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NS-TMA-2300

September 3, 1980

Mr. James R. Miller
Special Projects Branch
Division of Project Management
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Ref a: NS-TMA-2250, 5/29/80
Anderson (W) to Miller (NRC)

Ref b: Telecon, 7/29/80,
Hartzman (NRC) to Vashi (W)

Attention: Mark Hartzman

Dear Mr. Miller:

Per the referenced telecon on the subject of WECAN verification, Dr. Hartzman requested additional information necessary to continue review of the three benchmark problem solutions submitted by Westinghouse via Reference a. Dr. Hartzman noted that the WECAN results to problem number four showed certain forces in the Y direction to be significantly higher than the results obtained using either WESTDYN (another Westinghouse computer program), or the NRC computer code.

By this letter, Westinghouse is submitting a corrected WECAN solution to problem number four. An explanation of the differences in the two solutions is provided in Attachment A. Summary results for the revised WECAN solution are included in Attachment B. In addition, another WECAN solution to problem four is given in Attachment C for information only. In this solution the masses are lumped in the same manner as in the NRC approved WESTDYN program.

It is expected that this information will be used to assist in the review of WCAP 8929 "Benchmark Problem Solutions Employed for Verification of the WECAN Computer Program," and that NRC approval of this topical report will result in generic approval of the WECAN computer code for response spectrum analysis.

If you have any questions on this material, please do not hestitate to call.

Very truly yours,

for T. M. Anderson, Manager
Nuclear Safety Department

M. A. Haley/keg
Attachment(s)

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X605 1/1
Encl to:
M Hartzman

DISCUSSION OF THE REVISED WECAN SOLUTION FOR NRC BENCHMARK PROBLEM NUMBER FOUR

Internal pressure in the WECAN elbow element is used in determining the elbow flexibility factors as defined in ASME Section III NB-3687.4. The inclusion of other internal pressure effects in the WECAN pipe and elbow elements is accomplished by determining pressure stresses from equilibrium considerations and then converting the stresses into equivalent thermal strains for use in the stiffness equation formulation. The equilibrium stresses are added to the calculated stresses prior to output.

The NRC benchmark problem number four called for a pressure of 2400 psi, so an internal pressure of that magnitude was used in the WECAN run. In addition to the internal pressure effect on elbow flexibility factors, the WECAN run included the other internal pressure effects which should have been bypassed for the response spectrum analysis. This did not affect the frequencies, mode shapes, participation factors, or spectral displacement calculations. Also, it did not affect reaction forces for the standard piping supports which are represented by stiffness matrices (STIF27 elements). However, it did affect the reaction forces for the constrained ends of pipe elements along the axis of the pipes. For example, the reaction force (ten percent method) in the Y direction at WECAN node 14 (NRC node 10) was $.856 \times 10^8$ pounds. The NRC benchmark problem number four has been rerun on WECAN with the internal pressure set to zero and the elbow flexibility factors specified instead of being calculated in the program. In this run, the reaction force (ten percent method) in the Y direction of WECAN node 14 (NRC node 10) is now $.1161 \times 10^7$ pounds. This compares favorably with the corresponding WESTDYN piping end load of $.1166 \times 10^7$ pounds. There is one other type of constrained pipe end in the benchmark problem number four. These are WECAN nodes 26, 28, 48 and 50 (NRC nodes 27, 28, 70 and 71, respectively). For those nodes, the reaction force (ten percent method) in the Y direction of WECAN is now $.369 \times 10^6$ pounds, versus $.297 \times 10^6$ pounds from WESTDYN. These small differences have been determined to be due to variations in mass lumping techniques.

Included for NRC review is Attachment B, summary results for the revised WECAN solution of the NRC benchmark problem number four. Included for information is Attachment C, summary results for a WECAN solution of the NRC benchmark problem number four with the WESTDYN lumped masses. In Attachment C, the WECAN reaction force in the Y direction for the second type of constrained pipe end is $.299 \times 10^6$ pounds versus $.297 \times 10^6$ pounds fron WESTDYN. This demonstrates that the Attachment B result ($.369 \times 10^6$) is different due to differences in mass lumping techniques.