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EXPLOSIVES DEPARTMENT

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April 19, 1956

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Technical and Production Division
Savannah River Operations Office
U. S. Atomic Energy Commission
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2. C. J. Banick AED CO 2/4/59
Name Title

Dear Mr. Kilburn:

RESEARCH PROGRAMS IN SUPPORT OF SAVANNAH RIVER

At your request we are transmitting information pertaining to the programs of AEC National Laboratories and other AEC contractors in direct support of the Savannah River project during Fiscal Years 1957 and 1958. The major part of this supporting work we are recommending is associated with the development and the experimental production of extended-surface elements for increasing the Plant productivity of plutonium and tritium. For the first time a portion of this work on the development of extended-surface elements is aimed specifically at increasing their stability and reducing their cost. The total cost estimate of the supporting programs covered in this letter is about \$300,000 to \$400,000 lower than the cost of such programs in FY-1956. This reduction results principally from the discontinuation of work at Sylvania and Horizons on the development of improved processes for converting thorium nitrate to thorium metal.

The cost of the programs covered by this letter and described in the following paragraphs totals \$1,630,000 for FY-1957 and \$1,690,000 for FY-1958. We consider these programs important to the rapid and successful achievement of development and production objectives at the Savannah River Plant and accordingly recommend that the Commission support them.

NUCLEAR METALS, INC.

MASTER

During the past several years Nuclear Metals has worked to develop methods of producing extended-surface
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Reviewing
Official

C. J. Banick
C. J. Banick, AED Class Officer

Date

2/4/59

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elements for use in the Savannah River reactors. This work has been quite successful. A coextrusion technique was developed for producing clad tubes of uranium-aluminum alloy and of lithium-aluminum alloy. The Plant is now beginning to use this technique for manufacturing elements for the production of tritium. During FY-1956 Nuclear Metals developed a process for producing bare uranium tubes of suitable characteristics. Although this procedure is somewhat cumbersome, it permits the production of experimental quantities of these tubes for use in the development of other processes such as for cladding.

The details of the Nuclear Metals program for FY-1957 have not yet been clarified. However, the program will include work to establish an improved and more economic procedure for the production of bare uranium tubes and will include work to decrease the cost and improve the quality of enriched tubular fuel elements. We recommend that \$500,000 be set aside to cover the Nuclear Metals program for FY-1957 and \$400,000 for FY-1958. We shall make specific recommendations both as to scope and dollar-level in the near future.

PLATE MANUFACTURE

To date the Superior Steel Company has manufactured experimental quantities of bare uranium plates required for the development of plate fuel element assemblies. We recommend that \$200,000 be set aside for each of the next two fiscal years to cover a continuation of this work.

TUBE MANUFACTURE

During FY-1956 the scope of work at Nuclear Metals was increased to cover the production of natural uranium tubes for development purposes. Nuclear Metals does not have the facilities required for the production of these tubes, and for this reason it is expected that tubes for experimental purposes will be produced by some other company in FY-1957 and FY-1958. We recommend that \$500,000 for FY-1957 and \$400,000 for FY-1958 be set aside to cover this work. These figures are somewhat in excess of the amounts that have been spent for the production of plates for experimental purposes because the current method of producing tubes is somewhat cumbersome, as has been mentioned previously. The figure for FY-1957 is higher than that for FY-1958 because of our assumption that the initial production of tubes will be more expensive than production on a going basis.

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BETA TREATMENT

The Atlas Steel Company has to date beta-treated bare uranium plates. In the future it will be necessary that both plates and tubes be beta-treated. We recommend that \$20,000 be set aside for each of the next two fiscal years to cover the cost of beta treatment either at Atlas or some new location. We should like to point out, however, that the development of a new location for beta-treating would probably require initial additional funds for capital equipment.

ZIRCONIUM FABRICATION

Zirconium has a number of properties that make it attractive for use in reactors in place of aluminum and perhaps other metal. It is corrosion-resistant, it has acceptable working properties, it has a relatively low neutron capture cross-section (about half that of aluminum on a volume basis), and it has better mechanical stability than aluminum and thus can be used in thinner sections. It appears certain that development work will be required to establish techniques for producing zirconium shapes. As an example, it may be desirable to extend the semipermanent sleeves to the bottom of a reactor by adding a zirconium tube with internal ribs. This would permit the use of extended-surface elements of maximum size.

To cover work on the fabrication of zirconium we recommend that \$50,000 be set aside for FY-1957 and \$150,000 for FY-1958.

ZIRCONIUM PURCHASE

We recommend that \$30,000 be set aside for FY-1957 and \$90,000 for FY-1958 to cover the purchase of zirconium for development work such as that described in the preceding paragraph and perhaps for use in experimental alloys and cladding studies.

IMPROVED ELEMENTS

It is expected that the development of extended-surface fuel and target elements will permit the operation of the Savannah River reactors at significantly higher power levels. As power levels are raised, both the burden imposed on the elements and the potential hazards associated with failures are increased substantially. For this reason we expect that one of the most important phases of our program in

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the future will be the development of fuel and target elements of higher integrity. This might involve the use of alloys, of cermets, and of alternate cladding materials. Another important phase of our future program will be to reduce the cost of producing fuel and target elements, perhaps by using alternate material or developing cheaper methods of fabrication.

To cover work along these lines by AEC laboratories or contractors, we recommend that \$100,000 for FY-1957 and \$200,000 for FY-1958 be set aside. It is not possible at this time to mention specifically where this work might be done or, for that matter, what the work will consist of. However, as promising leads are uncovered in the future, these funds will be used to support new programs or perhaps increases in scope of existing programs.

SYLVANIA ELECTRIC PRODUCTS, INC.

During FY-1956 Sylvania worked on two items in support of our program: the development of a technique for producing plate elements using powder metallurgy and the development of a process for producing thorium metal from thorium nitrate.

A review of our development status near the end of 1955 indicated that a continuation of the Sylvania program to produce plate elements was not justifiable in view of the progress that had been made both in improving the quality of wrought metal and in developing processes for producing plate elements from wrought metal. For this reason Sylvania discontinued experimental work on this program at the end of 1955. At the present time we see no need for any further development work making use of powder metallurgy techniques.

During all of FY-1956 Sylvania has continued laboratory-scale work to develop a process for reducing thorium nitrate to thorium metal. Just prior to the beginning of FY-1956 it became apparent that processes requiring the use of thorium would not be used at the Savannah River Plant in the foreseeable future. However, it was deemed advisable to continue the work at Sylvania to a logical conclusion to avoid any loss of the art that had been developed. We feel that this objective will be met by the end of FY-1956, and at that time Sylvania will have prepared a report on this work. We believe the process to be quite promising and feel that anyone having a continued interest in selecting a thorium reduction process should consider conducting additional development work, perhaps on a pilot-plant scale, on this process after FY-1956.

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HORIZONS, INC.

As in the case of Sylvania, Horizons had in progress at the beginning of FY-1956 work on a semiworks scale aimed at the development of a process for reducing thorium nitrate to thorium metal. This work, too, is being brought to an orderly conclusion, including a final report, in FY-1956.

BUREAU OF MINES

The Bureau of Mines' site at Albany, Oregon concluded during the early part of FY-1956 a program associated with thorium metal quality. We see no need for further work of this sort in the future. However, an interest has recently arisen in obtaining construction materials such as stainless steels containing substances that will make the materials relatively black to neutrons. It is believed that such alloys could be put to good use in fabricating vessels for processes in which criticality must be considered. We plan to make use of the Bureau of Mines' facilities for the preparation of experimental quantities of stainless steels containing varying amounts of substances such as gadolinium and samarium. We recommend that \$10,000 be set aside for this purpose in FY-1957 and \$10,000 in FY-1958.

OAK RIDGE NATIONAL LABORATORY

In FY-1955 ORNL conducted an active program to establish design criteria for a U-235 separations plant for possible installation at Savannah River. This work was brought to a conclusion in FY-1956.

Early in FY-1956 ORNL undertook a cooperative effort with the Savannah River Laboratory to develop in-line analytical instruments for use in the Savannah River separations plants. We consider this arrangement to have particular advantages because ORNL has for some time worked with continuous processing and also has hot semiworks facilities that can be used in testing such instruments. We recommend that this program be continued through FY-1957 and that \$100,000 be provided for this purpose. For your information this program is described in detail in ORNL document CF-55-12-145, copies of which are available at Savannah River.

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INSTRUMENT DEVELOPMENT

Instrument development work in support of the Savannah River Plant must be a continuing effort to meet the requirements imposed by ever-increasing productivity levels in existing plant facilities. Examples of these requirements include the need for more rigorous testing of fuel and target elements prior to irradiation, the need for improved monitoring instruments during reactor operation, and the need for chemical control instruments. We cannot at this time designate any specific AEC laboratory or contractor that might cooperate in this instrument development work, but we recommend that \$100,000 be set aside to cover work of this nature in FY-1958.

KNOLLS ATOMIC POWER LABORATORY

We recommend that \$10,000 be set aside for FY-1957 and an equal amount for FY-1958 to cover consultation and perhaps small-scale laboratory work by KAPL.

BROOKHAVEN NATIONAL LABORATORY

During the past several years BNL has conducted work on the handling of contaminated liquid wastes to provide the Savannah River Plant with information on the characteristics and behavior of the wastes produced by the Purex process. It appears that this work can be essentially completed in the first half of FY-1957 and that a small amount of consultation assistance will be needed during the remainder of FY-1957. BNL estimates that this effort will cost \$50,000. We recommend that the necessary funds be provided to finish this program.

WASTE DISPOSAL

The difficulties and cost associated with the disposal of contaminated wastes at the Savannah River Plant will warrant additional development efforts for the next few years. Although it is expected that the work at BNL will be completed in FY-1957, it is certain that additional problems will arise requiring the cooperation of AEC laboratories. To cover work of this nature we recommend that \$50,000 be provided for FY-1957 and \$100,000 for FY-1958.

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MOUND LABORATORY

At the middle of FY-1956 Mound Laboratory began a fundamental study of the effect of variables in thermal diffusion processes, with particular emphasis on facilities suitable for the separation of hydrogen isotopes. Our specific interest in the Mound program has changed since last December. Our successful operating experience since that time has given us assurance that our facilities are suitable and flexible within foreseeable requirements. Any additional facilities that we think we might need are in an advanced stage. Accordingly we are not recommending allocation of funds to Mound using benefits to SRP as justification. However, we feel that the information being developed under the Mound program would be of particular interest to any new AEC installations using thermal diffusion operations and to any currently operating thermal diffusion processes that might be experiencing difficulties.

AEC COMPUTER

We recommend that funds be set aside to cover the use of AEC computers at various sites during FY-1957 and FY-1958. We suggest \$10,000 a year as a reasonable sum.

ATOMIC ENERGY DIVISION

H. W.
Hood Worthington, Director
Technical Division

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SUMMARY

<u>Item</u>	<u>Estimated Cost</u>	
	<u>FY-1957</u>	<u>FY-1958</u>
Nuclear Metals, Inc.	\$ 500,000	\$ 400,000
Plate Manufacture	200,000	200,000
Tube Manufacture	500,000	400,000
Beta Treatment	20,000	20,000
Zirconium Fabrication	50,000	150,000
Zirconium Purchase	30,000	90,000
Improved Elements	100,000	200,000
Sylvania (Powder Metallurgy)	0	0
Sylvania (Thorium Reduction	0	0
Horizons, Inc.	0	0
Bureau of Mines	10,000	10,000
ORNL	100,000	0
Instrument Development	0	100,000
KAPL	10,000	10,000
BNL	50,000	0
Waste Disposal	50,000	100,000
Mound Laboratory	--	0
AEC Computer	10,000	10,000
	<u>\$1,630,000</u>	<u>\$1,690,000</u>

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