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DATE: January 24, 1957

SUBJECT: Compatibility of Zirconium and Uranium Oxide

TO: Power Reactor Fuels Processing Committee

FROM: E. S. Bomar

Classification Cancelled

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Date SEP 07 1971

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Single rereview of CCRP-declassified documents was authorized by DOE Office of Declassification memo of August 22, 1994.

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INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

January 24, 1957

TO: Power Reactor Fuels Processing Committee

SUBJECT: Compatibility of Zirconium and Uranium Oxide

At the December 14, 1956 meeting of the PRFP Committee, R. E. Blanco reported a Canadian visitor had recently stated that some sort of accident had occurred in handling a prototype PWR fuel element. The possibility that this accident may have occurred as a result of an attempt to carry out a dissolution step made the incident of special interest to the PRFP Program. The following people were contacted in the course of trying to determine whether or not the statement about an accident was true.

12/17/56 Members of the Metallurgy Division at ORNL were questioned for information on this accident. No one had heard of it.

Called W. J. Herford, Manager of Manufacture, Nuclear Core Department, Westinghouse, Bettis Field.

Mr. Herford referred my call to Dr. Benjamin Lustman. Dr. Lustman stated that the only difficulties encountered with the Zr-UO_2 system were associated with fabrication steps and were mechanical rather than chemical.

Called A. J. Taylor, Ceramics Section of Metallurgy Division, ORNL.

Mr. Taylor had not heard of an accident, but suggested checking the most recent volume of Resumé of Uranium Oxide Data, VIII, December 3, 1956 (WAPD-PWR-P44-904). This report gave the results of examinations of sections of Zircaloy-clad UO_2 which had been irradiated in the Chalk River Reactor. In some of the samples, the temperature reached by the UO_2 was sufficient to cause melting of the inner portions of the UO_2 . The description of the specimens mentioned a reaction at the interior surface for only one of the samples. The product was assumed to be ZrO_2 and it was located about one-half inch from a blister failure in the Zircaloy tube. The hydrogen content of the Zircaloy rose from an unirradiated value of 17-25 ppm to an irradiated value of 6800 ppm.

A report of Battelle's work on the "Kinetics of Zirconium-Uranium Dioxide Reactions" was also presented in this report. Reactions between the two materials for the temperature range 950° to 1600°

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being studied. Successive layers were cut from a zirconium sample at the surface held in contact with UO_2 for 495 hr at $450^\circ F$. The uranium concentrations reach a maximum value of 32 wt.% at a distance of 3.5 mils from the interface. EMI-1023 also contains information on this study.

Called Dr. D. F. Cope of the Oak Ridge Atomic Energy Commission.

Dr. Cope had no knowledge of the subject accident, but said he would call E. E. Sinclair, who is the American liaison officer with the Canadians.

1/14/57 Called Dr. Cope to inquire about the outcome of his talk with Mr. Sinclair.

Mr. Sinclair had contacted several of the Canadians, but found no information on the subject.

1/16/57 Called the office of Daniel F. Hayes, Chief, Safety and Fire Protection, Division of Organization and Personnel.

Mr. Hayes was not in. The call was transferred to Mr. R. B. Smith of the same division. Mr. Smith was not able to shed any light on the subject.

1/22/57 Called Frank Kerze, Jr., Chief, Chemical Engineering, Division of Reactor Development.

Mr. Kerze's office has also failed to hear about any sort of accident involving the system zirconium-uranium dioxide.

Original signed by
E. S. Bomar

E. S. Bomar
Metallurgy Division

ESB:mv

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