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SANDIA CORPORATION
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ALAN POPE
DIRECTOR OF AERO PROJECTS

September 8, 1967

Mr. Glen A. Newby
Assistant Director
Space Electric Power Office, SNS
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Glen:

Re: Po-210 Fuel Form Research and Development at Battelle Pacific Northwest Laboratory (U)

Early in July of this year Sandia Corporation, through Werner Kern, requested a presentation by Battelle Pacific Northwest Laboratory on their efforts in Po-210 fuel form development. At that time, we offered to present our opinions of this effort specifically directed to both Systems and Safety on the SNAP 29.

On July 20, 1967, R. K. Robinson and K. R. Sump, Battelle Northwest Laboratory, visited Sandia Corporation. They gave a verbal presentation of their work in the development of the encapsulated hollow microsphere. It is the consensus of those present that this concept holds great promise toward the development of an improved polonium fuel form utilizing the present fuel compound.

However, we feel the final utility of this fuel form concept is dependent upon further development and studies which include the following:

1. The development and application of an antioxidation coating to the fueled microsphere. The coating must be compatible with the tungsten and tantalum encapsulation material and prevent the oxidation of these materials when the microsphere is exposed to oxidizing environments at 900°C or higher temperatures.

Since each encapsulated microsphere is a containment vessel for a microquantity of fuel, it is necessary in this concept that the strength member (tungsten) and the compatibility coating (tantalum) remain intact to prevent the exposure of

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the fuel to the atmosphere. However, since tungsten and tantalum are both easily oxidized at high temperatures, a nonporous, nonfrangible antioxidation coating is necessary.

2. The development of techniques to deposit controlled thicknesses of tantalum rather than tungsten as the primary substrate.

Battelle has demonstrated that hollow microspheres of tungsten can be made, and they have deposited gadolinium telluride on the surface of these microspheres. However, the fuel compound is reported to be incompatible with tungsten while it is compatible with tantalum. Therefore it would be most advantageous to have a hollow tantalum microsphere as the substrate for the fuel compound.

3. The development of techniques for controlled deposition of the fuel over the microsphere surfaces, whether stepwise by co-deposition or as the compound. Scale-up of this process is a necessity. While small scale production of microspheres could be tolerated, the short half-life of polonium requires that the process of applying the fuel and the subsequent microencapsulation techniques be applicable to bulk quantities of microspheres.
4. Successful conclusion to studies which:
 - a. relate the structural strength of the primary substrate and finished microsphere to various coating thicknesses;
 - b. provide physical properties of the completed spheres and matrix, i.e., heat capacity and thermal conductivity; and
 - c. determine the extent of chemical or physical interaction of the materials at high temperatures.

We feel that the Battelle concept holds more promise for the application of polonium to aerospace systems than any of the other advanced fuel form work presently under way of which we are aware. We strongly recommend that Battelle Pacific Northwest Laboratory be funded in order to actively pursue this concept. The funding and effort should be sufficient so that an RTG system utilizing the fuel form could be demonstrated on or before December 1969, in essence, adhering to the present SNAP 29 development schedule. In view of the numerous commitments of Mound Laboratories in the nuclear fuels program, it is our opinion that Battelle Pacific Northwest Laboratory should be directed and funded to perform the development work with the radioactive material.

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Subsequent to arriving at the above conclusions, we received a copy of the Battelle Pacific Northwest Laboratory Schedule 189 Proposal from your office (J. A. Powers). We are in full agreement with the proposed work; however, as noted above, we would prefer a greater effort through FY 69 so that the ultimate application would be demonstrable by the end of the second quarter of FY 70.

Yours very truly,

Alan

A. Y. Pope

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