RAI

Radiation Applications Incorporated

370 LEXINGTON AVENUE, NEW YORK 17, N. Y., ORegon 9-9170

April 13, 1959.

Dr. Charles E. Crompton
Associate Technical Director
National Lead Company of Ohio
P. O. Box 158, Mt. Healthy Station
Cincinnati 31, Ohio

Dear Dr. Crompton:

As you know, we have, for the past year and a half, been engaged in a project under contract to the Reactor Development Division of the Atomic Energy Commission to investigate the removal of cesium and strontium from fission product waste solutions by the use of our foam separation process. We have also recently begun a program for the Office of Isotopes Development to apply foam separation to fission product separation and purification. In addition, we are studying the applicability of foam separation in a number of other areas including nickel-cobalt separation and removal of trace impurities from beryllium.

The enclosed brochure gives a brief introduction to the foam separation process. We are also enclosing our last monthly report to the Reactor Development Division under Contract AT(30-1)-2093; you may obtain copies of prior reports through Dr. E. L. Anderson of the Reactor Development Division.

We have been reviewing other possible applications of the foam separation technique to processing problems in the Atomic Energy program. It appears to us that there are two problems at Fernald to which foam separation may well be applicable. These are:

(1) Removal of fluoride and chloride ions from uranium solvent extraction raffinates;

(2) Removal of thorium from uranium solvent extraction raffinates.

Based on the results we have obtained in the course of our work for the Atomic Energy Commission and based also on preliminary experiments, performed for our own account, we believe that foam separation may give better and more economical removals than those presently obtained.

Dr. Charles E. Crompton
Associate Technical Director

April 13, 1959.

It is the purpose of this letter to outline the technical factors involved and to propose a research and development contract program to determine the applicability of the foam separation process. We propose a contract period of six months at a total estimated cost of $16,700.

STATEMENT OF THE PROBLEM

(1) Removal of Fluoride and Chloride Ions

Examination of data contained in the paper by Arnold, Whitman and Podlipec entitled, "Nitric Acid Recovery from Raffinate by Evaporation and Fractional Distillation" has revealed the existence of a corrosion problem. The existence of fluoride and chloride ions in raffinate streams from uranium extraction units causes corrosion in the evaporators and distillation units used to recover nitric acid from the raffinate. The present methods of eliminating or reducing the seriousness of these problems are as follows:

A. Fluoride ion is complexed by the addition of five parts of aluminum per part of fluoride (by weight) to reduce the volatility of the fluoride.

B. Chloride removal is accomplished by an air-ozone sparge of liquid from the distillation column. The chloride is oxidized to chlorine by the ozone and is removed from the solution by air blowing.

We understand that the chloride and fluoride are present in the raffinate stream at a total concentration of from 200 to 500 ppm.

(2) Removal of Thorium

The second problem involves the removal of thorium from uranium extraction raffinates or from the feed stream to uranium purification process. Examination of report NLCO-762, "Laboratory and Pilot Plant Evaluation of Stanrock Uranium Concentrate" shows the following:

Certain uranium ores, notably those from the Blind River Area, contain small but definite amounts of thorium. The presence of the thorium is detrimental to the uranium extraction process so that it is necessary to add phosphate to complex the thorium. This additional phosphate may cause precipitation of thorium phosphate in the raffinate which could be an undesirable situation. The thorium is present in the feed solution at a concentration of approximately 1 gram per liter.

Dr. Charles E. Crompton
Associate Technical Director

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PLAN AND SCOPE OF PROPOSED WORK

(1) Removal of Fluoride and Chloride Ions

A. Attempt to remove fluoride and chloride ion from synthetic solutions approximating the composition of actual raffinate.

B. Evaluate the use of several foaming agents for this purpose.

C. Determine optimum conditions for such a separation.

D. Depending on the results of steps A, B and C, attempt the use of a foam separation process on actual samples of raffinate.

(2) Removal of Thorium

We propose to study the removal of thorium by foam separation from both feed solutions and raffinates. This will involve essentially the same type of program as that outlined above for fluoride and chloride removal.

PRIOR WORK

The work done to date by RAI on foam separation demonstrates that the approach suggested herein is theoretically sound and may well be of practical importance. All of this prior work can, of course, be applied with considerable profit to the study of the removal of fluoride and chloride, and also of thorium.

With respect to the fluoride-chloride removal, we have performed some very preliminary experiments which demonstrate feasability:

Two experiments were run on solutions containing 3500 ppm chloride ion in the form of HCl. These solutions were foamed and enrichment ratios of 1.1 were obtained. Since these chloride concentrations were approximately ten times higher than those in the solutions to be treated, we expect to obtain much better enrichments in the actual solutions. In our previous work on the foaming of cations (Cs and Sr) from solution, we have found that the enrichment ratio increases as the concentration of the cation decreases.

Dr. Charles E. Crompton
Associate Technical Director

April 13, 1959.

CONCLUSION

It is our expectation that the foam separation process will, for both of the removal operations considered in this proposal, permit better removals than those presently obtained and will do so more economically.

A budget breakdown of the estimated cost of the proposed program is attached to this letter as Appendix I.

We are taking the liberty of sending copies of this letter and attachments to Mr. Bertram Schwartz, Production Division, United States Atomic Energy Commission, and Dr. E. L. Anderson, Reactor Development Division, United States Atomic Energy Commission.

We would be pleased to meet with you at your convenience to discuss the proposed work in further detail.

Sincerely yours,

RADIATION APPLICATIONS INCORPORATED

Munroe F. Pofcher
President

MFP/pgp
cc: Mr. Bertram Schwartz
Dr. E. L. Anderson

Enclosures:
"Foam Separation"
Progress Report (March, 1959)
Appendix I

APPENDIX I

ESTIMATED COSTS

The following budget is based on a contract period of six months:

Personnel		
Project Director (part time)	$1,000	
Chemical Engineer	4,500	
Technician (part time)	1,150	
		$ 6,650
Overhead		
At 120% of personnel costs (estimated; subject to audit to determine actual overhead)		7,980
Equipment		300
Expendable materials and supplies		400
Travel and miscellaneous		300
Fee		1,070
TOTAL ESTIMATED COST		$16,700