption and copper sulfide precipitation treatment of the uranium product stream. This could be useful in removing residual quantities of ruthenium, niobium, and zirconium. It is roughly estimated this would require a capital expenditure of between $2,000,000 and $3,000,000 and an annual operating expense of approximately $250,000. Conversely, depending upon the specific fission products which might be present and their concentration, it might be possible to build enough additional lag storage to allow natural decay to a point where the material could safely be handled in the UO_3 Plant. In addition, ion exchange facilities could be included for further clean-up of plutonium, if this proved necessary. Such facilities are roughly estimated to cost approximately $700,000 to $800,000 and would require an annual operating expense of approximately $70,000 to $80,000.

Any extensive change to the Purex flowsheet, such as those contemplated above, would delay the design and construction schedule by four to six months. Still further, additional time would be required at start-up to develop operating procedures for processing material cooled less than 90 days, or a full pilot plant development program would have to be carried out during the design and construction period.

Very recent data from Oak Ridge pilot plant operations have indicated the need for installing the major solvent recycle system in the remotely maintained zone because of zirconium and niobium retention and for iodine removal from the equipment ventilation gases. Also, the solvent treatment process has been extended to include additional processing steps. By removing any question of contact maintenance on this equipment, and by minimizing the potential iodine contamination of the environs, these changes greatly improve the probability of eventually operating on feed cooled less than 90 days (if the yields, decontamination, etc., prove not to be adversely affected). Since these changes are being made for processing 90-day feed, their effect on cost and schedules should not be associated with the question of processing 60-day material.

Stub lines are being installed through the back wall of the 202-A Building for possible routing of material out of and into the canyon at various points. A second process building could be built at a later date, when the actual need might be proven and the required processing steps firmed up.

It should be pointed out that, with the limited data available, most of it from laboratory experiments alone; no combination of the possible actions mentioned above could assure successful operation on 60-day-cooled feed. Under such circumstances, the General Electric Company would expect to start up the Purex Plant with material cooled no less than 90 days, even if such design changes were made.

3. Without the addition of lag storage for U^{237} decay, there is no possibility that 60-day-cooled feed could be handled in the combined Purex and UO_3 operations. With such lag storage provided and with the revised major solvent recycle system in the canyon, together with iodine removal from the equipment vent gases, it is estimated that there is a 5-to-1 chance of working out procedures for processing 60-day-cooled material after plant startup. However, the chances of operating on material cooled between 60 and 90 days, without specifying an exact cooling period, are much greater than this.

Problems of solvent degradation from radio-iodine become of next importance in evaluating the possibilities for processing 60-day-cooled feed. Data for such evaluation are very limited but tend to indicate that additional processing steps might be required. Provision of additional centrifugation capacity and facilities for removal of volatile fission products in the head-end might increase the probabilities of eventually processing 60-day-cooled feed material to a 10-1 ratio; however, this is very nebulous and the effect of such a flowsheet change at this time on schedules and costs, as noted in (2) above, should not be ignored.

The value of any changes made beyond those mentioned above, such as providing for tail-end treatment of the two product streams, becomes entirely indeterminate.

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4. The high degree of integration of equipment, piping, and building design and construction required for safe handling of radioactive solutions makes it impossible to design for unlimited expansion or revision of the processing line. Empty cell space, with a judicious choice of wall connectors, can be provided at an estimated cost of approximately $25,000 per foot. Whether or not this space would be usable for a given processing step developed at a later date cannot be positively known. The number of additional processing steps which might be required for operation with 60-day-cooled feed is, of course, unknown, as is the exact nature of the equipment that might be required. The possibilities of utilizing gravity flow from one processing step to the next would essentially be eliminated and otherwise unnecessary run-down tanks and pumps would be required with their attendant capital, operating, and maintenance costs.

Utilization at a later date of unassigned cell space would be inefficient as it could only partially be used for effective process equipment.

In summary, it is recommended that the design program continue on the present basis with the addition of lag storage for U237 decay, recognizing the probability of being able to develop procedures for processing uranium cooled significantly less than 90 days within the plant as it would then exist.

Very truly yours,

W. E. Johnson

GENERAL MANAGER

WE Johnson: RHB:jb

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