Douglas R. Gipson
Senior Vice President
Nuclear Generation

Detroit Edison

Fermi 2
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Newport, Michigan 48166
(313) 586-5249

October 23, 1996
NRC-96-0120

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks," dated June 26, 1996

Subject: Detroit Edison Response to NRC Generic Letter 96-04

Enclosed is Detroit Edison's response to Generic Letter 96-04 as requested in Reference 2 above. Specific responses follow each of the questions in the enclosure to this letter. The following commitments are made in this letter:

1. Detroit Edison will use the RACKLIFE computer code to model the Fermi 2 racks.

2. Fuel storage in cells with inverted Boraflex elements has been suspended pending completion of a satisfactory analysis for the effects of potential gaps considering their as-built condition.

3. To augment the existing coupon surveillance program, Detroit Edison will monitor rack exposure and pool silica to identify signs of degradation of Boraflex.

4. Test results from other plants with similar racks will also be considered with the ongoing monitoring of the Fermi 2 racks.

If you have any questions, please contact Joseph Conen at (313) 586-1960.

Sincerely,

Enclosure

cc: A. B. Beach
M. J. Jordan
A. J. Kugler
A. Vegel

I, DOUGLAS R. GIPSON, do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

DOUGLAS R. GIPSON
Senior Vice President

On this 23rd day of October, 1996 before me personally appeared Douglas R. Gipson, being first duly sworn and says that he executed the foregoing as his free act and deed.

Rosalie A. Armetta
Notary Public

ROSALIE A. ARMETTA
NOTARY PUBLIC - MONROE COUNTY, MI
MY COMMISSION EXPIRES 10/11/99

RESPONSE TO NRC GENERIC LETTER 96-04
"BORAFLEX DEGRADATION IN SPENT FUEL POOL STORAGE RACKS"

Provide an assessment of the physical condition of the Boraflex, including any deterioration, on the basis of current accumulated gamma exposure and possible water ingress to the Boraflex and state whether a subcritical margin of 5% can be maintained for the racks in unborated water. Monitoring programs or calculational models in effect or being developed, or an estimation of anticipated concerns based on the specific rack design, are considered an appropriate basis for this response.

The fuel storage rack design used at Fermi 2 has a low water exchange rate. The Joseph Oat High Density Fuel Storage Racks at Fermi 2 are made up of a series of elements known as "Cruciforms", "Ells" and "Tees." These elements are manufactured using angular and straight sub-elements. A cavity for the Boraflex is created by using end strips of stainless steel to form a "picture frame" between adjacent cells. Strips are welded along the long edge of the elements, as well as the bottom and top edges. Because these are not seal welded edges, the Boraflex is in contact with pool water that seeps into the panel cavities. The elements are welded together to form an "egg crate" structure which ultimately provides the storage cells for the fuel assemblies.

The coupon testing program to date has shown the coupons to be in good overall condition. Coupons removed from the pool in March of 1994 (prior to Fermi's fourth refueling outage) indicate a shrinkage of approximately 2.2% on the average specimen tree which received approximately 2.3E9 rads. Data from coupons whose dose was accelerated indicates approximately 3.2% shrinkage with a corresponding exposure of approximately 4.9E9 rads. No significant thinning was observed, and there is no indication of significant boron carbide loss or loss of integrity of the polymer matrix. Detroit Edison estimates the average dose to all irradiated panels in the fuel pool to be 2.05E9 rads with the peak dose to be 6.6E9 rads. Therefore, these results are considered to represent the condition of the Boraflex in the racks reasonably well, although the coupons may be more susceptible to water ingress effects due to their smaller size.

A blackness test was performed in 1992 which revealed some small gaps in the Boraflex. The details of this test are discussed subsequently in this response. A criticality analysis was performed based on the gap data measured in the blackness test. The calculations show that the racks as originally designed had substantial margin to the 0.95 k_{eff} limit. The calculations also showed that significant gap effects can be accommodated within this margin to the 0.95 k_{eff} limit.

Because silica has been observed in spent fuel pool water samples, it is possible that a low rate of Boraflex dissolution is occurring. Because the observed silica levels remain low and the irradiated coupons do not show significant degradation, it is concluded that dissolution is not causing significant degradation of the Boraflex. Therefore, based upon all of these factors, Detroit Edison concludes that the 5% subcritical margin can be maintained in the Fermi 2 racks.

Submit a description of any proposed actions to monitor or confirm that this 5% subcriticality margin can be maintained for the lifetime of the storage racks and describe what corrective actions could be taken in the event it cannot be maintained.

Detroit Edison will continue to perform coupon testing in accordance with our established coupon testing program schedule. In addition, Detroit Edison will use the RACKLIFE computer code developed for EPRI to model our racks. RACKLIFE calculates exposure to each of the Boraflex rack panels using actual fuel data. Based on this exposure data, the configuration of the Boraflex in the rack, and pool geometry and silica data, RACKLIFE estimates the extent to which Boraflex panels in the racks are deteriorating due to water ingress. Detroit Edison intends to remain involved with industry efforts working to address the problems associated with Boraflex. Detroit Edison plans to continue its membership in the EPRI Boraflex User's Group through the end of 1997. Membership in this working group will give Detroit Edison access to tests, measurements, and any other Boraflex related data that may arise in the industry.

Should it be determined that 5% subcriticality margin cannot be maintained within the existing analysis assumptions, additional margin can generally be obtained by refining the criticality analysis. In addition, burnup credit for highly exposed fuel and administrative controls (e.g., checkerboarding of fuel in the racks) could be considered if localized problems develop. Finally, various poison insert products are becoming available and may be suitable to provide additional reactivity margin.

Describe the results from any previous post operational blackness tests and state whether blackness testing, or any other in-situ tests or measurements, will be periodically performed.

A post operational blackness test was performed at Fermi in 1992. Fast scan tests were performed on a total of 306 cells (1203 different panels). The fast scan is primarily used to detect the presence of gaps. The cells for fast scan testing were selected to assure that a large number of panels with relatively high integrated gamma exposures were tested. When the blackness test was performed, Fermi had completed 2 refueling outages. In both outages, the core had been fully offloaded. The fuel

going back into the core was generally placed in the same cells for both refueling outages. In Fermi's third and fourth refueling outages, full core offloads were again performed, but in both cases the fuel going back to the core was placed in different racks than those used during the first 2 refueling outages. Gamma exposure to the panels that were tested was estimated to have been between 1.7E8 to a maximum of 2.9E9 rads.

Of 1203 panels tested, 424 (35.2%) had 1 or more gaps. Of the 424 panels identified as having 1 or more gaps by the fast scan test, 70 were selected for slow scan testing. The slow scan is used to actually measure the gap size. Of the 70 panels tested, 66 panels were found to have 1 gap, 4 panels were found to have 2 gaps. Eleven panels were found to have a cumulative gap size of 0-1 inch. Forty seven panels were found to have a cumulative gap size of 1-2 inches. Twelve panels were found to have a cumulative gap size of 2-3 inches. The largest single gap was 2.65 inches. A criticality analysis was performed based on the gap data. The calculations showed that the gap effects could be accommodated within the original margin to the 0.95 k_{eff} limit even assuming that all panels in the racks eventually develop a gap of 4 inches. However, this analysis did not account for a previous reactivity penalty associated with 8 cells which had been found to be improperly assembled. Three Boraflex rack subassemblies affecting 8 fuel storage cells were installed upside-down, resulting in an approximate 13 inch vertical offset for the Boraflex in those subassemblies. A specific analysis was performed when this was discovered during plant construction, and the racks were accepted because the reactivity effect did not impact the 0.95 k_{eff} limit. The use of these cells for fuel storage has been suspended pending completion of a satisfactory analysis for the effects of potential gaps considering their actual as-built configuration.

Detroit Edison has no plans to perform periodic blackness testing at this time. However, Detroit Edison plans to continue the coupon surveillance program and augment it by monitoring rack exposure and pool silica to identify signs of degradation of the Boraflex. Also, Detroit Edison has access to in-situ test data from other plants through the EPRI Boraflex Users' Group. Test results from other plants having similar rack designs will also be considered. In-situ testing may be performed if warranted based on the evaluation of these factors.

Provide chronological trends of pool reactive silica levels, along with the timing of significant events such as refuelings, pool silica cleanups, etc. Implications of how these pool silica levels relate to Boraflex performance should be described.

Silica data are attached. The increasing trend of silica after refueling outages suggests that some dissolution may be occurring. However, the relatively low silica level is consistent with the coupon surveillance and blackness test results (which don't reveal

any major degradation). This performance is also consistent with a low water exchange rack design and the estimated exposure seen by the racks.

Taking all of this into consideration Detroit Edison concludes that dissolution is not causing significant degradation of the Boraflex.

FUEL POOL INLET SiO2

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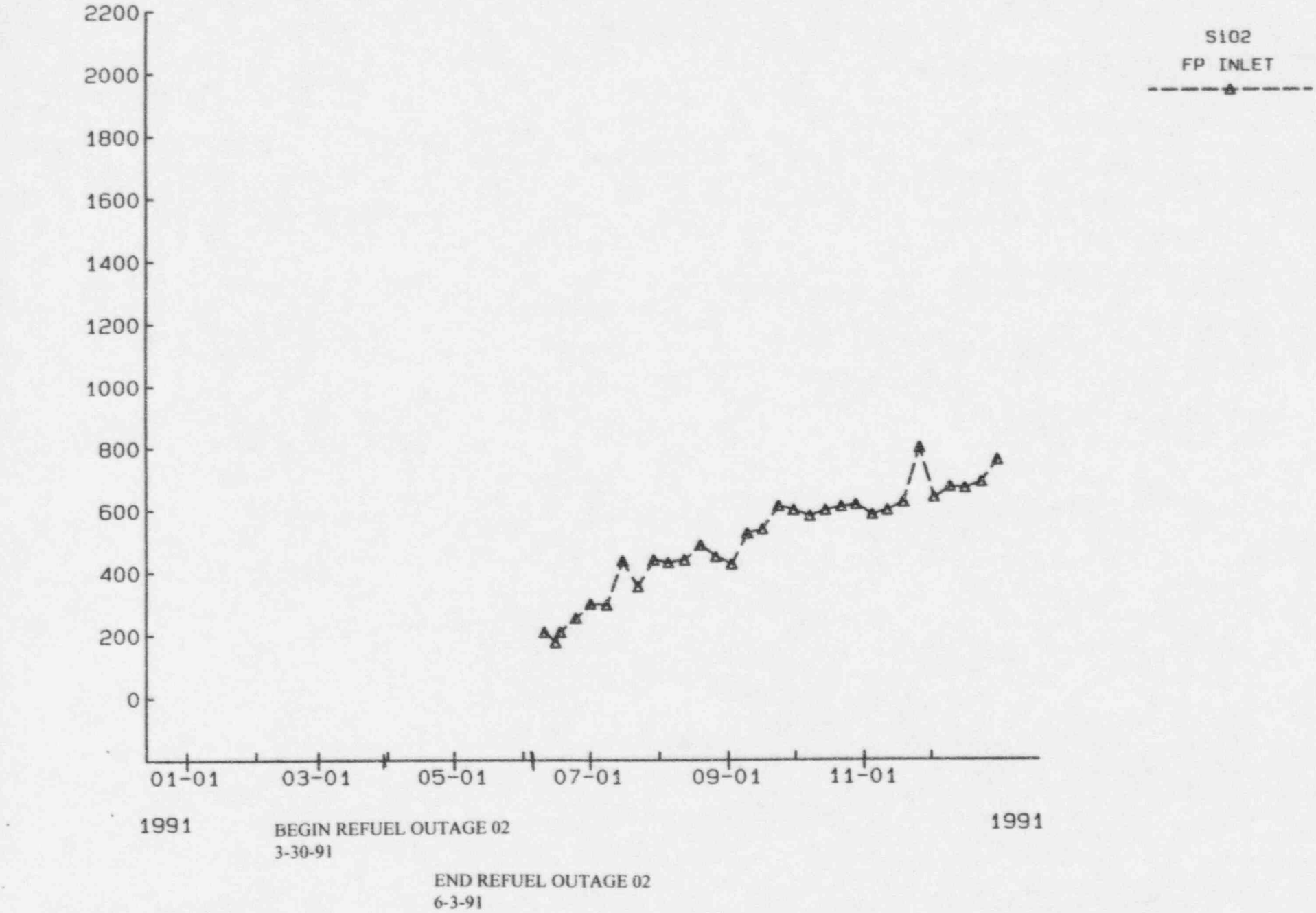
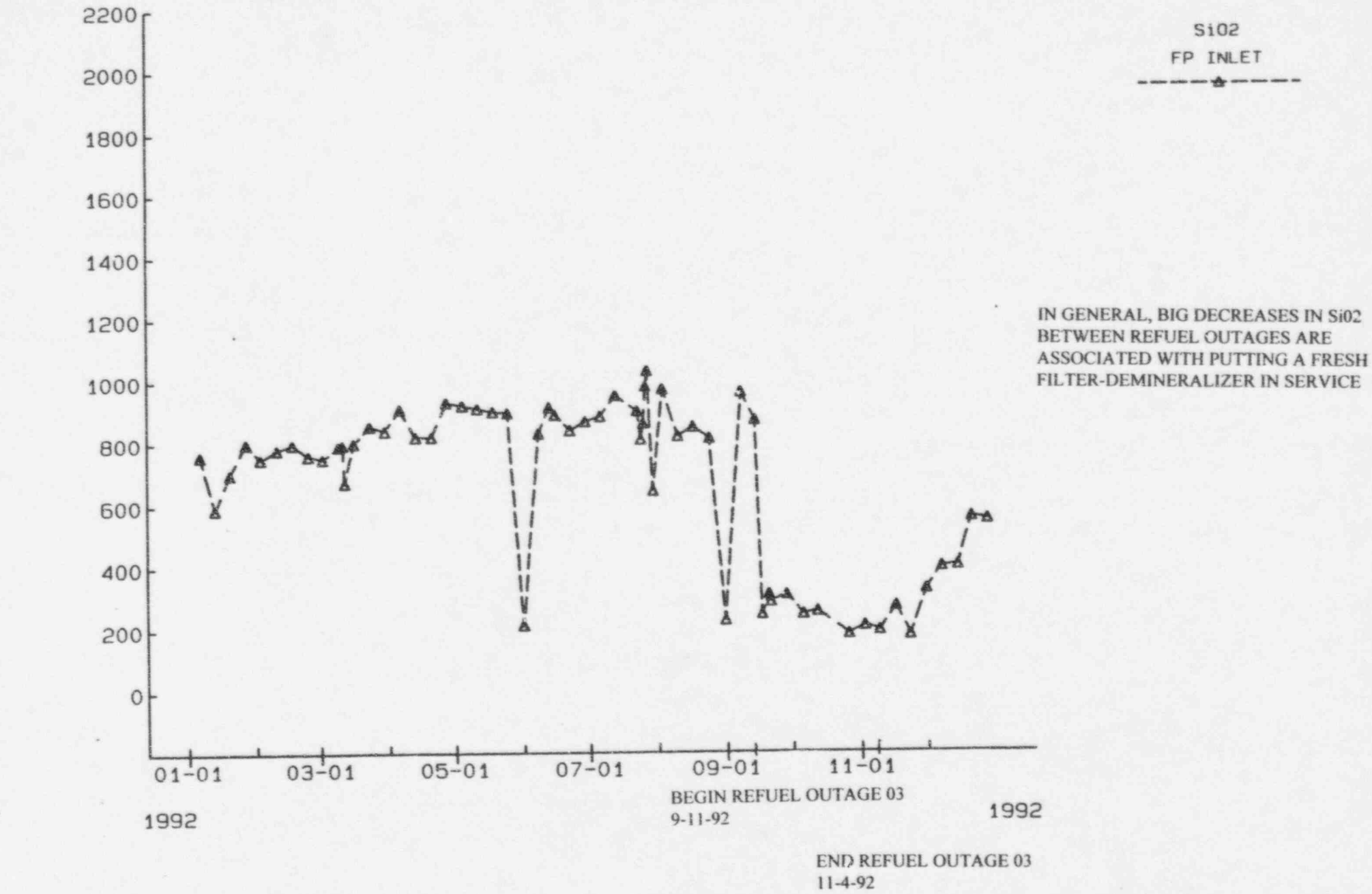
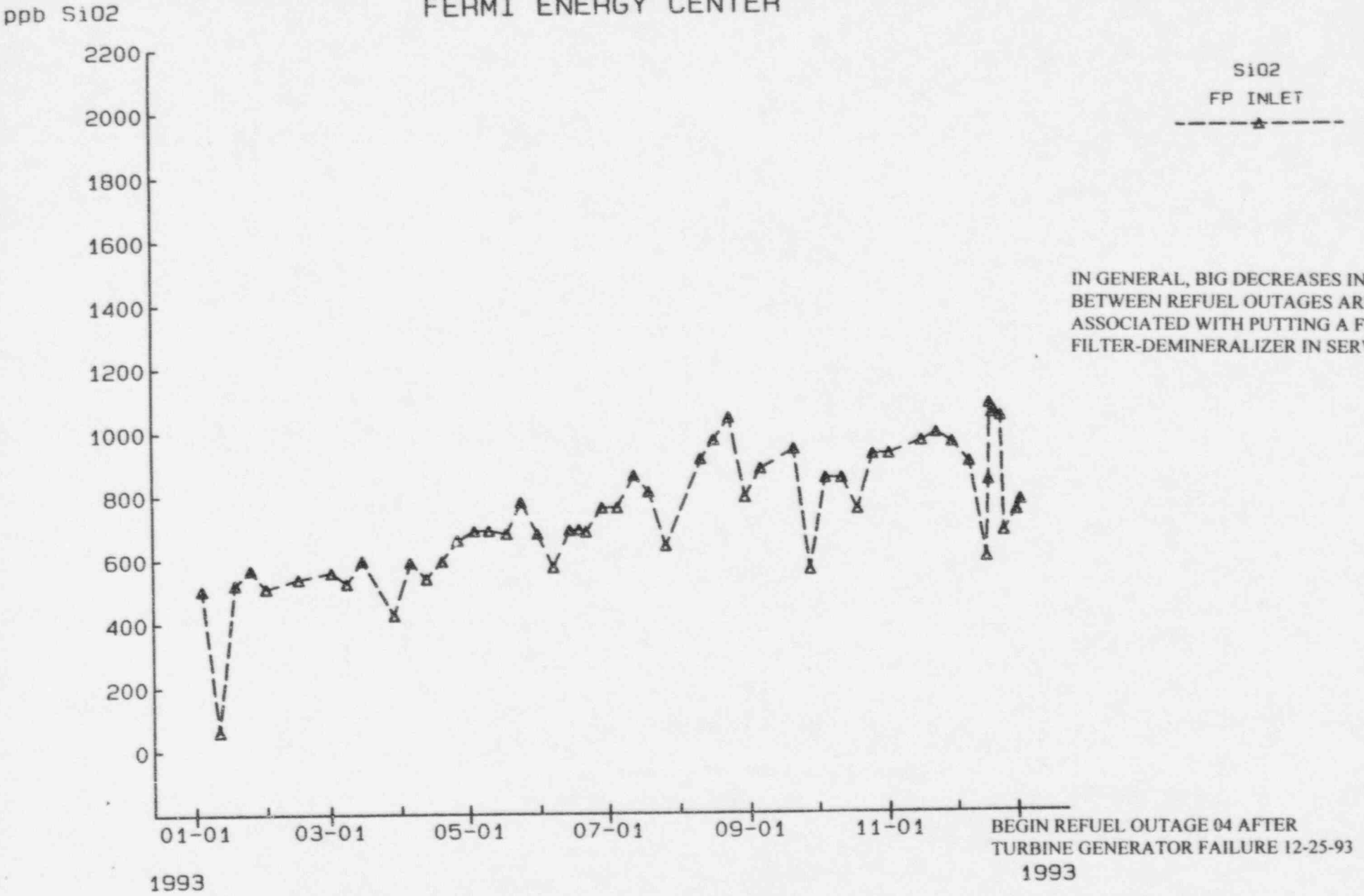


FUEL POOL INLET SiO2
FERMI ENERGY CENTER



IN GENERAL, BIG DECREASES IN Si02 BETWEEN REFUEL OUTAGES ARE ASSOCIATED WITH PUTTING A FRESH FILTER-DEMINERALIZER IN SERVICE

FUEL POOL INLET SiO2
FERMI ENERGY CENTER



FUEL POOL INLET SiO2

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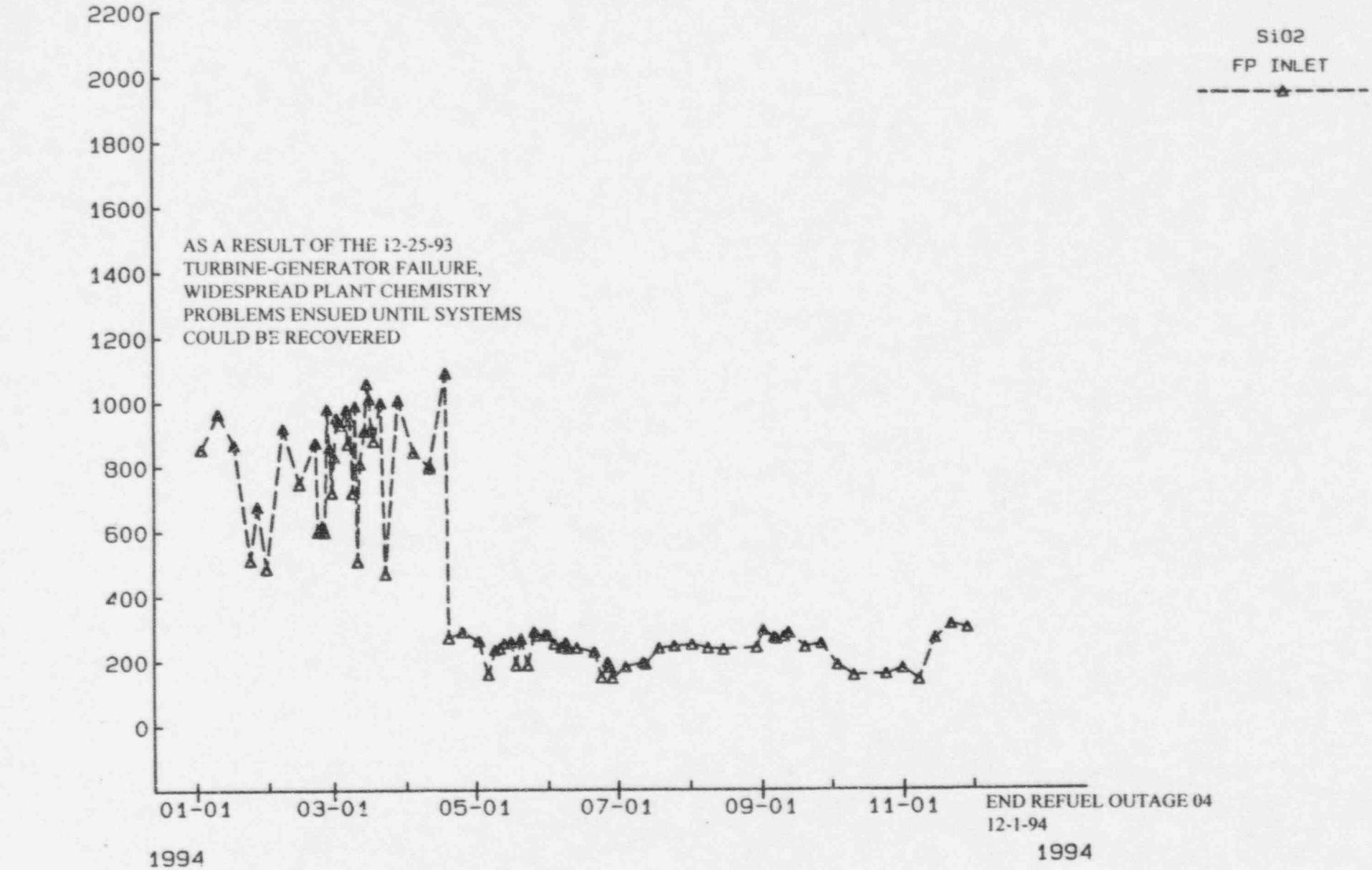

FUEL POOL INLET SiO2

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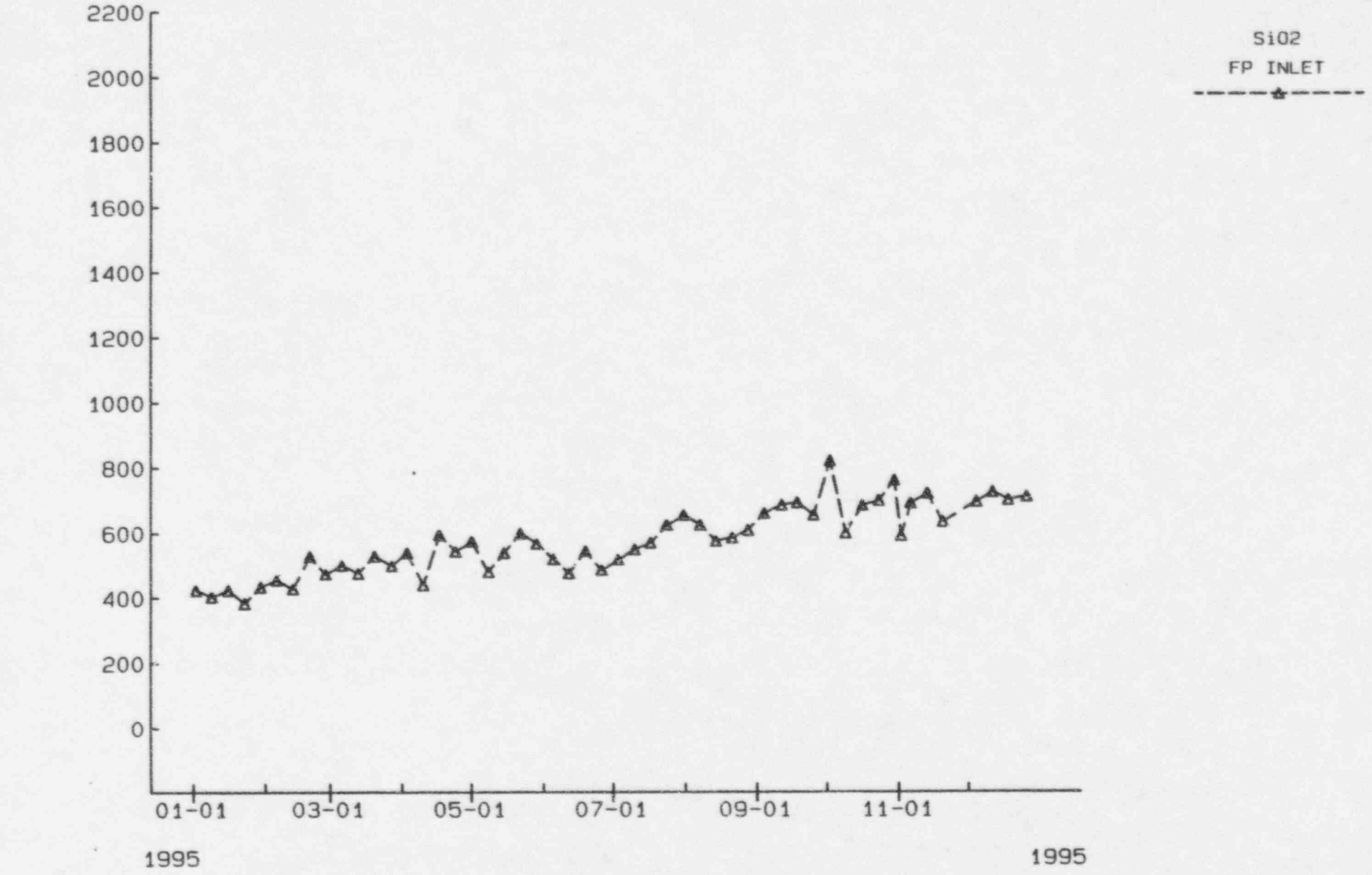

FUEL POOL INLET SiO2
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