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DRESSER INDUSTRIES

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November 2, 1979

U. S. Nuclear Regulatory Commission
P. O. Box 448
Middletown, PA 17057

Attention: Mr. Jacque Durr

Gentlemen:

Confirming our telephone conversation of this date, we will expect you in our facility on November 15th at 8:30 a.m. to discuss several design aspects of the 31533VX Electromatic Relief Valve.

As I discussed in our telephone conversation, I am enclosing a series of questions and answers which were posed to us by the President's Commission on the Three Mile Island Accident which I believe may provide early answers to many of the questions you have posed.

I suggest that you make your overnight reservations at either the Sheraton Alexandria or the Best Western Motel in Alexandria as these are relatively convenient to the Dresser plant.

If there is any further information I can provide, please feel free to call me.

Very truly yours,

W. Tacy, Jr.
Manager Engineering

WT:mw

Enclosure

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RESPONSE TO REQUEST FOR INFORMATION

ATTACHMENT I

1. A summary count of numbers of valves similar to the TMI-2 PORV (Pilot Operated Relief Valve) and Pressurizer Code safety relief valves supplied to the non nuclear power generating industry and to the nuclear power generation industry over a defined period of time.

Our records reveal that Dresser Industries has delivered, in the time frame between 1971 and the present, a total of approximately 800 Electromatic valves, both fossil and nuclear. These can be tabulated as follows:

1525VX (Commercial)	94
1533VX (Commercial)	628
1525VX (Nuclear)	47
31533VX (Nuclear)	31

The 31533VX is similar to the Electromatic Relief Valve installed at Three Mile Island. The other valve types are of similar, but slightly differing design. During the same time frame, approximately 71 pressurizer code Safety Valves in various orifice sizes have been supplied to the nuclear power generation industry. The non-nuclear power generation industry does not use a pressurizer type Safety Valve.

2. An expression of the number of such valves, as in item 1 above, returned to the plant for re-work and the number re-worked in the field by Dresser Representatives in a defined period of time compared with number of like-valves in use.

Approximately 15-16 Electromatic valves are returned to Alexandria for factory maintenance, refurbishing, or repair each year. Most Electromatics returned to Alexandria are used in non-nuclear stations. The Field Service organization works on approximately 100 per year. The actual work performed by a Field Service Engineer can range from a preventive maintenance activity to a full scale repair. There is no readily available data that would identify this information by individual unit for the purpose of establishing a frequency rate. We know that many Electromatic users perform their own preventive maintenance and repair.

Pressurizer Safety Valves are seldom returned to Alexandria for repair because of the difficulty associated with decontamination. An average of 2 - 3 Pressurizer Safety Valves are reworked in the factory each year. The Field Service organization has worked on Pressurizer Safety Valves at the Nuclear Generating Plant and at Wyle Labs. Two to three jobs have been performed at the Generating Plant and two to three jobs have been performed at Wyle Labs. All of this activity during 1979 and is typical of our historical activity.

3. History of the PORV in use in TMI-2 at the time of the March 28, 1979 accident; and comparison of this PORV to the one previously installed in TMI-2. Of particular interest is comparison of configuration, flow capacity, and application of controls during design and manufacturing.

The Pilot Operated Relief Valve in use at Three Mile Island Unit 2 at the time of the March 20, 1979 incident was Dresser's Serial Number BN04233. This is the valve which was originally supplied for installation on Unit 2. Our records show that this valve was returned to Alexandria for inspection and testing. The unit was inspected, tested, and shipped back to TMI-2 on 10/7/76. We have no record of any effort having taken place on this valve since that date. Valve Serial Number BL08905 was originally supplied for Three Mile Island 1 and at the time of the incident was mounted on Three Mile Island Unit 1. This valve had had work performed on it in the field approximately 3 to 4 weeks before the event. Our Field Service man replaced the pilot disc, the bellows gaskets, and machined the main valve disc. He inspected the unit, it was tested O.K. All of this effort was reviewed by in-plant Quality Assurance personnel. Both valves were manufactured under the same Quality Control procedures here in Alexandria. The valve mounted on TMI Unit 1 has a bore of 1-3/32nds with a capacity of 106,450 pounds per hour of saturated steam. The TMI-2 valve has a 1-5/32nd bore diameter with a capacity of 118,909 pounds per hour of saturated steam. Due to conversations with NRC personnel, we understand that these valves had been interchanged between TMI-1 and TMI-2 at some time prior to the incident. It is believed that Serial No. BN04233 was returned to Alexandria for inspection and test after having been removed from TMI-1 prior to mounting it on TMI-2.

what about end?

4. Description of design changes incorporated in nuclear PORV's since initial delivery of TMI-2 PORV; including application of these changes to the TMI-2 PORV.

Following an incident at Oconee III Nuclear Power Station on Friday, June 13, 1975 in which a Pilot Operated Relief Valve failed to close, investigation by Oconee personnel and Dresser personnel indicated that the operating lever for the Pilot Valve had remained in the ported position which prevented the main valve from reseating. Restraint of the lever was caused by corrosion of the lever pin, lever hinge, and solenoid bracket. On 6/20/75 the valve was repaired and reinstalled with no further operational difficulty. On 10/11/76 Dresser issued a commentary with a suggested solution consisting of installing sintered oil impregnated tin bronze bushing type bearings around the lever pin to provide lubrication and eliminate any corrosion. Instruction AS64 was provided so that field replacement could be accomplished readily. This AS64 instruction was issued on October 14, 1976. On 11/8/76 B & W issued a document comment form in association with Dresser AS64 indicating "these engineering instructions for the Electromatic Relief Valve (design modification) are applicable to the following contracts: NSS-3, NSS-4, NSS-5, NSS-6, -7, -8, -9, -11, -12, -13, -15, -16, -23, -24, -30, -31, and -32". The status on AS64 at that time was indicated as approved. On 4/22/77 our records indicate that our serviceman installed the bushings in the 31533VX Pilot Operated Relief Valves on both Unit 1 and Unit 2 at Three Mile Island. In late 1976 a design modification was issued by the Engineering Department for all future Electromatic Pilot Operated Relief Valves in which the disc, the guide retaining plug, the guide in the lock plate were modified to utilize a locking plate which would be a fabricated part as opposed to the special machined screw which is in the original design. This change was basically in the form of a cost improvement type change as opposed to a mandatory type of design improvement. To the best of our knowledge this modification was not made on the TMI-2 Pilot Operated Relief Valve, nor was it recommended to be changed.

5. Description of the design, the handling (inspection, shipping, storing, traceability) and the qualification, by test as analysis, of the PORV that was in use at TMI-2 at the time of the accident; compared with PORV supplied in the same time period to non nuclear plants, PORV's supplied in response to safety related classification; and PORV's with N-stamp classification. Please include copy of the purchase order, or similar document, which identfied the classification of the TMI-2 PORV, such as "safety related" or "non safety related".

A comparison of the Pilot Operated Relief Valve in use at TMI-2 at the time of the accident with similar valves supplied the same time period to non nuclear plants requires that we first identify the valves in question. The PORV at TMI-2 is a 31533-VX-30. Those units which are supplied to non nuclear plants are 1533VX. The primary difference between these two units is the 31533VX-30 includes a bellows seal on the pilot valve to preclude the release of radioactive steam to the containment. The other difference is in the materials where the 31533VX is a stainless steel valve as compared to carbon steel on the 1533VX.

Other than those identified elements, the design of the two valves is the same. The handling of the nuclear level valve is as defined in ASME Boiler & Pressure Vessel Code Section III. The 1533VX, which is supplied to non nuclear plants is provided in accordance with the requirements identified in Section I of the ASME Boiler & Pressure Vessel Code, although this valve is not Code stamped, nor is it sold as a identified Section I valve. PORV's that are supplied to nuclear stations with the "N" stamp classification receive the additional inspection of documentation and procedures from the authorized nuclear inspector who is resident in the Alexandria facility.

A copy of the purchase order identifying the classification of the TMI-2 Pilot Operated Relief Valve is attached to this response.

6. Description of the changes you would recommend to PORV design, qualification, handling, maintenance, and documentation, in view of TMI-2 experience, if PORV were to be classified as "safety related".

In view of the TMI-2 experience, we would recommend the Pilot Operated Relief Valve design be modified in order to provide direct feedback to the control room operator of valve main disc position. We would further recommend that the electrical portion of the system be treated as IEEE 382 and that the entire system be tested under those conditions which would expand upon the present qualification procedures. The handling, maintenance, and documentation of the valve during its manufacturing cycle would require no modification in order to classify the valve as "safety related".

7. Results of FMEA's (Failure Modes and Effects Analyses) performed on TMI-2 PORV design subsequent to the TMI-2 accident. Also description of company experience in application of FMEA's to non nuclear and nuclear valves in the time period before the TMI-2 accident and after the accident.

As indicated under No. 4 above, a form of FMEA (Failure Modes and Effects Analyses) was performed on the PORV following the Oconee III valve malfunction. The FMEA lead to the introduction of the bronze bushing at the hinge pin on the Pilot Operated Relief Valves. Following the Three Mile Island incident, the Engineering Department at Dresser Alexandria operations performed a Failure Modes and Effects Analyses considering a) the valve failed in the open position and b) the valve had been subsequently closed but leaking. These two forms of analyses were performed because we had indication by telex from B & W indicating that the ERV was closed, but leaking. Given that the valve was considered to have failed in the open position, three possibile failure modes were identified and probabilities of occurrence assigned. The primary mode was identified to be that of faulty electrical equipment creating a condition where extreme repetition in opening and closing of the valve would create a tilted disc which would then remain in the open position. The condition had never been noted on a nuclear valve, however, it had been identified as occurring approximately 6 times in the past 9 or 10 years on fossil plant ERV's by our Repair Department. This is usually considered to be a failure mode as a result of faulty controller signals or improper sensor location. A probability of .50 was assigned. The second failure mode was identified as potential galling between the piston ring and the guide with subsequently high friction force and eventual failure of the valve in the open position. When utilized on steam service, the probability of this occurrence was assigned .10. When passing water, the probability of

occurrence is considered as .15. A third probability was identified where the valve main disc could have remained open as a result of foreign material trapped between the seat and the disc. Due to the consideration of a full open position, this was assigned a low probability of .05.

Under the consideration that the valve was closed but leaking, the highest probability of this occurrence was identified with regard to foreign material trapped between the seat and the disc. This is the most probable occurrence with a probability of .80. Piston rings and subsequent galling between the ring and the guide were again identified as possible during the closed but leaking condition with probability of occurrence on steam of .10, on water service .15.

8. Your thoughts on maintenance practices that could be utilized to reduce the likelihood of PORV leaks and to handle PORV leaks, as reported existing at TMI-2 before the accident.

Dresser finds it difficult to respond to the question No. 8 since we have issued maintenance manuals regarding the subject Pilot Operated Relief Valve and are not sufficiently cognizant of the operating restraints which are faced by operating personnel in the various nuclear power stations which could preclude interchanging of spare PORV's with a leaking unit to permit seat and disc maintenance.

9. Description in general terms of audits performed on Dresser by AEC/NRC, ASME, Hartford Insurance, Customers (special mention of GPU or Metropolitan), B & W, and others, include approximate frequency of audits and goal of audits.

Following is a summary of agency audits and pertinent customer audits from TMI-2 PORV order date to the present. The order for the TMI-2 PORV was received 10/1/70 and the valve was shipped 2/25/72.

Five AEC audits relating to and with specific customers were performed between July, 1969 and March, 1973.

Five NRC audits were performed between June, 1976 and July, 1979.

Two Hartford Steam Boiler audits were performed, one in May, 1975 and one in April, 1979.

One General Public Utilities audit was performed in August, 1969.

One Metropolitan Edison audit was performed in August, 1979.

Fifteen B&W audits were performed between January 1, 1971, and March 1, 1979 (average two per year).

Three ASME audits were performed between June, 1971, and March, 1979.

Atomic Energy Commission (AEC) audits were, in general, addressed to verification of compliance with customer specifications and technical requirements. The AEC audited against selected customer orders and performed these audits via authorization of Dresser's customer.

Nuclear Regulatory Commission (NRC) audits primarily address compliance with the ASME accepted Quality Assurance program established to satisfy the requirements of ASME Code Section III. NRC audits have not necessarily followed specific customer orders, but have covered various segments of the Quality Assurance program as applied to orders on a random basis. NRC audit schedules are set at NRC's discretion without customer involvement. These audits may also address factors beyond the code or customer requirements at the auditor's discretion.

American Society of Mechanical Engineers (ASME) audits (surveys) are performed as a requirement for issue or renewal of the ASME Certificate of Authorization to apply ASME Code Section III "N" stamps. These audits address all elements of ASME Code Section III requirements for Quality Assurance including manual preparation, supporting procedures and compliance on active contracts. The ASME survey is performed once every three years.

Customer audits -- Babcock & Wilcox, Metropolitan Edison, and General Public Utilities, addressed specific contract requirements and applicable code requirements where code compliance applies.

The Hartford Steam Boiler Inspection and Insurance Company conducted two in-depth audits as shown in addition to their participation in the ASME audits. Hartford Steam Boiler is Dresser's authorized Inspection Agency, under contract with Dresser to verify compliance with applicable ASME Code requirements. This contract is in itself a code requirement. Hartford Steam Boiler also performs audits of specific program sections, on a random basis, covering the entire program each year. The ANI auditing system is considered continuous and is more of a monitoring function than an auditing function.

10. Two copies of the current Dresser Quality Assurance Manual, as used by Dresser Nuclear Operations, mail one of these direct to Mr. Art Carr, Code EG-11, Product Assurance Office NASA, NSFC, Huntsville, Alabama 35812.

One copy of the current Dresser Quality Assurance Manual, Rev. No. 8, issued 2/20/79 is attached as requested. Our quality program requires acknowledgement of receipt of this manual. Please acknowledge receipt by returning the transmittal form attached to the manual.

One additional copy of the above manual has been transmitted under separate cover to Mr. Art Carr at his NASA, Huntsville address as requested by Mr. Carr and Mr. Bland.

11. Indicate what portion of the Quality Assurance Manual applied to the TMI-2 PORV.

The TMI-2 PORV was not "N" stamped. The B&W contract, however, did require compliance with ASME Code Section III Quality Assurance program including authorized inspection. Dresser's Section III Quality Assurance Manual No. 3, issued 1/21/71, applied to the TMI-2 valve. The governing codes for the TMI-2 valve were the November, 1968 draft Pump and Valve Code and the 1968 edition of ASME Code Section III, Winter, 1969, addenda.

12. Brief general description of Dresser knowledge of PORV problems listed and described in document NUREG 00560 at the time the document was issued; sources of Dresser knowledge. Description of PORV problems in addition to those listed in NUREG 560 that Dresser was aware of at the time and source of this information.

A review of the history of identified Pilot Operated Relief Valve failures selected from NUREG 0560 by station is as follows: Three Mile Island Unit 2 on 3/29/78 had a failure in which the PORV failed to close. This was as a result of malfunction of the integrated control system. Dresser was not informed of that incident. Rancho Seco on 1/5/79 sustained a short circuit in the integrated control system. No PORV maloperation is identified. Oconee III on 6/13/75 had a condition where the PORV failed to open. This was discussed earlier in this report. Dresser was notified by Oconee III personnel. Oconee II on 7/12/76 had an integrated control systems problem. The Pilot

Operated Relief Valve operated normally. Oconee I on 12/4/78 had a short circuit which caused an integrated system recorder error. The Pilot Operated Relief Valve operated normally. Davis Besse on 9/24/77 had a Crosby pilot operated relief valve which failed to close. The seal-in relay had been removed from the system and the PORV oscillated and failed in the open position. This information was relayed to us through industry contacts. Arkansas Nuclear I Unit I had an integrated control systems problem and then again in 1974 a pilot operated relief valve failed to close. This was identified as improper venting. Dresser was informed by Arkansas Nuclear I personnel and after correction of the venting, the pilot operated relief valve has operated normally. We receive feedback of potential problem conditions directly from site personnel. We also receive data drom our Field Service personnel who at times are called in to do refurbishment and maintenance on equipment. The Licensee Event Reports are a primary source of information. We are on the mailing list for those reports. We have been informed of leaking conditions primarily at Rancho Seco station with the pilot operated relief valve. These conditions are identified as being probably gasket induced leak situations. Our field service personnel have been closely involved with Rancho Seco operations people and this case appears to be related to improper field maintenance by the station.