SSINS No.: 6835
IN 87-02

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

January 13, 1987

IE INFORMATION NOTICE NO. 87-02: INADEQUATE SEISMIC QUALIFICATION OF DIAPHRAGM VALVES BY MATHEMATICAL MODELING AND ANALYSIS

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is provided to alert recipients to a potential problem pertaining to seismic qualification of safety-related diaphragm valves. These valves were furnished as qualified by mathematical analysis based on an inadequate model; the results of later tests showed that the actual lowest natural frequency of the valve may be less than that required by the purchase specification.

It is expected that recipients will review this information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem from occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On December 27, 1984, ITT Engineered Valves (formerly Dia-Flo Division of ITT Grinnell Valve Co., Inc.) notified purchasers of air-operated valves with extended operator structures that such valves had been determined by test to have natural frequencies less than 33 hertz. The notification was directed to nuclear power plant owners or suppliers who had purchased valves to specifications requiring the valves to have all natural frequencies equal to or greater than 33 hertz as demonstrated by analysis or test.

The natural frequencies of these valves had been originally determined by analysis. Subsequent information obtained from testing similar valves disclosed that the natural frequency of air-operated valves with extended structures is less than 33 Hz. ITT Grinnell undertook a testing program that included fragility testing to provide data for evaluating the characteristics and capabilities of the valves. On the basis of the fragility testing results, Grinnell drew the generic conclusion that there was not a safety problem related to valve functionality; this conclusion was presented in the December 27, 1984 notification. No notification of this problem under 10 CFR Part 21 was made at that time; however, a notification under 10 CFR Part 21 subsequently was received by the NRC from one power plant.

The NRC staff reviewed the test reports obtained from ITT Grinnell and reviewed the design applications and field installations of such valves to see if they agreed that there was adequate justification for a generic conclusion that no safety problem existed. The NRC staff concluded that generic acceptance of the valves could not be determined and informed ITT Grinnell that a Part 21 notification should be issued. As a result, on October 10, 1986 ITT Grinnell issued two Part 21 notices, one for diaphragm valves with air operators on extended structures and one for diaphragm valves with Limitorque operators.

The Part 21 notices point out that, in addition to valve considerations, the piping systems containing these valves and the associated piping supports also may be affected by the change in frequency and that an evaluation of the analysis methods used to qualify the valves and of the potential impact on a system may be required.

Discussion:

The natural frequencies of the diaphragm valves are reflected in the mathematical model and are used for dynamic analyses of those systems requiring dynamic analysis. Therefore, these results of dynamic analysis using the model affect predicted accelerations and forces on the valve and its operator, stresses in the piping, and forces on the pipe supports.

The test results, reported in the Part 21 notices, for valve fragility in terms of acceleration "g" levels are consistent with those that the NRC obtained from review of the ITT test report data. Although the high g levels for fragility of the valves are impressive, no generic conclusion of valve acceptability can be made because (1) the large range of capability in g levels included in the purchase specifications (0.15g to 4.5g) and (2) the possibility of amplified response at frequencies less than 33 Hz can result in unacceptable installations. Except for cases where the valve operators are supported directly, no basis can be found for considering piping and supports to be unaffected by the change in frequency.

Although the information provided above deals with diaphragm valves manufactured by ITT Grinnell, there are indications that similar problems may exist in valve/actuator assemblies sold by other manufacturers. The difference between the original ITT Grinnell analysis and the test results illustrates the difficulty in analytically determining the natural frequency of the valve/actuator assembly. To provide valid results, the analytical model must accurately reflect the flexibility of the connection between the actuator and the valve. This may require confirmatory experimental data. Thus it appears that a potential problem with the validity of valve qualification and piping analysis can exist for cases where valve seismic qualification was performed by analytical methods that were not confirmed by test results. This problem appears to be more common for diaphragm valves that have a predicted natural frequency of less than 55 Hz and that have heavy extended operators with flexibility in the interface between the valve and the operator structure.

This information is being made available to licensees to provide insight to a problem which may exist in systems with valves other than those specifically addressed in the Part 21 notices from ITT Grinnell. No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: William F. Anderson, IE
(301)492-4819

Attachment: List of Recently Issued IE Information Notices

*See Previous Concurrences

					D:DEPER:IE
					ELJordan
					12/ /86
*DEPER:IE	*DEPER:IE	*PSB:IE	DEPER:IE	DEPER:IE	DD:DEPER:IE
WFAnderson	AWDromerick	DGable	RLBaer	JERosenthal	SASchwartz
11/24/86	11/25/86	11/26/86	12/4/86	12/16/86	12/11/86

Attachment 1
IN 87-02
January 13, 1987

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
87-01	RHR Valve Misalignment Causes Degradation of ECCS in PWRs	1/6/87	All PWR facilities holding an OL or CP
86-110	Anomalous Behavior of Recirculation Loop Flow in Jet Pump BWR Plants	12/31/86	All BWR facilities holding an OL or CP
86-109	Diaphragm Failure In Scram Outlet Valve Causing Rod Insertion	12/29/86	All BWR facilities holding an OL or CP
86-108	Degradation Of Reactor Coolant System Pressure Boundary Resulting From Boric Acid Corrosion	12/29/86	All PWR facilities holding an OL or CP
86-107	Entry Into PWR Cavity With Retractable Incore Detector Thimbles Withdrawn	12/29/86	All power reactor facilities holding an OL or CP
86-106	Feedwater Line Break	12/16/86	All power reactor facilities holding an OL or CP
86-105	Potential For Loss Of Reactor Trip Capability At Intermediate Power Levels	12/19/86	All holders of OL or CP for PWR or BWR
86-104	Unqualified Butt Splice Connectors Identified In Qualified Penetrations	12/16/86	All pressurized and boiling-water reactor facilities holding an OL or CP
86-14 Supplement 1	Overspeed Trips Of AFW, HPCI, And RCIC Turbines	12/17/86	All power reactor facilities holding an OL or CP
86-103	Respirator Coupling Nut Assembly Failures	12/16/86	All power reactor facilities holding an OL or CP and fuel facilities

OL = Operating License
CP = Construction Permit

confirmed by test results. This problem appears to be more common for valves that have a predicted natural frequency of less than 55 Hz and that have heavy extended operators with flexibility in the interface between the valve and the operator structure.

This information is being made available to licensees to provide insight to a problem which may manifest itself in systems with valves other than those specifically addressed in the Part 21 notices from ITT Grinnell.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: William F. Anderson, IE
(301)492-4819

Attachment: List of Recently Issued IE Information Notices

					D:DEPER:IE ELJordan 11/ /86
DEPER:IE WFAnderson 11/24/86	DEPER:IE AWDromerick 11/25/86	PSB:IE DGabler 11/26/86	DEPER:IE RLBaer 11/ /86	DEPER:IE JERosenthal 11/ /86	DD:DEPER:IE SASchwartz 11/ /86