Westinghouse Electric Corporation

Water Reactor Divisions

Nuclear Technology Division

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February 5, 1980

NS-RAW-005

Mr. Dennis Ziemann, Chief
Operating Reactor Branch #2
Division of Operating Reactors
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Docket No. 50-244, R. E. Ginna Nuclear Power Plant

REF: Rochester Gas and Electric Company Application for Withholding, White to Ziemann, February 1980

Dear Mr. Ziemann:

The proprietary material for which withholding is being requested by Rochester Gas and Electric Company (RGE) is of the same technical type as that proprietary material previously submitted in connection with an NRC Staff reload review. The previous application for withholding, AW-76-31, was accompanied by a non-proprietary affidavit signed by the owner of the proprietary information, Westinghouse Electric Corporation. The subject proprietary material is being submitted in support of the reload review associated with RGE's R. E. Ginna Nuclear Power Plant, Cycle 10.

On March 2, 1977, Westinghouse submitted a proprietary affidavit to supplement the non-proprietary affidavit accompanying application for withholding AW-76-31. Because the reload review material associated with Cycle 10 is of the same technical type as that associated with WCAP-9272, the proprietary affidavit submitted to supplement the previous justification is equally applicable to this material.

Accordingly, this letter authorizes the utilization of the previously furnished affidavits in support of the reload review associated with RGE's R. E. Ginna Nuclear Power Plant, Cycle 10.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavits should reference CAW-80-08, and should be addressed to the undersigned.

Very truly yours,

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Regulatory & Legislative Affairs

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cc: J. A. Cooke, Esq. (NRC)
L. D. White (RGE)

Attachment B

Response to Question 6 on Mixed Oxide Fuel
(Proprietary)

6. The staff SER on Mixed Oxide Fuel states that use of UO_2 densification models for MOX should be verified.(1) Since it appears that this assumption was used for the MOX fuel for Ginna, please verify this assumption. Does the predicted amount of densification satisfy Reg. Guide 1.126.

The current Westinghouse UO_2 fuel densification model was used to predict the densification performance of the MO_x fuels fabricated for Ginna. This empirical model, which was derived using only UO_2 performance data, uses fuel sintering temperature and sintered density to predict the extent of densification. The application of the model to MO_x fuel is justified on two bases; the similarity in procedure used in fabrication of MO_x fuel to UO_2 procedures and the ability to conservatively predict the performance of previously irradiated MO_x fuels.

While studying the densification of pure UO_2, the relative dimensional stability of fuel was found to be strongly dependent on the pelletizing process employed and the values of key processing parameters. The processes used in pellet fabrication for Ginna are essentially identical with those used in preparing MO_x fuel previously irradiated by Westinghouse whose performance is conservatively predicted by the UO_2 model. Further, the pelletizing processes used for preparing the Ginna MO_x fuel is very similar to that used by Westinghouse to produce UO_2 fuel. The limiting processing parameters, sintering temperature and final pellet density, were controlled to a range which produces UO_2 fuel with predicted performance within design requirements.

The Westinghouse experience with MO_x densification performance during irradiation has been reported and compared with model predictions in WCAP-8349-P. Theoretically, MO_x densification would be expected to proceed at a lower rate than in UO_2 since pore removal is directly related to local fission events. Densification or pore removal is a bulk process and in UO_2 fuel the fission events are fairly uniformly distributed in the material and the product densifies uniformly. However, in MO_x the fission events are concentrated in or very near to PuO_2 particles which are free to densify independently of the UO_2 matrix. The low enrichment UO_2 matrix experiences a lower frequency of fission events than normal enriched UO_2 fuel at similar burnup and should show a lower amount of densification. The Westinghouse

experience with densification of MO_x fuel operated in a commercial power reactor is compared with predicted values in Figure 1 which is taken from WCAP-8349-P. The Figure also contains data for the performance of a UO_2 fuel with similar fabrication characteristics for direct comparison. Figure 1 contains data for both mechanically mixed and "mastermixed" fuel. Mastermixed fuel is prepared by co-precipitating UO_2 and PuO_2, then mixing the Co-precipitated material with UO_2.

The UO_2 model is a best estimate model and hence there should be as many points with densification under predicted as overpredicted. This is obviously not the case for either the UO_2 or MO_x fuel with the densification being generally overpredicted. Significantly, the prediction of the model was noticeably more conservative for the MO_x fuel than for the UO_2 with similar processing history. As shown in Figure 1, the prediction for master mixed MO_x was less conservative than for mechanically mixed MO_x. This is as expected and further illustrates the lower densification expected from fuel with inhomogenously distributed fission events.

The performance of an MO_x fuel of higher PuO_2 content which was operated in the Saxton test reactor was also reported in WCAP-8349-P. This fuel, which operated at higher temperatures than commercial power reactors, was also found to densify less than predicted by the model.

The predictive capability of the UO_2 model was further tested by evaluating the performance of the MO_x fuel in the EPRI MO_x densification program. These fuels were prepared by a wide variation in processing variables and hence represent a range of conditions greater than was present in data on which the model was based. The performance of the EPRI fuels as reported in EPRI NP-637 are compared with model predictions in Figure 2. The data in Figure 2 indicate the model is essentially conservative for all fuels shown, even those unstable fuels prepared by procedures dissimilar to those for fuel on whose performance the model is based. For the stable fuels, those which densified $\leq$ 2 volume percent, the model is highly conservative in that it greatly overpredicts the densification. The Ginna MO_x fuel is projected to behave stably; all currently manufactured Westinghouse UO_2 fuels are also projected to show stable behavior.

Reg. Guide 1.126 does not indicate a maximum amount of densification allowable but, rather defines the amount of densification that must be assumed based on a thermal resintering test. Design must account for the amount of densification assumed from the resinter test. Thermal resinter data is not available for the Ginna MO_x fuel so an alternate method must be chosen to predict the densification performance; the method used was the Westinghouse UO_2 model. The accuracy of this model can be compared to the predictions from the thermal resinter model in Reg. Guide 1.126.

The basis for establishing the relative abilities of the two models to predict performance was established by use of the EPRI data. The predicted performance using the thermal resintering model is compared with actual performance in Figure 3. Examination of data in Figure 3 indicates the resinter model significantly overpredicts the amount of densification, especially in the region of stable fuels ($\leq$ 2 volume percent densification) where the overprediction is as much as 2.5 percent. Comparison of Figures 2 and 3 indicates the relative predictive abilities of the two models. The comparison shows the two models are very similar, both models being generally conservative. The degree of conservatism is found to be greater in the region of stable fuels. Similar numbers of data points are slightly under-predicted by the two models, however, the Westinghouse model is both more consistent and more conservative in the less than 2 percent densification range which is representative of the Ginna MO_x fuel.

The data presented demonstrate that the Westinghouse UO_2 fuel densification model yields predictions similar to and more reliably conservative for MO_x fuel than the resinter model in Reg. Guide 1.126.

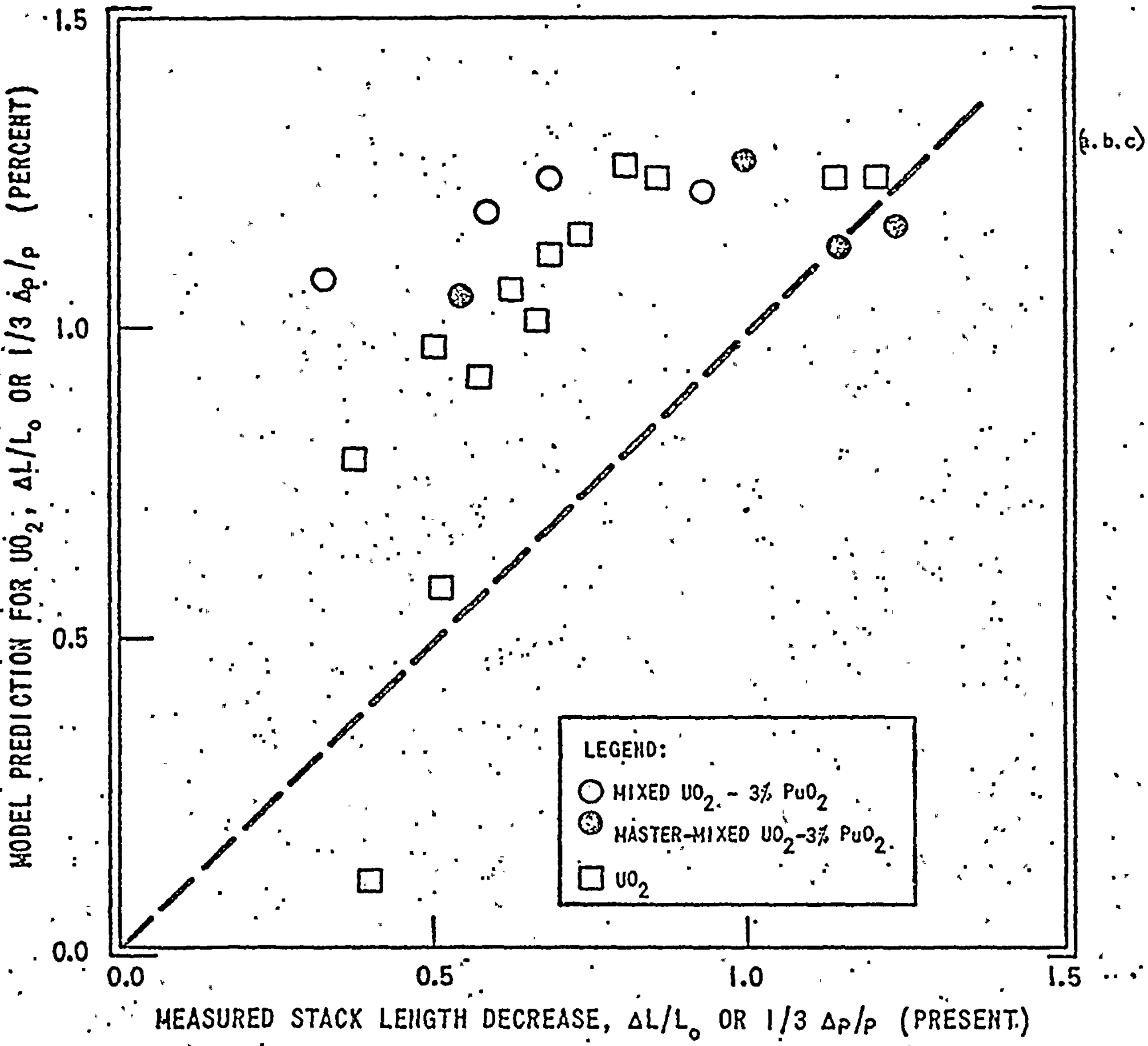

Figure 1. Comparison of Densification Data for UO_2-3% PuO_2 with UO_2 Both Fabricated under Similar Conditions to a Density of Approximately 91% T.D.

Figure 2. Westinghouse UO_2 Model Prediction of Densification of EPRI MO_x Fuels

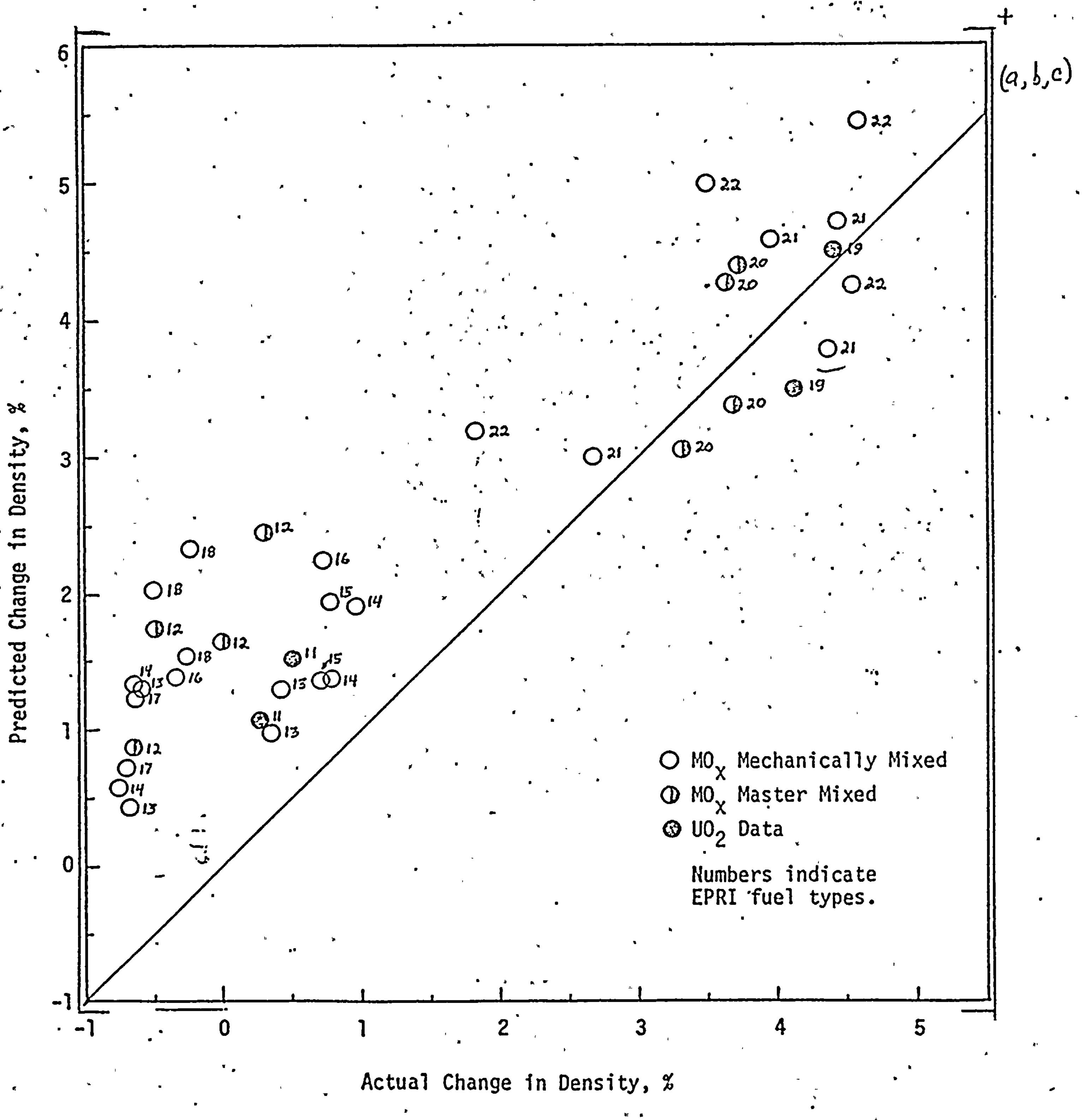

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Figure 3. Reg. Guide Prediction of EPRI MO_x Data