William S. Orser
Senior Vice President

Detroit Edison

Fermi 2
6400 North Dixie Highway
Newport, Michigan 48166
(313) 586-5201

Nuclear Operations

January 31, 1992
NRC-92-0015

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) Detroit Edison Letter, NRC-91-0102, "Proposed License Amendment - Uprated Power Operation," dated September 24, 1991

Subject: Condensed Significant Hazards Consideration Assessment for the Proposed Fermi 2 Power Uprate License Amendment

A condensed, non-proprietary version of Detroit Edison's assessment of the 10CFR50.92 Significant Hazards Consideration has been prepared, as requested, for the proposed power uprate license amendment for Fermi 2 (Reference 2). A copy of this condensed, non-proprietary assessment is enclosed.

If you have any questions regarding this submittal, please contact Mr. Robert J. Salmon at (313) 586-4273.

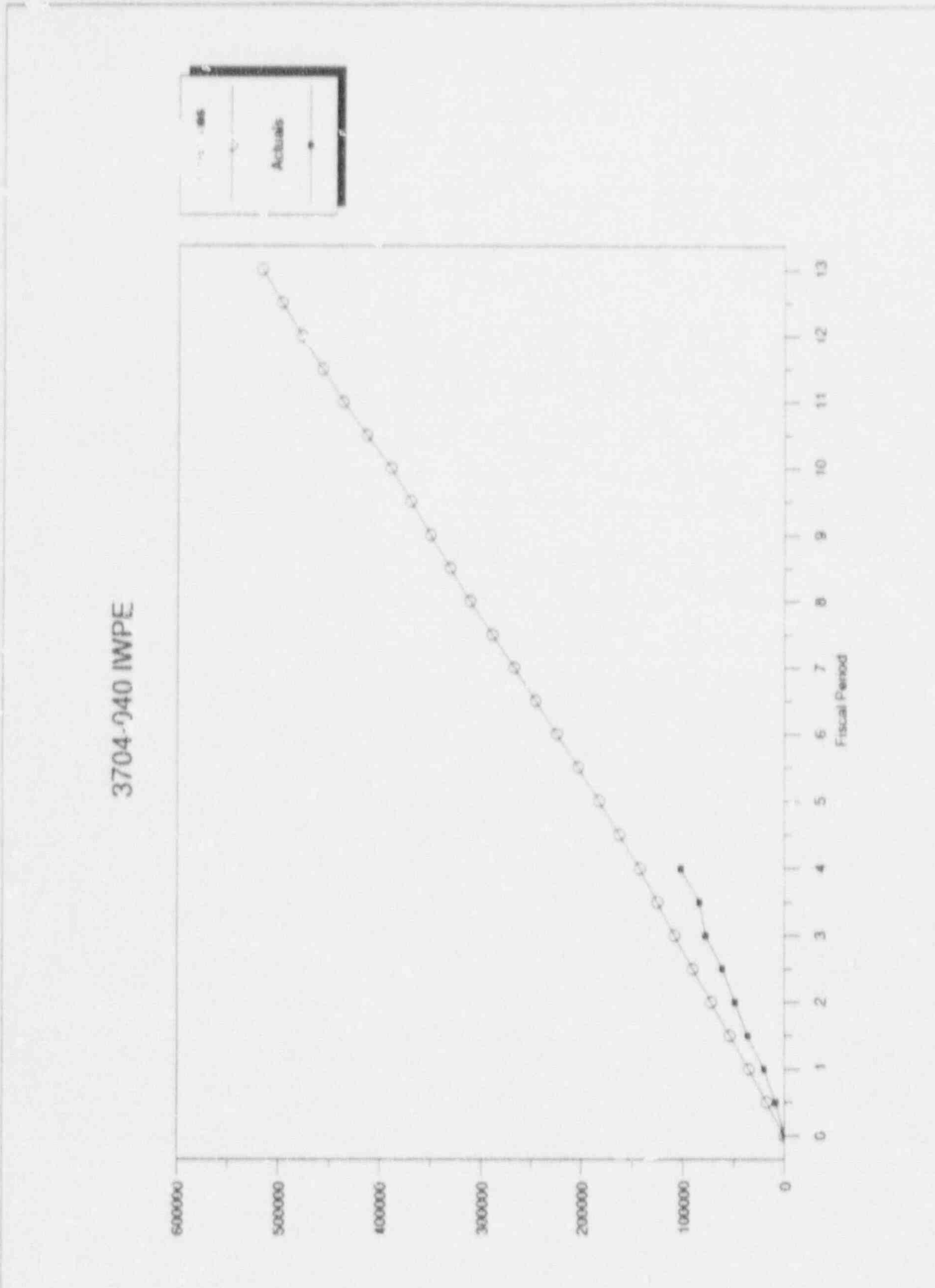
Sincerely,

Enclosure

cc: T. G. Colburn
A. B. Davis
R. W. DeFayette
S. Stasek
R. J. Stransky
Supervisor, Electric Operators, Michigan
Public Service Commission - J. R. Padgett

030163

A001 1/1


3704-040 IWPE
600000
500000
400000
300000
200000
100000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Fiscal Period
Actuals

I, WILLIAM S. ORSER, 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.

William S. Orser

WILLIAM S. ORSER
Senior Vice President

On this 31st day of January, 1992, before me personally appeared William S. Orser, being first duly sworn and says that he executed the foregoing as his free act and deed.

Rosalie A. Arnetta

Notary Public

ROSALIE A. ARNETTA
NOTARY PUBLIC STATE OF MICHIGAN
MONROE COUNTY
MY COMMISSION EXP. NOV. 20,1995

3704-050 STOCH MODELING Elemen* Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	15050	15901	15018	14945	14763	15888	14988	15672	17473	17643	17380	16949	17691	60914
ACT. PERIOD COST	8807	12026	10381	11861	0	0	0	0	0	0	0	0	0	43074
VARIANCE, $	6244	3876	4638	3083	0	0	0	0	0	0	0	0	0	17840
VARIANCE, %	41.5	24.4	30.9	20.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.3
EST. FY CUMUL	15050	30951	45970	60914	75677	91568	106554	122228	139698	157342	174722	191[illegible]	209362	
ACTUAL FY CUMUL	8807	20832	31213	43074	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.042	0.100	0.149	0.206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	6244	101?9	14757	[illegible]140	0	0	0	0	0	0	0	0	0	
VARIANCE, %	41.5	3?.7	32.1	29.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1991 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

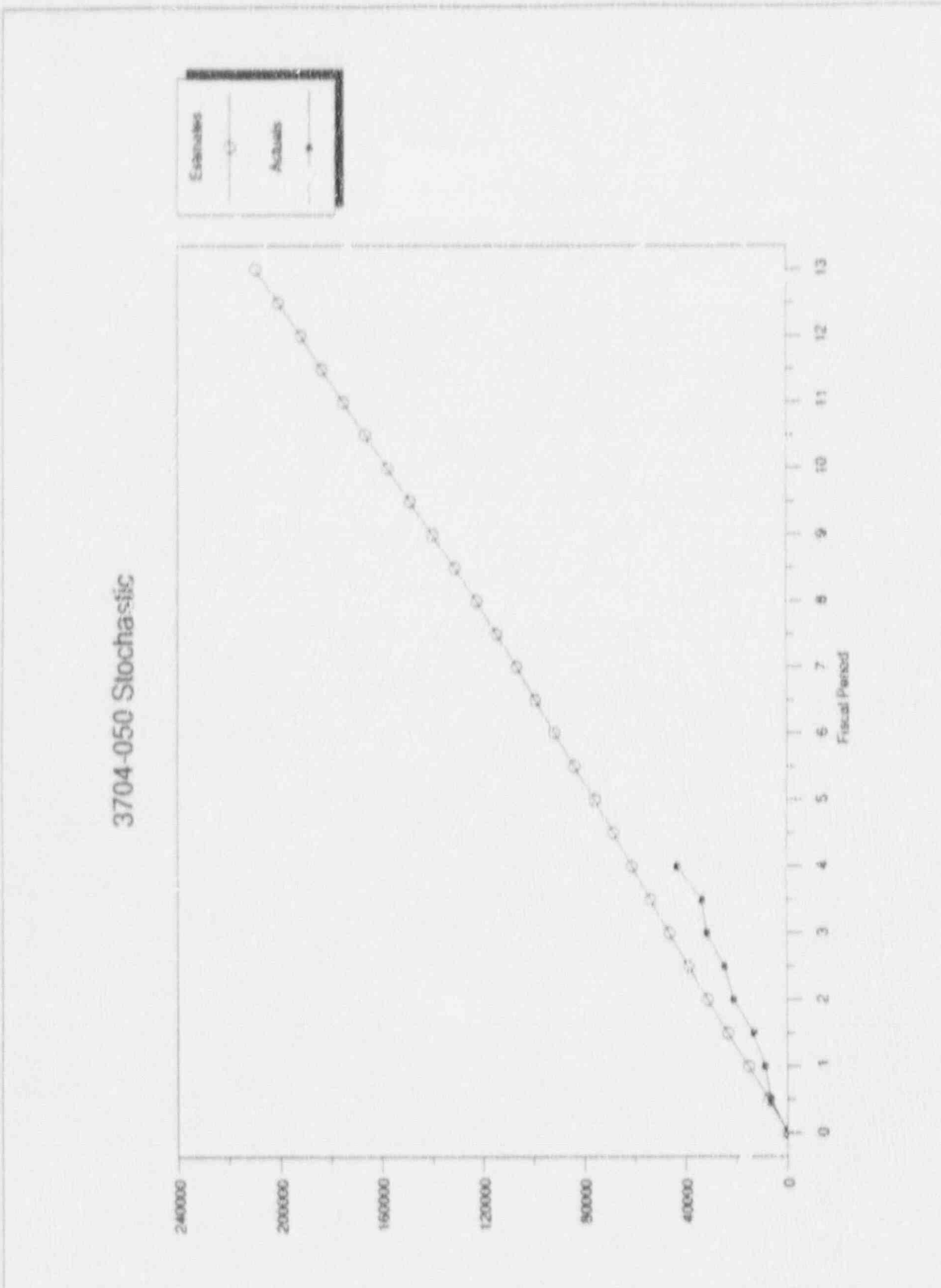
SIGNIFICANT HAZARDS CONSIDERATION ASSESSMENT

Fermi 2 is currently licensed at 3293 MWt (100% power). The original safety analyses were based on the reactor operating continuously at a power level at least 1.02 times the licensed power level. The uprated power level requested in this application is 3430 MWt, approximately 104.2% with 105% steam flow. Several of the original analyses have already been performed and reviewed by the NRC at 104.2% power, including the overpressurization analysis, emergency core cooling systems (ECCS) and design basis accident (DBA) loss of coolant accidents (LOCAs). A 2% power uncertainty factor has been included in the initial conditions used for the analyses at uprated power level. Therefore, the plant has been reanalyzed at a power level of at least 1.02 times the uprated power rating. The means for achieving higher power is to expand the power/flow map by increasing core flow along existing flow control lines. However, there will not be an increase in the maximum recirculation flow limit over the pre-uprate value. Uprated operation will also involve slightly higher reactor vessel dome pressure to provide adequate inlet pressure conditions at the turbine, accounting for the larger pressure drop through the steamlines at higher flow, and providing sufficient pressure control and turbine flow capability.

No change is required in the basic fuel design to achieve the uprated power levels or to meet the plant licensing limits. The fuel operating limits such as maximum average planar linear heat generation rate (MAPLHGR) and operating limit minimum critical power ratio (MCPR) will still be met at the uprated power level. Reload analyses will continue to meet the criteria accepted by the NRC. The margins prescribed by the Code of Federal Regulations are maintained by meeting the appropriate regulatory criteria. NRC accepted computer codes and calculational techniques are used to make the calculations that demonstrate meeting the stipulated criteria. Similarly, margin specified by application of the American Society of Mechanical Engineers (ASME) design rules has been maintained, as have other margin-assuring criteria used to judge the acceptability of the plant.

The effects of power uprate on postulated plant transients have been evaluated by investigating a number of disturbances of process variables and malfunctions or failures of equipment according to a scheme of postulating initiating events. These events were evaluated using NRC-approved methods and have been shown to meet the required acceptance criteria. The operating limit MCPR is increased appropriately to insure that the licensing safety margins are maintained.

For BWR licensing evaluations, capability is demonstrated for coping with the full spectrum of hypothetical pipe break sizes including the recirculation, steam, feedwater, ECCS, and instrument lines. This break spectrum concept analytically investigates the full spectrum of large and small, high and low energy line breaks and the success of the plant systems in dealing with them while accommodating a single active equipment failure in addition to the postulated LOCA. Several of the most significant licensing assessments are made using these LOCA design criteria, including challenges to fuel, challenges to the containment, and design basis accident radiological consequences. The results of these


3704-050 Stochastic
240000
200000
160000
120000
80000
40000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Fiscal Period
Estimates
Actuals

assessments remain well within the established regulatory acceptance criteria, therefore the safety margins established by those limits are maintained.

Uprate analyses use fuel designed to present NRC-approved criteria and operated within present NRC-approved limits to produce more heat in the reactor which slightly increases reactor pressure and increases steam flow to the turbine. NRC-approved design duty cycle criteria are used to assure mechanical performance at uprate. Design basis accidents are hypothesized to assess challenges to the fuel, containment, and offsite dose limits. These challenges are evaluated separately in accordance with conservative regulatory procedures such that the separate effects are more severe than any combined effects. The offsite dose evaluation specified by Regulatory Guide 1.3 and Standard Review Plan section 15.6.5 provides a more severe DBA radiological consequences scenario than the combined effects of the hypothetical LOCA which produces the greatest challenge to the fuel and/or containment. That is, the DBA which produces the highest PCT and/or containment pressure does not fail large amounts of fuel and thus the source term and doses are much smaller than those calculated in the Regulatory Guide 1.3 evaluation.

All non-LOCA radiological releases discussed in the Standard Review Plan are either unchanged because they are not power dependent, or increase at most by the amount of the uprate. The radiological assessments presented in the updated safety analysis report (USAR) were run at 3430 MWt. A new set of analyses have been performed at 3430 MWt plus 2% uncertainty or 3499 Mwt. The assessment for these events at uprated power plus 2%, had the calculations been done using the same methodology and assumptions, would be only a 2% increase in the calculated dose. The dose consequences for all of the non-LOCA radiological release accident events are bounded by the design basis radiological consequences events.

Balance of plant (BOP) systems/equipment used to perform safety-related and normal operating functions have been reviewed for uprate in a manner comparable to that for safety-related nuclear steam supply system (NSSS) systems/equipment. This includes, but is not necessarily limited to all or portions of the main steam, feedwater, turbine, condenser, condensate, essential and non-essential service water, emergency diesel generator, BOP piping, and support systems. Significant groups/types of BOP equipment/systems are justified for uprate by generic evaluations. Plant unique evaluations justify power uprate operation for BOP systems/equipment that are not generically justified.

Technical Specification changes have been proposed which are consistent with and justified by the safety analyses performed. The safety analyses show that the results are acceptable and within regulatory limits.

Assessment Against 10CFR50.92 Criteria

For this significant hazards consideration assessment, the criteria of 10CFR50.92 were applied to power uprate. The conclusions are based on the safety evaluations described in the licensing report, and are summarized as appropriate for the following safety

3704-060 GEOCHEMICAL ANALOGS Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	28006	28663	27970	24272	26319	28466	28091	29292	28443	28194	28765	28382	28197	112211
ACT. PERIOD COST	37625	45691	24536	14875	0	0	0	0	0	0	0	0	0	122727
VARIANCE, $	-9619	-17027	3433	13397	0	0	0	0	0	0	0	0	0	-9816
VARIANCE, %	-34.3	-59.4	12.3	-7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8.7
EST. FY CUMUL	28006	56669	84638	112911	141230	169695	197787	226079	254522	282717	310882	339264	367450	
ACTUAL FY CUMUL	37625	83315	107851	122727	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.102	0.227	0.294	0.334	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-9619	-26646	-23213	-9816	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-34.3	-47.0	-27.4	-6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1991 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

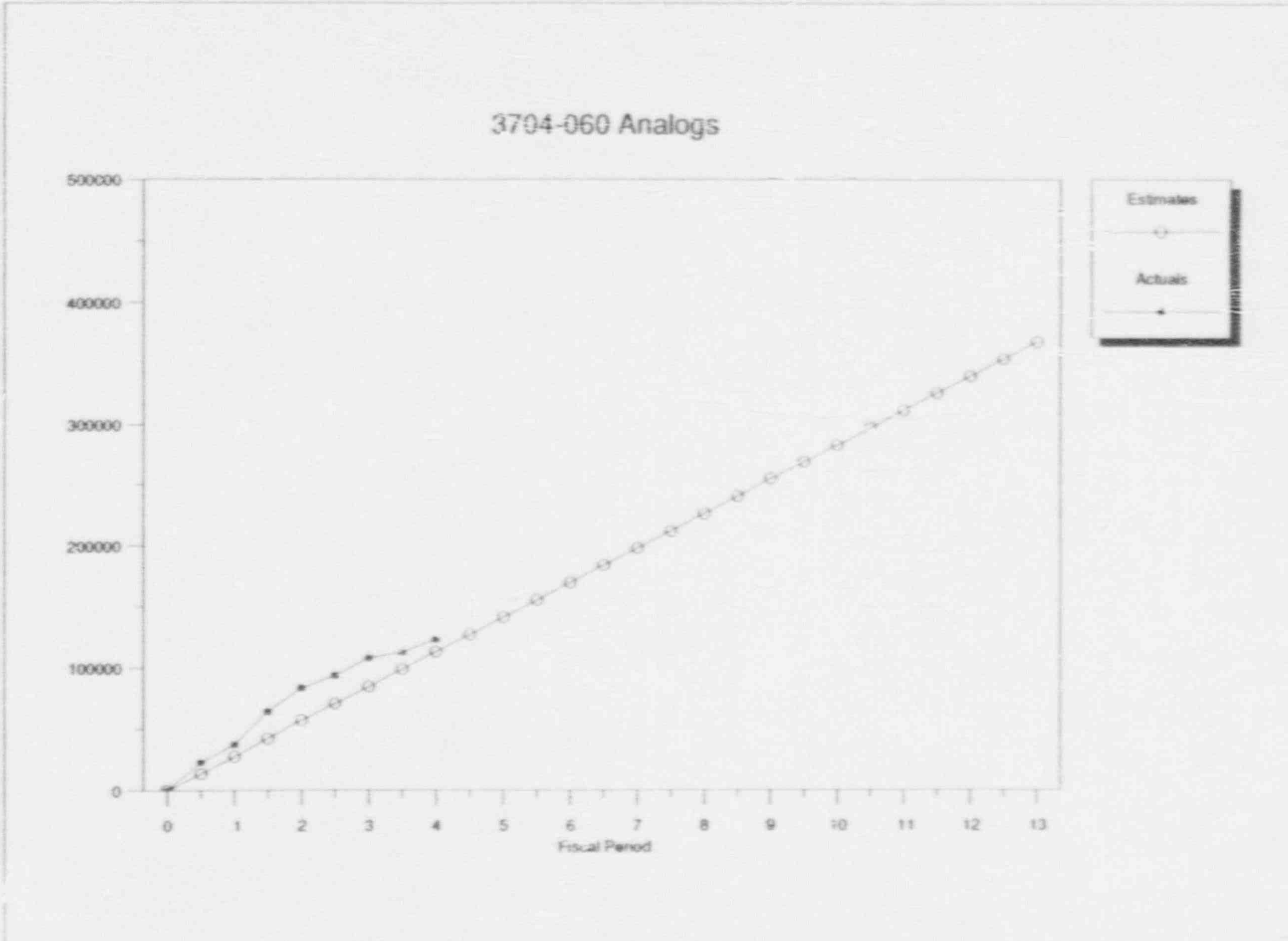
considerations in accordance with 10CFR50.92.

(1) **Will the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

Uprated power operation is achieved primarily by increasing core flow slightly along existing flow control lines to achieve a five percent increase in the steamflow to the turbine/generator. The maximum allowable reactor recirculation flowrate remains unchanged. The increased flowrate is well within the capabilities of the feedwater system which supplies the additional feedwater needed due to the increased steamflow. A slight increase in reactor pressure maintains turbine control valve controllability at the increased steamflows. Safety relief valve and power, pressure, and flow related instrumentation trip setpoints are increased slightly to accommodate uprated power operation and to maintain approximately the same level of trip avoidance and safety system challenges as before uprated power operation.

The plant is operated in the same manner at uprated power as it is at the currently licensed power level. That is the methods and sequences of operation are unchanged. Emergency operating procedure steps remain the same with only minor changes to timing required. Since the level of trip avoidance and safety system challenges remains approximately the same, the frequency of operational responses to those events is not increased. Reactor fuel operating limits designed to protect the fuel cladding are maintained and provide the same level of protection as before uprated power operation. Fuel reload analyses performed subsequent to power uprate will continue to meet current acceptance criteria. Operation at 3430 MWt is consistent with the original plant design capability and thus will not significantly increase any failure probabilities. All of the original equipment design or regulatory criteria established for plant equipment (ASME code, IEEE standards, NEMA standards, etc.) are still imposed and met for operation at the uprated power level. Furthermore, a review of the plant's individual plant examination (IPE) which uses probabilistic risk analysis (PRA) methods determined that the IPE would be minimally affected. A comprehensive review was performed on the effects of increased power and pressure conditions on the reactor vessel and internals, reactor connected piping, balance of plant piping, primary containment, and related systems and components. These reviews and associated analyses show continued compliance with the original design and licensing criteria.

The consequences of the spectrum of hypothetical accidents and transients have also been investigated and meet the same regulatory criteria after uprate as before uprate. Selected original plant transients that were run at rated power plus 2% were rerun at uprated power plus 2% with no change in consequence (i.e., no fuel failure). Sufficient operating limit minimum critical power ratio will be maintained to ensure that the safety limit minimum critical power ratio is not exceeded during uprated power operation thus providing the same level of protection as previously provided. All of the analyses with postulated radiological consequences and the


3704-060 Analogs
500000
400000
300000
200000
100000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Fiscal Period
Estimates
Actuals

overpressurization analysis were originally performed using 3430 MWt and were reviewed by the NRC. The overpressurization analysis was reperformed at uprated power plus 2% uncertainty using the increased operating dome pressure and safety relief valve setpoints. At uprated conditions a slightly higher peak reactor vessel pressure results, but remains well below the 1375 psig ASME code limit.

The radiological consequences of several design basis accidents including the DBA/LOCA and main steam line break (MSLB) accidents were recalculated at 3430 MWt plus 2% uncertainty or 3499 MWt. When compared on a consistent basis, calculated offsite doses increase proportionately to reactor power since the radiological source term is directly proportional to reactor power and since the meteorology factors remain the same. Because the original analyses were performed at 3430 MWt, power uprate analyses would show an increased dose rate of 2% due to the additional 2% uncertainty factor, when compared on a consistent basis. The recalculated doses for Fermi 2 are not comparable to previous calculations since the NRC approved methodology and assumptions used have undergone revision. The new radiological calculations, however, remain well within the 10CFR100 limitations. These calculations would be 2% higher than the original calculations due to the addition of the 2% uncertainty factor if the original calculations had been performed on the same basis as the new (improved) calculations. The 2% increase in dose associated with the uncertainty factor does not constitute a significant increase in the consequences of an accident.

Thus, the increase in power level discussed herein and associated Technical Specification changes do not significantly increase the probability (frequency of occurrence) or consequences of an accident previously evaluated.

(2) **Will the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

The full spectrum of accident considerations defined in Regulatory Guide 1.70 has been reviewed and no new or different kind of accident has been identified. Power uprate uses already developed technology and applies it within the capabilities of existing plant equipment in accordance with presently existing regulatory criteria including NRC-approved codes, standards, and methods. GE has designed BWRs of higher power levels than the uprated power of any of the currently operating BWRs, and no new power dependent accidents have been identified. In addition, Fermi 2 was originally designed to the proposed uprated steam flow (105%) and all of the accident analyses with postulated radiological consequences were performed at that condition. The plant systems have been assessed and have been verified to be adequately designed and capable of performing their design intent at uprated operating conditions. Only minor changes to plant systems are required to effect uprated power operation. Also, as discussed in the response to question 1 above, methods of plant operation at uprated power are virtually the same as before power uprate. Since there are no significant changes to the plant equipment or methods

3704-070 SORPTION MECHANISMS Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	13733	14421	14264	27808	36734	36503	37029	36544	36664	36649	36955	36810	36576	70226
ACT. PERIOD COST	26210	36022	18568	17017	0	0	0	0	0	0	0	0	0	97816
VARIANCE, $	-12477	21600	-4304	10791	0	0	0	0	0	0	0	0	0	-27591
VARIANCE, %	-90.9	-149.8	-30.2	38.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-39.3
EST. FY CUMUL	13733	28154	42418	70226	106960	143463	180492	2170[illegible]	253701	290350	327305	364115	400691	
ACTUAL FY CUMUL	26210	62232	80800	97816	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.065	0.155	0.202	0.244	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-12477	-34076	-38382	-27591	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-90.5	-121.0	[illegible]	-39.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

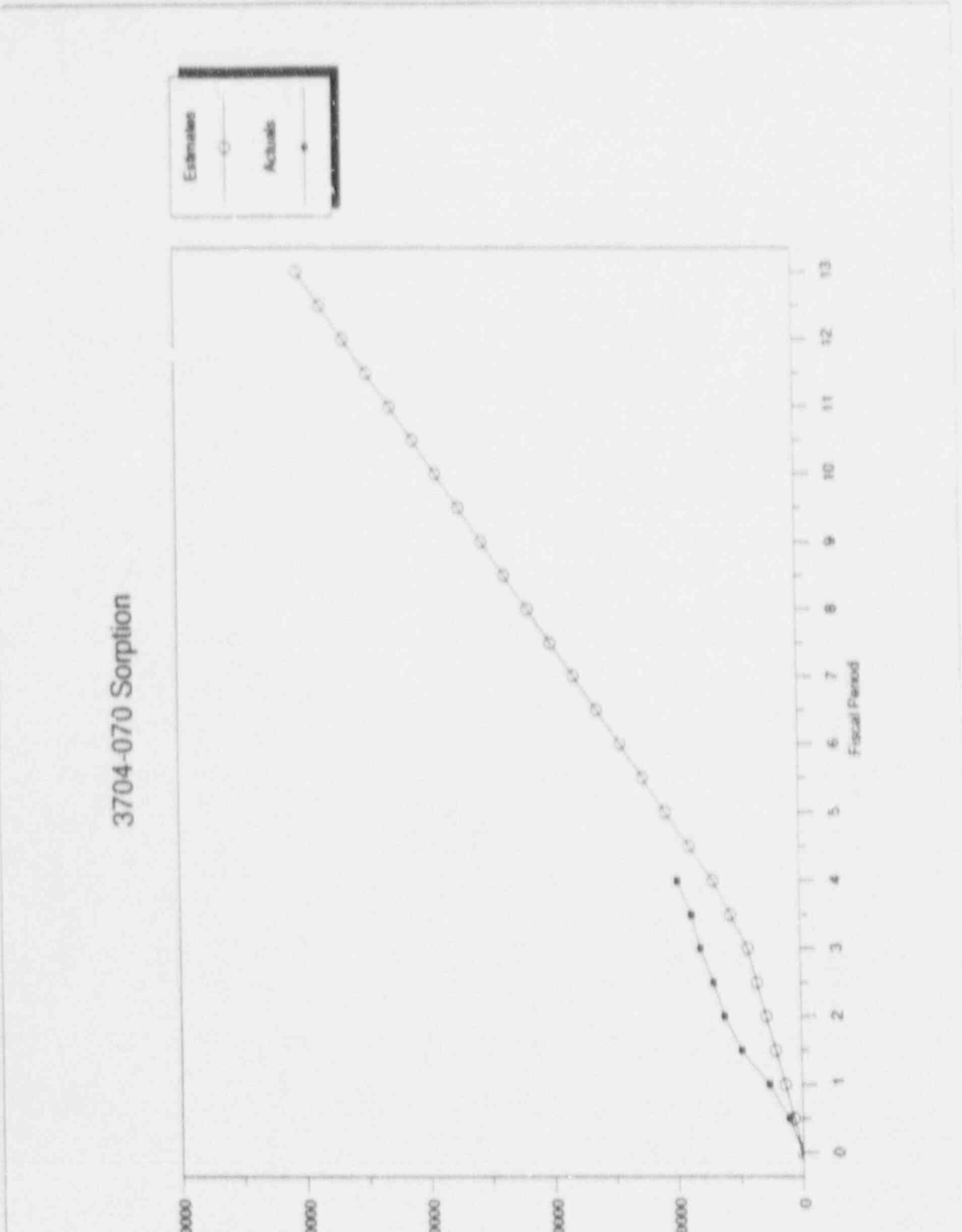
NOTES:
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1991 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

and sequences of operation, no new accident scenarios are created. Therefore, this change will not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) **Will the change involve a significant reduction in a margin of safety?**

The plant was originally designed for operation at 3430 MWt. As previously discussed, no change is required in fuel design or safety limits. The MAPLHGR limit remains the same. The operating limit MCPR is increased appropriately to ensure that the same safety margin is maintained. Only minor changes to plant equipment are required to accommodate power uprate and the methods and sequences of operation are essentially unchanged. The entire plant design has been reviewed to ensure that plant equipment will perform properly and will still meet original design and licensing criteria. Although, as discussed herein, some analyses produce results somewhat closer to the related acceptance criteria, results remain within those criteria. The safety margins prescribed by the Code of Federal Regulations have been maintained by meeting the appropriate regulatory criteria. Similarly, the margins provided by the application of the ASME design acceptance criteria have been maintained where applicable, as well as other margin-assuring acceptance criteria used to judge the acceptability of the plant. Several accident and transient analyses have been reperformed at uprated plant operating conditions consistent with the requested Technical Specification changes with the most significant ones discussed below.

All of the accidents with postulated radiological consequences and the overpressurization analysis were originally performed at 3430 MWt. The overpressurization analysis was reperformed at uprated power plus 2% uncertainty using the increased operating dome pressure and safety relief valve setpoints. At uprated conditions a slightly higher peak reactor vessel pressure results, but remains well below the 1375 psig ASME code limit. The radiological doses of several design basis accidents including the DBA/LOCA and MSLB accidents were recalculated at 3430 MWt plus 2% uncertainty factor added for conservatism. When compared on a consistent basis, calculated offsite doses increase proportionately to reactor power since the radiological source term is directly proportional to reactor power and since the meteorology factors remain the same. Because the original analyses were performed at 3430 MWt, power uprate analyses would show an increased dose rate of 2% due to the additional 2% uncertainty factor when compared on a consistent basis. The recalculated doses are not comparable on a consistent basis to previous calculations since the NRC-approved methodology and assumptions used have undergone revision. However, it has been demonstrated that the recalculated doses remain well within the acceptance criteria of 10CFR100. Dose calculations would be 2% higher than the original calculations due to the addition of the 2% uncertainty factor if the original calculations had been performed on the same basis as the new (improved) calculations. The 2% increase in dose associated with the uncertainty factor does not constitute a significant reduction in the margin of safety.


3704-070 Sorption
Estimates
Actuals
500000
400000
300000
200000
100000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Fiscal Period

[illegible] 110 PERFORMANCE ASSESSMENT Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	18156	34687	35224	34706	34668	34644	37885	43757	42330	38192	38410	46220	45745	122772
ACT. PERIOD COST	26550	17249	16267	25033	0	0	0	0	0	0	0	0	0	85099
VARIANCE, $	-8395	17438	18957	9673	0	0	0	0	0	0	0	0	0	37673
VARIANCE, %	-46.2	50.3	53.8	27.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7
EST. FY CUMUL	18156	52842	88066	122772	157439	192083	229969	273725	316055	354247	392657	438877	484622	
ACTUAL FY CUMUL	265	43799	60066	85099	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.055	0.090	0.124	0.176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-8395	9043	28000	37673	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-46.2	17.1	31.8	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1991 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.