Edward Hines
Assistant Vice President
Quality Assurance

Detroit Edison

3331 W. Big Beaver Road
Troy, Michigan 48084
(313) 649-7123

August 22, 1979

EF2-46,919

Mr. James G. Keppler
Regional Director
Directorate of Regulatory Operations
Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Mr. Keppler:

Subject: Detroit Edison Response to IE Bulletin No. 79-07

This letter supplements our letter of May 30, 1979 on the same subject. With the attached letter by Edison Engineering and the letters, also attached, from two engineering firms we feel our investigation is complete.

Please advise us if you have any questions regarding this report or our interim report of May 30, 1979, letter number EF2-46,147.

Sincerely yours,

T. A. Alessi
for Edward Hines

EH/TGB/hr

Enclosure

cc: Mr. John G. Davis, Acting Director
Office Inspection and Enforcement
Division of Reactor Inspection Programs
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

AUG 27 1979

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Detroit Edison

ENRICO FERMI UNIT 2 PROJECT
ENGINEERING

August 21, 1979

EF2 - 46224

To: R. W. Barr
Quality Assurance
206 Engineering Construction-Troy

From: F. E. Gregor
Principal Engineer - EF2
318 Engineering Construction-Troy

Subject: Follow-up Report in Response to IE Bulletin 79-07

Following our initial response (EF2 - 45214) to the subject bulletin, we received two outstanding replies from engineering firms that have conducted seismic analysis of safety related piping systems. The responses are as follows:

1. Atomics International Division of Rockwell
Canoga Park, California

   As stated in our memorandum, EF2-45214, AI did not use any of the unacceptable methods identified in the bulletin. A detailed response is attached as Attachment "E."

2. General Electric - I&SE, Oak Brook, Illinois

   The detailed response confirmed our telephone communication that none of the unacceptable methods were used in the analysis of the CRD piping. The GE-I&SE letter is included as Attachment "F."

The above concludes our review and response to NRC Bulletin 79-07.

FEG/dk
Attach.

cc: W. F. Colbert
E. Lusis/L. Bertani
M. G. Sigetich
G. Butterworth
T. G. Byrd
Document Control

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ATTACHMENT E

Atomics International Division
Energy Systems Group
8900 De Soto Avenue
Canoga Park, CA 91304
Telephone: (213) 341-1000
TWX: 910-494-1237
Telex: 181017

Rockwell International

June 27, 1979

In reply refer to 79ESG-6478

Mr. F. E. Gregor
Systems Engineer
Enrico Fermi-2 Project
Detroit Edison Company
2000 Second Avenue
Detroit, Michigan 48226

Reference: Letter EF2-44673 dated May 10, 1979, "Information Request Regarding the Use of Computer Program for Seismic Analysis of Safety Related Piping Systems"

Dear Mr. Gregor:

Subject: Enrico Fermi Hydrogen Recombiner - Information on Use of Computer Program for Seismic Analysis of Safety-Related Piping Systems

In response to the referenced letter, the following answers are provided:

(1) A Response Spectrum Model Analysis was used, but loads were combined as follows:

$$U = \sqrt{\sum_{I=1}^{N} (UI)^2}$$

Where:

U = Response (force, moment, translation, etc.) for a particular degree of freedom

N = Number of modes

UI = /UIXX/+/UIYY/+/UIZZ/

and:

UIXX = Response in I^{th} mode, x earthquake direction, x spectrum input

UIYY = Response in I^{th} mode, y earthquake direction, y spectrum input

UIZZ = Response in I^{th} mode, Z earthquake direction, Z spectrum input

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(2) Computer program listings (using SAP IV) were documented for the Fukushima 4 design in the Fukushima 4 stress report (SR-019-120-003). The same stress report is used for the Fermi-2 recombiner and should already be in the possession of Detroit Edison.

(3) The SAP IV Program has been verified by analysis and the verification report will be mailed by July 16, 1979.

(4) None of the methods mentioned in Item 1 of the referenced letter were used.

Very truly yours,

R. J. Cardenas
Project Manager
BWR Recombiners
Atomics International Division
Energy Systems Group

geg:3/1-2

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, 814 COMMERCE DR., OAK BROOK, ILL. 60521

INSTALLATION AND
SERVICE ENGINEERING
DIVISION

August 7, 1979

cc: D.L. Rybarik

ATTACHMENT =

Mr. F.E. Gregor
System Engineer
Fermi 2 Project
Detroit Edison
2000 Second Avenue
Detroit, MI 48226

SUBJECT: Information Request Regarding the Use of Computer Program for Seismic Analysis of Safety Related Piping Systems.

REFERENCES: Detroit Edison letter EF2-45219, 5/29/79, W.F. Colbert to V.J. Bain.

Dear Mr. Gregor:

Pursuant to your letter on the above Subject, G.E.-I&SE submits the following responses:

Teledyne Engineering Services (TES) performed the seismic analysis of CRD Hydraulic piping for Enrico Fermi Unit 2 and the attached information is intended to assist DECO in responding to USNRC IE-Bulletin 79-07 dated April 14, 1979.

Essentially, TES did not use any of the methods listed in USNRC IE-Bulletin 79-07. The methods used by TES on the Fermi plant are described in Attachment 1.0.

The computer program used on Fermi 2 was ADLPIPE, which is commercially available through CBC. TES cannot send a Fortran listing of the ADLPIPE program since it is proprietary to Arthur D. Little.

A comparison analysis of ADLPIPE and TMRSAP is given in Attachment 2.0. This comparison is done for the method used by TES running earthquake directions separately and combining outside the program.

We hope that this information will assist you and DECO in the preparation of DECO's response. If you have any questions concerning this, please contact the writer.

Sincerely,

V.J. Bain

V.J. Bain
Service Manager-Construction
Central Nuclear Service Operation

VJB:kkk
Attachments

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ATTACHMENT 1.0

TES SEISMIC ANALYSIS METHOD

Piping systems were analyzed for each of three orthogonal component response spectra (two horizontal and one vertical) separately. The representative maximum value of the three moments M_x, M_y, and M_z at any point in the piping system subjected to each of the three independent spatial component response spectra was obtained by taking an SRSS summation of the medal responses for all significant modes of the system. Mathematically, this is expressed as follows:

$$M_j = \left| \sum_{k=1}^{N} M_{j_k}^2 \right|^{1/2} \qquad (1)$$

where M_j is the representative maximum value of moment, j is the moment component direction k, y, or z. M_{j_k} is the peak value of moment component due to the k^{th} mode, and N is the number of significant modes.

The combined effect of the three spatial components of earthquake was determined subsequently by the following procedure. The representative maximum values of the codirectional moments (either M_x, M_y and M_z) from the two horizontal components of earthquake were combined by the SRSS method and this SRSS value then added absolutely to the representative maximum value of the codirection moment for the vertical component of earthquake. Mathematically, this is expressed as

$$\bar{M}_j = \left| (M_j)_X^2 + (M_j)_Z^2 \right|^{1/2} + (M_j)_Y \qquad (2)$$

where $\bar{M}_j$ is the total seismic moment component $\bar{M}_x$, $\bar{M}_y$ or $\bar{M}_z$, $(M_j)_{X,Y,Z}$ are the representative maximum values of codirectional moments (SRSS values) for each of the X, Y, Z earthquake directions, respectively. Since all terms are SRSS values, they all possess a positive sign. This is basically the equation given in the methods reports (References 1 and 2) for the plants in question.

The only alternative to any of the steps described above that TES used in the piping seismic evaluation in some of the plants was a slightly conservative but more expedient method to evaluate stress in Class 2 and 3 piping systems. This alternative consisted of taking the representative maximum values (SRSS of modes) of the M_x, M_y and M_z moments and combining them by the SRSS method to determine the ASME Code resultant moment M_B for each spatial component of earthquake. The total resultant moment $\bar{M}_B$ was then determined by combining the individual resultant moments for each spatial

component of earthquake in a similar manner as described above in Equation 2.

$$\overline{M}_B = |(M_B)_X^2 + (M_B)_Z^2|^{1/2} + (M_B)_Y \qquad (3)$$

Again, all terms on the right side are SRSS values and hence are positive.

One can see from the above procedures that there are no algebraic summations involved which could lead to unconservative results.

ATTACHMENT 2.0

COMPARISON ANALYSIS

Comparison of ADLPIPE and TMRSAP Seismic Stresses for PIPDYN Manual example problem that is also used in SAP IV Manual.

X - Direction Seismic Spectral Loading, B31.1 Stress Summary

Mode Number	Component	Intensification Factor	ADLPIPE Stress, psi	TMRSAP Stress, psi
3	Run	1.00	411	409
3	Elbow	2.00	1122	1146
4	Elbow	2.00	1105	1108
4	Run	1.00	397	395
8	Branch	1.00	896	894
9	Run	1.00	537	537
9	Elbow	2.71	1448	1452