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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
REVIEW AND COMMENTS ON DRAFT REPORT, "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS"

This submittal provides the results of a review by Consumers Energy of the two NRC draft reports entitled, "Evaluation of Air-Operated Valves at U.S. Light-Water Reactors," and "A Study of Air-Operated Valves in U. S. Nuclear Power Plants." Consumers Energy requests serious consideration of the comments provided herein prior to the upcoming publication of the above two reports.

Attachment 1 provides comments on the "Evaluation of Air-Operated Valves at U.S. Light-Water Reactors" report. Attachments 2 provides comments on the INEEL Report, "A Study of Air-Operated Valves in U. S. Nuclear Power Plants". Attachment 3 provides comments and corrections on the INEEL Report in the form of redline/strikeout for the specific Trip # 3 Report covering Palisades. Attachment 4 provides additional supporting information on activities conducted over the last 20 years which have dramatically improved both the air quality and the performance of the Instrument Air System.

The information contained in the draft report entitled "Evaluation of Air-Operated Valves at U.S. Light-Water Reactors" has been presented numerous times by Dr. Harold Ornstein including the 7th International Conference on Nuclear Engineering in Tokyo, Japan (April 19-23, 1999) and the 2nd Joint Meeting of the Air Operated Valve and Motor Operated Valve Users' Groups in Orlando, Florida (December 7-11, 1998). Consumers Energy is especially concerned about the releases made in this paper and

at these conferences because the information was made public without allowing the licensee to comment on and/or verify the accuracy of the information.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.

Nathan L. Haskell
Director, Licensing

CC Administrator, Region III, USNRC
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HLOrnstein, RES, USNRC
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4 Attachments

ATTACHMENT 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

REVIEW AND COMMENTS ON DRAFT REPORT "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS"

REVIEW COMMENTS ON 19 PAGE DRAFT REPORT "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS"

The following comments apply to the 19 page report entitled "Evaluation of Air-Operated Valves at US Light-Water Reactors"

1. Table 1 (Page 2), under the "Safety Related AOVs" column, the paper indicates that the total number of safety related AOVs was not provided. That number was available at the time of the site visit but may not have been specifically requested. The number of safety related AOVs is 191.

2. Table 1 (Page 2), under the "Category 2 AOVs" column, the paper indicates that there are 403 AOVs in Category 2. This is apparently a typographical error as the correct number at the time of the site visit was 42.

3. Table 1 (Page 2), under the "Category 3 AOVs" column, the paper indicated that there were approximately 586 AOVs in this category. The correct number should be 561.

4. Under Section 3, "Operating Experience" (Page 4), the paper describes an event at Palisades in 1978 and 1981. The paper uses the terminology of a "residual heat removal heat exchanger." This is not the correct terminology for Palisades. These components are correctly described as "Shutdown Cooling System" components in the Technical Specifications and the FSAR. Also in this paragraph, it discusses an AOV which was prevented from going to its "fail safe," open position. The valve described is CV-3025, the common outlet valve from the Shutdown Cooling Heat Exchangers. This valve's "fail safe" position, which presumably means its failure mode on loss of Instrument Air, is in the closed position - not the open position. CV-3025 is a direct acting valve with a reverse acting actuator. The valve performs both a shutdown cooling function as well as the Low Pressure Safety Injection and Containment Spray Isolation function. From a design basis perspective this valve does need to fail closed on loss of air. Lastly, this paragraph states that "poor quality air conditions that led to these events existed at the plant at the time of our site visit." Palisades disagrees with this statement and believes that the air quality of the instrument air system has been improved. See Attachment 4 of this letter for a listing of improvements.

5. Under Section 4, "Site Visits," (Page 9 - Table 3), the paper describes the diagnostic testing being performed at the various sites visited. The paper erroneously states that dynamic testing was being planned at Palisades. At the time of the site visit, Palisades had performed both dynamic and static testing.

ATTACHMENT 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

REVIEW AND COMMENTS ON DRAFT REPORT "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS" ("A STUDY OF AIR-OPERATED VALVES IN U.S. NUCLEAR POWER PLANTS")

3 Pages

REVIEW COMMENTS ON INEEL REPORT "A STUDY OF AIR-OPERATED VALVES IN U.S. NUCLEAR POWER PLANTS"

The following comments apply to "A Study of Air-Operated Valves in U. S. Nuclear Power Plants." This document was transmitted from INEEL to the NRC on April 26, 1999.

Section 8.3.1 (Page 17)

The report states that 9 of 22 air regulators were found to be blocked. Significant amounts of material were found in only three regulators. The restriction orifice was partially blocked on these regulators. The only regulator that was totally blocked was the identified failure of PCV-3018. This was the only high pressure regulator that failed to perform its function. Also, we disagree with the statement that this event was a common-cause failure condition.

Section 8.3.2 (Page 18)

Contrary to the description of the valve function in the report, CV-3025 does not have a design basis function to open after a small break LOCA. The scenario that is discussed is not part of the design basis of the plant.

The condition of the Instrument Air System serving CV-3025 has been significantly improved since the reported failures while on Shutdown Cooling. See Attachment 4.

RHR should be renamed Shutdown Cooling.

Section 10.1 (Page 39)

CV-3025 does not have a design basis function to open after a small break LOCA. Its safety-related function to close is to isolate LPSI from Containment Spray.

The report also describes a recent NRC Regional inspection that identified several gallons of water found at a low point in the air line. Contrary to this statement, the referenced Inspection Report, No. 50-255/97018(DRP), did not identify any collection of water.

A great deal of discussion is made with respect to the condition of the Palisades Instrument Air System. A discussion of the improvements made to the system is included in Attachment 4. Palisades takes exception to the comment that, "All of

the plants visited, except Palisades, improved the performance of their air systems in response to in-plant events and in response to Generic Letter 88-14." Palisades has significantly improved the performance of the Instrument Air System.

Section 12.2 (Page 50)

This section, and several other sections throughout the report, mentions the Utilities Service Alliance Group (USA) and adds that Palisades "withdrew" from the USA Group. This is not accurate. Palisades was, and continues to be, an active USA Group participant in the AOV initiative. At one time, Palisades performed the leadership role for this initiative. After further evaluation, and a realization that Palisades was significantly further ahead of other USA Plants in AOV Program development, Palisades decided to suspend their leadership role.

Section 12.3 (Page 50)

In the early part of this section, the report contrasts the AOV and MOV Programs. Under the "Design Basis" discussion the report states that "The design bases for MOVs (were) found to contain incomplete information and/or non-conservative assumptions in a number of cases." This sentence could easily be taken out of context. It should be clarified that this condition existed prior to the NRC Generic Letter 89-10 Program. (Palisades has closed out each of the Generic Letters on MOVs including NRC GENERIC LETTER 89-10, 95-07 and 96-05.) The design bases of the MOVs were acceptable at the time of Dr. Ornstein's site visit.

Section 15.3.1 (Page 63)

Consumers Energy suggests that the PRA techniques used at Fermi 2 be verified. Palisades used the PRA techniques that are described in the paragraph for Fermi 2. Also, there are a total of 84 AOVs modeled as active in the PSA, 75 which are active and 9 which are not active in the Inservice Testing Program.

Section 16.2 (Page 77)

The report discusses an EPRI sponsored AOV program where Palisades and Fermi were the lead plants. The report indicates that the effort is restricted to high risk AOVs. This is not an accurate statement. The Palisades AOV Program was established to develop design basis information and perform testing for all active safety related valves. This included many low risk significant AOVs.

REVIEW COMMENTS ON INEEL REPORT
"A STUDY OF AIR-OPERATED VALVES IN U.S. NUCLEAR POWER PLANTS"

Section 16.4 (Page 78)

This section states that - "Every plant visited had experienced major problems with air quality and all but one plant visited had taken actions, some quite extensive, and mostly in response to Generic Letter 88-14, to address their air quality problems." Earlier in the report Palisades was singled out as the exception. Consumers is very concerned about this characterization and does not feel it is representative of the true condition of the Instrument Air System. (See Comment from Section 10.1 and Attachment 4.)

Table 1-3 "Population of Air-Operated Valves in Plants Visited"

The numbers listed in this table are not correct. This is the same table used in the report entitled, "Evaluation of Air-Operated Valves at U.S. Light-Water Reactors". See Attachment 1 for the proper numbers.

Appendix C - Trip No. 3 Report

Because of the large number of inaccuracies in the Trip Report, the Palisades comments are being provided as a red lined mark up with the more accurate information. This can be found in Attachment 3.

ATTACHMENT 3

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

REVIEW AND COMMENTS ON DRAFT REPORT "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS" (TRIP No. 3 REPORT - STUDY OF AIR-OPERATED VALVES PALISADES, NOVEMBER 18 AND 19, 1997)

20 Pages

TRIP No. 3 REPORT
STUDY OF AIR-OPERATED VALVES
PALISADES, NOVEMBER 18 AND 19, 1997

We had two days of meetings with the engineers and technicians at Palisades concerned with the air system and air-operated valves. We did not have an opportunity to view equipment in the plant, however we did tour the diagnostic facilities that were used to evaluate power operated valves at Palisades.

Palisades has a dedicated AOV Program Engineer under the Manager of ~~System~~ Engineering Programs. At the time of the visit Palisades was a member of a group of utilities that pool their resources to devise integrated solutions to problems and concerns. This group of utilities is known as the Utilities Service Alliance, USA, and was made up of Fermi 2, WNP2, Palisades, Ft. Calhoun, Clinton, Cooper, and Wolf Creek. ~~The Palisades AOV Program was part of this group effort, however, it was recently learned that Palisades is no longer a member of the USA group.~~ The Palisades AOV Program is still participating with this group but to a lesser extent because of the completion of their design basis reviews.

The engineers at Palisades provided us with a notebook, prepared for our visit, that described their program and some of the pertinent problems regarding AOVs. The contents of the notebook also included a description of the Palisades organization, a document entitled "Air Operated Valve Program" (that specifically excludes HVAC dampers from its scope), and several lists of AOVs, as well as lists of AOV failures and deficiencies that have occurred. We were provided with several summary charts to indicate the pertinent Probabilistic Safety Assessment (PSA) results for Palisades. We were provided with a copy of an engineering analysis entitled "System Level Design Basis Review for Air Operated Valves (AOV) in the Engineered Safeguards System (ESS)." Also, copies of the hand-written logs associated with the 1978 and 1981 incidents involving failure of AOV CV-3025 in the shutdown cooling mode were also provided.

We were provided with a summary of the results and goals associated with the Maintenance Rule review. The primary goal is to implement an action plan for the improvement of the high pressure air system. A closeout memo for the previously implemented plan for improvement of instrument air compressors, summarizing what had been accomplished, was also provided. In addition, we were provided with a copy of another action plan for improvement of the plant air system that was not associated with actions required by the Maintenance Rule. The reason for the distinction was not clear.

In early December the plant engineers forwarded a document entitled "Compressed Air System Safety System Design Confirmation Report," (SSDC) dated November 21, 1997. This report was prepared by the plant for the purpose of an internal review and

was mentioned during our visit.

The cooperation, courtesy, and knowledgeable responses from the members of the Palisades staff was noted and appreciated by those of us who are involved in this study of AOVs.

Prior to the visit the NRC TM provided us with a description of the Palisades compressed air (service and instrument air), high-pressure air, and nitrogen backup systems from the FSAR. Service and instrument air is provided by three compressors, each with a separate receiver. The receivers are connected to the compressed air header, which branches to an instrument air header and a service air header. The instrument air header is equipped with a single desiccant dryer and pre and post filters. ~~a filter.~~ There are two additional compressors that can be connected to the instrument air system.

High pressure compressed air is provided by three high-pressure compressors, each with its own refrigeration type dryer and air receiver.

Nitrogen is supplied from bottles or in bulk as a back-up. Two banks of 2000 psig nitrogen bottles provide limited back-up for the auxiliary feedwater system valves. Four other nitrogen back-up stations, each consisting of 2000 psig nitrogen bottles, are located in the auxiliary and turbine buildings to provide for operation of certain safety-related AOVs. A bulk nitrogen back-up system of the instrument air system provides for the operation of the atmospheric dump valves (ADVs).

The instrument air system and the high pressure air system have had significant design and operational weaknesses, which could have led, ~~in the past (such as loss of shutdown cooling in 1978 and 1981 due to the failure of the single CV-3025 AOV), and can, in the future, lead~~ to safety-significant events and common-cause and/or common-mode failures of AOVs and other pneumatic equipment (such as loss of shutdown cooling in 1978 and 1981 due to the failure of the single CV-3025 AOV). Those design issues ~~weaknesses~~ included:

- lack of redundant dryers for the instrument air system. The dryer was being bypassed when serviced and the system was left without drying capability during that time.
- use of refrigerant dryers on the high pressure air system. These dryers lack the capability to lower the dew point sufficiently to ensure that a supply of sufficiently dry air is provided.
- misplacement of filters. Several filters were noted to have been placed downstream of the pressure regulators that they are intended to serve.
- deterioration of piping and equipment served by the high pressure air system. One clogged high pressure air regulators and corroded piping were reported.

A bank of air bottles provides 1800 psig air to back-up the high pressure air system for

the operation of AOV CV-3018, to meet the fire protection requirements of Appendix R of 10 CAR.

The condensate demineralizer building compressed air needs are supplied by either of two air compressors, each with an integral intercooler and separate aftercooler and receiver. Service air is piped directly from the receivers, while instrument air is routed from the receivers to a dryer and then to the instruments. This system can provide backup to the primary air compressors.

The operation and control of the air and nitrogen systems is described in the FSAR.

The AOVs at Palisades are classified as Category 1, 2, or 3. Category 1 valves include safety-related AOVs with an active safety function, AOVs that are important to safety based on their PSA risk significance, or AOVs designated by an Expert Panel. Category 2 valves may be safety-related and of low risk-significance or non-safety related and used in critical applications that could affect plant availability, capacity factor, heat rate, or maintenance costs. The remaining AOVs are included in Category 3. There are 111 Category 1 AOVs, and ~~403~~ 42 Category 2 AOVs. There are approximately ~~1100~~ 714 AOVs, total, in the Palisades plant. For comparison, there are 54 motor-operated valves (MOVs) in the plant, 30 of which are covered by NRC Generic Letter 89-10.

The goal of the Palisades AOV Program is to ensure the program valves are capable of performing their design basis function. Both static and dynamic testing has been performed to compare actual valve performance to assumptions made in the AOV calculations.

Palisades is now involved in efforts in response to the requirements of the Maintenance Rule, 10 CAR 50.65, and those efforts complement their AOV program. Specifically the Palisades staff is reviewing the importance of their AOVs from several different perspectives, including PRA and Expert Panel insights. Palisades has a formal AOV maintenance program and is in the early stages of implementing a plan for improvement of the performance of AOVs similar to that previously invoked and accomplished for motor-operated valves (MOVs), and based on experience with MOVs. Palisades is also part of an EPRI pilot program on AOVs similar to the one described to us in more detail at Fermi 2, and is using the ~~based on~~ EPRI's Performance Prediction Program devised for motor-operated valves. Palisades and EPRI are involved in a collaborative agreement to develop design basis AOV calculations. ~~EPRI is providing funding for analyses of the AOVs at Palisades.~~

Implementation of the Maintenance Rule made the plant engineers consider each AOV and rank the valves in terms of risk-significance, in accordance with industry guidelines. The ranking process resulted in about 11 of ~~75~~ 84 active AOVs in the PSA model being categorized as "high safety significance". Those 11 AOVs are listed in item 21 in the table that follows.

The plant engineers were fully cognizant of the air system design limitations and deficiencies and were pursuing activities to improve ~~not particularly concerned about~~ the quality of the air supplied by their air systems. ~~They believed it to be acceptable although it is not monitored on a continuous basis~~ They believe the air system is acceptable because of the corrective actions taken since 1981 ~~and the quality is judged subjectively (i.e., direct observation to detect droplets during blowdown).~~ The air system engineer has a series of action plans to improve air system performance. Progress of the action plan milestones is closely monitored. ~~indicated that he had not received management support to modify the system to attain the air system quality levels noted in ISA-S7, "Quality Standard for Instrument Air."~~ After reviewing their program and the air system, including the recent incident~~s~~ (CV-3018), we made several observations about the air quality and the failures that they had experienced. The issues on CV-3025 was addressed in NUREG 1275 and Palisades has addressed the root cause of this issue. No failures of components in the instrument air system have occurred since 1981. Palisades is still working on corrective actions from the recent incident of CV-3018. Our comments on the Palisades AOVs and air system, as well as those of the other plants that we visited, are summarized in the table that follows.

The following tabular summary was prepared to describe the information gathered during the subject visit. The NRC, with assistance from the INEEL, is studying the performance of air-operated valves (AOVs) in commercial nuclear power plants. The information was collected in accordance with the Program Plan dated 10/22/97 (INEEL Letter to H. Ornstein, NRC, from J. Bryce, 10/23/97, Job Code E8238, Task Order 15 - JHB-167-97).

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
1	Date.	November 18 and 19, 1997
2	Name of Interviewer.	Owen Rothberg, INEEL/LMITCO, 301/816-7773 John Watkins, INEEL/LMITCO, 208/526-0567 Hal Ornstein, NRC/AEOD, 301/415-7574 Gerry Weidenhamer, NRC/RES, 301/415-6015
3	Plant Name & Docket No.	Palisades Nuclear Plant, 50-255

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
4	Person(s) Interviewed, Title(s), Phone Number(s), E-Mail address, short description of organization(s) and duties.	Plant address is Palisades Nuclear Plant, 27780 Blue Star Memorial Highway, Covert, Michigan (MI), 49043. (See the phone listing in the materials provided for phones not shown.) Philip D. Flenner, Senior Licensing Engineer, 616/764-2544~~, E-Mail fln@aol.com~~ Gary W. Foster, Component Engineer, 616/764~~674~~-2684~~, E-Mail gwfoster@worldnet.att.net~~ Robert A. Gambrill III, Component Engineering Supervisor, CE, Engineering Programs; 616/764~~674~~-2497 Thomas E. Bordine, Licensing Manager, CE Daniel Mauck, Crane-Movats, Component Engineer Chet ~~Cynaski, CYNCAM~~Cynoski, CYNCOM, Consulting Engineer Leslie Bradshaw, ~~Value~~Valve Engineer, CE Ronald Penna, Alpine Enterprises, AOV Technical Specialist Judy K. Ford, Manager of Engineering Programs, Engineering Programs Dept., CE, 616/764-2340 Kerry A. Toner, Licensing Supervisor, CE Ken T. Speicher, Systems Engineer CAS, CE Robert A. White, Reliability Engineering Supervisor, CE, 616/764-2860 Paul F. Prescot, NRC Resident Inspector, 616/764-2741 Eric Grindahl, Diesel Generator Engineer, CE R. A. Fenech, Sr. V.P. Generation, CE T. J. Palmisano, Site V.P., Palisades, CE Bill Beach, NRC, Region III Melvin Leach, NRC, Region III Gregory B. ~~Szeozotka~~Szczotka, Manager ~~NAPD~~NPAD, CE Kurt Haas, Director of Engineering (Acting), CE Rob McCaleb, ~~NAPD~~NPAD, CE Phillip Young, Project Engineer, ~~CE~~ DE&S Ken Squibbs, System Engineer Supervisor, CE Paul Fitton, System Engineer Manager, CE R. A. Vincent, Licensing Supervisor, CE Daniel G. Malone, Operations Supt., CE

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
5	If necessary, and if person(s) interviewed can do so, obtain any missing information not provided prior to the site visit, as described in the outline for Task 4 above. Note what information was provided.	We were given the following materials when we arrived and during the course of the discussions: 1. A notebook containing organization charts, the Air-Operated Valve Program Plan, an analysis of the AOV Program scope, a list of Maintenance Rule (10 CAR 50.65) evaluations, and several valve lists. 2. A design basis review of AOVs in the Engineered Safeguards System. 3. Action plans for air systems improvements and instrument air compressor improvements.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
6	Describe plant events involving AOVs and provide reference information, if possible. Recent: Recurring: Significant:	LERs 25578003 and 25581030 were concerned with the significant 1978 and 1981 failure-to-open of a particular shutdown cooling system AOV (CV-3025) when activated at shutdown. ~~The valve is also required to open to mitigate the effects of a small-break LOCA.~~ The single active failure of the valve on each occasion resulted in a rise in core temperature and apparent boiling or near-boiling conditions in the core. We do not know the exact amount of time that it would take to uncover the core, but it is believed to be only a few hours. Following these events modifications were performed to the air system to improve air quality. Through the years following these events there have also been operational changes to ensure the system provides clean, dry air. Although the valve had not failed when called to open at shutdown during the last 16 years, we became concerned that the quality of the air provided by the instrument air system is such that the event could occur again. We expressed our concerns at the exit meeting. However, Palisades believes that the improvements made since 1981 have resulted in a quality air system. Another significant and recent event of interest was the ~~common-cause/common-mode~~ failure of one ~~nine~~ high-pressure air regulators caused by contamination from rust in the high pressure air lines. This situation was originally reported to AEOD in April 1997 but was not covered by an LER. (Palisades Condition Report C-PAL-97-0404, dated 3/18/97, ~~4/22/97~~ and OE 8335 dated 4/7/97 refers to this event.) All of the valves connected to the high pressure air system, that have an active function, have satellite filters installed upstream of the regulators or have nitrogen or instrument air backup that is connected directly to the valves. ~~The conclusion was that the high pressure air system, which serves many ECCS components has not been operating in accordance with industry standards. As a result, the pneumatic equipment (including AOVs) serving the ECCS is highly susceptible to common-cause/common-mode failures.~~

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
7	Describe AOV or air-system actual or detected potential failures at the plant? Provide reference information, if possible.	In discussions with the plant staff in charge of the air system, it became clear that the quality of the air delivered by the instrument air and high pressure air systems at Palisades had a previous history of operating below optimal air quality standards ~~was suspect~~. In addition to the problems noted in item 6, above, we were told that the instrument air system has only one dryer and it is ~~frequently~~ bypassed when required by plant operations (typically less than one day per year). We were also informed that the high-pressure air system's refrigerant dryers do not work as well as a desiccant dryers ~~properly or reliably~~, which has resulted in past ~~resulting in frequent~~ instances of air system contamination (water and/or rust). In addition, several filters in the high pressure air system had been installed downstream of pressure regulators served by the air system rather than upstream. As a result, corrosion products have produced ~~common-cause~~ one pressure regulator malfunctions.
8	Describe actions taken after events or failures involving AOVs or the air system. Provide reference information, if possible.	The plant has focused on the high-pressure air system as part of its Maintenance Rule reviews. The plant conducted a review of their air systems and have added several goals under the Maintenance Rule, some of which are still in the process of being implemented. The high pressure air system was on the a(1) list due to concerns about long term performance. ~~Our additional comments prompted plant management to assure us of renewed and additional attention to the quality of air.~~
9	Were there any actual or potential common mode or common cause failures in the air system or AOVs at the plant? Describe and provide reference information, if possible.	Yes See item 6, above for past failures. Actions to prevent reoccurrence have been taken.
10	Describe root cause analysis procedures for the plant. Provide reference information, if possible.	Not described.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
11	Describe root-cause analyses performed for air system or AOV failures at the plant. Provide reference information, if possible.	Not described. ~~Based on our observations of plant events and LERs, root cause analyses regarding the air systems and AOVs do not appear to be complete~~.
12	Describe maintenance procedures for the air system. Provide reference information, if possible.	Maintenance and operating practices for the air system were discussed at length. The air system~~, including AOVs served by it,~~ is maintained by an engineer and station maintenance personnel ~~technicians~~ dedicated to this system. The station AOV Program is managed by several valve engineers/technicians. Dampers for ventilation and diesel generator air system ~~AOVs~~ are maintained by others. ~~Maintenance of the air system appears to be substandard. See items 6 and 7, above.~~ Air quality with respect to water and particulate content is monitored "periodically." The plant engineers were fully cognizant of the air system design limitations and deficiencies and were pursuing activities to improve the quality of the air supplied by their air systems. ~~The plant engineers do not appear to be particularly concerned about the quality of high-pressure air and instrument air and believe them to be acceptable.~~
13	Describe maintenance procedures for AOVs. Provide reference information, if possible. Safety-related: Important non-safety-related: Non-safety-related:	Palisades has a formal AOV maintenance program and is in the early stages of implementing a plan for improvement of the performance of AOVs similar to that previously invoked and accomplished for motor-operated valves (MOVs), and based on experience with MOVs. (See the material in the notebook provided by the plant engineers.) Diagnostic testing equipment specifically adapted to AOVs is being evaluated. The prioritization of AOV importance is being established from studies implemented to meet the requirements of the Maintenance rule. It appears that the AOVs are getting their deserved attention. ~~and the same should be done for the air systems that serve them.~~
14	Describe IST procedures for the air system. Provide reference information, if possible.	IST is performed on the required ASME Class 1, 2 and 3 components. This excludes much of the instrument and high pressure air systems. ~~No periodic IST is done on the air system.~~ Post-maintenance testing is done on components and portions of the system affected by repairs or maintenance.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
15	Describe IST procedures for AOVs. Provide reference information, if possible. Safety-related: Important non-safety-related: Non-safety-related:	Periodic testing of AOVs is done on Category 1 AOVs and consists of ASME stroke/time testing (no load). Diagnostic testing and bench testing are done on AOVs, although apparently not periodically. Special dynamic testing of AOVs is performed as needed to verify that AOVs can perform their design function.
16	Describe diagnostic systems, if any, used for AOVs. Provide reference information, if possible. Description of system: Specifications: Data collected and frequency of collection: Vendor assistance provided, if any:	Palisades uses a MOVATS Universal Diagnostic System for AOVs ~~MOVs~~ and is trying to adapt the Liberty Technologies ~~new~~ Easy Torque/Thrust (ETT) sensor ~~system~~ for AOVs. Also, the Liberty Technologies Valve Vision System is being used for testing AOVs. They have become quite adept at diagnostic testing because of their MOV experience and believe that they can determine margins using such tools. The new AOV diagnostic system is in the early stages of evolution and Palisades is evaluating the software. See Palisades AOV Program, Procedure EM-28-03, which was included in the notebook provided to us, for further discussion.
17	Describe design (and analysis) procedures for AOVs. Describe how design basis is established and maintained for AOVs. Provide reference information, if possible.	We were provided with a copy of a document entitled "System Level Design Basis Review for Air Operated Valves (AOV) in the Engineered Safeguards System (ESS)." Similar documents for other systems were observed during the visit. Palisades is reviewing their design bases for AOVs to ensure that it is accurate and complete. As part of that process, they are reviewing or revising the original calculations for the valves. In some cases plant calculations are being generated for the first time. Palisades is conducting system and component level design basis reviews of their AOVs, as described in their Program Plan.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
18	Describe analyses and/or testing for verification of operability during postulated transient or accident conditions. Provide reference information, if possible.	Analyses are described in item 17, above. No specific test program is in place for verifying design-basis operability of AOVs, other than dynamic diagnostic testing and comparisons with the EPRI PPM methodology. Dynamic testing is performed if the valves do not exhibit adequate margin. Special test procedures are prepared for the dynamic tests to allow operations to manipulate the plant to maximize differential pressure and flow.
19	Describe training for installation, maintenance, and testing of AOVs. Provide reference information, if possible.	Training for valve disassembly, diagnostic testing, and valve maintenance is provided. We viewed part of the Palisades facility for diagnostic testing and the procedure was demonstrated. The engineers appear to be quite knowledgeable about the various diagnostic systems. ~~available and are in the process of choosing among them for use at the plant~~. Palisades personnel made presentations regarding diagnostic testing at the AUG ~~and international (ICONE)~~ meetings, to the benefit of other plants.
20	Describe databases used to track maintenance, failures, and events regarding AOVs. Provide reference information if possible. On site: Company wide: Industry:	Palisades maintains a number of computerized, on-line databases to track failures and events. These can be sorted for particular valves and valve types. Engineers and technicians are familiar with the operation and performance of equipment in the plant on a detailed level.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
21	Describe the impact of the Maintenance Rule, 10 CAR 50.65 on AOV and air system maintenance and testing. Provide reference information if possible.	Implementation of the Maintenance Rule made the plant engineers consider each AOV and rank the valves in terms of risk-significance, in accordance with industry guidelines. The ranking process resulted in about 11 of ~~75~~ 84 active AOVs in the PSA model being categorized as "high safety significance". Those 11 AOVs are: - CV-3006, LPSI Shutdown Cooling HX Bypass - CV-2010, Condensate T-2 Inlet - CV-0522B, Normal Steam to P-8B from SG "A" - CV-3025, Shutdown Cooling HX to LPSI - CV-3029, Containment Sump Isolation to ESS Pumps - CV-3030, Containment Sump Isolation to ESS Pumps - CV-0779, SG E-50B Steam Dump Control - CV-0780, SG E-50B Steam Dump Control - CV-0781, SG E-50A Steam Dump Control - CV-0782, SG E-50A Steam Dump Control - CV-3055, Shutdown Cooling Inlet to Shutdown HX.
22	Is PRA data used for predictive maintenance or replacement of AOVs? If so, how?	PRA is receiving limited use as an input to determine predictive ~~Predictive~~ maintenance activities on ~~of~~ AOVs. ~~was not a current maintenance practice. Corrective maintenance appears to be the norm. It is anticipated that full implementation of the Maintenance Rule will change this.~~
23	Are AOVs serviced on site, serviced off site, or replaced as piece-parts if found to require service?	No standard service process is used. Maintenance, repair, or replacement methods depend on the circumstances. Selected AOVs do have maintenance procedures that discuss overhauls and predictive maintenance checks.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
24	Identify and describe the most common recurring maintenance problem(s) and failures regarding AOVs and the air system. What did you see? Provide reference information if possible.	The following are design related issues not common recurring maintenance problem(s) and failures. Palisades has not experienced any common recurring maintenance problems associated with the instrument air system since 1981. There is only one dryer for the instrument air system. As a result, when the dryer must be taken off line for any reason, the compressor after cooler is relied upon for air drying. ~~no air drying is available. This resulted in contamination of the air system from moisture and corrosion products, and elevates the risk of common-cause/common-mode failures. A backup dryer is available but, because of the expense, had yet to be installed. Air quality was monitored infrequently.~~ The high-pressure air system serves both safety-related ECCS equipment and non safety-related equipment. Refrigerant dryers for the non safety related high pressure air system tends to freeze up and so it is necessary to cycle the compressors to prevent that. An adjustment was made to the drain valve timer to ensure moisture does not remain in the air dryer exchanger. This problem has not been experienced on the safety related equipment. Recently, an air ~~several~~ regulators was ~~were~~ found to have failed due to ~~because~~ corrosion products in the air, which plugged the small regulator orifice. ~~which~~ The corrosion products were caused by moisture in the air system. ~~, plugged the small orifices in the components.~~ In addition, several filters on passive valves are installed downstream of the air regulators in the high pressure air system rather than upstream. ~~of them.~~

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
24 cont'd.	Identify and describe the most common recurring maintenance problem(s) and failures regarding AOVs and the air system. (Continued)	One valve CV-3025 (high risk-significance AOV, see item 21), used for shutdown cooling, failed in 1978 and again in 1981 in single-failure incidents that led to boiling, or near-boiling conditions in the reactor during shutdown. ~~Although the~~ The valve ~~had~~ has been modified (provided with a hand wheel), and has not failed since 1981~~, the quality of the air in the air system is suspect, and therefore, so is the potential performance of this valve.~~ This AOV is now ~~only~~ stroked quarterly to satisfy ASME/ ANSI OMa-1988 requirements ~~during shutdown when it is called upon to operate.~~ Previously, CV-3025 was stroked on a cold shutdown frequency. See item 6 in this table for additional information concerning the history of this AOV. The Compressed Air System SSDC provides detailed information on the licensee's assessment of the Palisades air systems. The SSDC report was design oriented and would not have included the CV-3025 event ~~It was noted that the CV-3025 valve was not mentioned in Attachment B of that report, which describes air system functional requirements.~~ (Continued on next page.)

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
24 cont'd.	Identify and describe the most common recurring maintenance problem(s) and failures regarding AOVs and the air system. (Continued)	Several SOV related events have occurred. One event of interest, documented in LER 25592007, occurred on February 5, 1992 while the plant was operating at 100% power. As a result of an ongoing Equipment Classification (Q-list) review program it was determined that the main steam isolation valve (MSIV) actuator solenoid valves could be rendered inoperable by a main steam line break outside of containment. There were several contributing factors related to the cause of the MSIVs solenoids not meeting the EQ rule (10 CAR 50.49) requirements regarding electrical isolation: - The redundant set of solenoid valves were installed in a non-harsh environment to ensure that the main steam isolation valves would still close in the event of a main steam line break outside of containment. This modification, however, used the same power source as the original SOVs without ensuring appropriate isolation of non-qualified equipment on the power circuit. This resulted in the second set of solenoid valves not being completely redundant. - In 1981 the plant environmental qualification (EQ) project evaluators believed the FSAR to be correct. They failed to realize that the FSAR was incorrect and that the non-harsh environment solenoid valves were truly not redundant. Based on the erroneous information the MSIV solenoids were removed from the EQ list.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
24 cont'd.	Identify and describe the most common recurring maintenance problem(s) and failures regarding AOVs and the air system. (Continued)	Another event that described inadequate environmental qualification of SOVs which are piece-parts of AOVs is documented in LER 25592016. SOVs and position switches for the control valves which control the service water flow from the CCW Heat Exchangers were not environmentally qualified in accordance with 10 CAR 50.49. SOVs SV-0823A, SV-0823B, SV-0826A, SV-0826B, and position switches POS-0823 and POS-0826 provide control and indication for control valves CV-0823 and CV-0826 which control the service water flow from the CCW Water Heat Exchangers E-54A and E-54B, respectively. These components were not qualified for a high-energy line break outside containment and were not on the EQ list. Furthermore, they were not electrically isolated from environmentally qualified instruments in the same electrical scheme. The root cause for this event was attributed an inadequate engineering analysis.
25	Interviewer comments regarding actual valves viewed during the visit, in the plant, undergoing maintenance or replacement, or in the plant stock system, if applicable to this interview.	We did not have time to view specific AOVs in the plant itself, however, we saw several AOVs in a test/training facility and viewed diagnostic testing devices that the plant uses.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
26	Has the plant made changes to valves or systems that include AOVs, or replaced AOVs with different models of AOVs or different valves that are not AOVs? If so, describe the changes and the circumstances. What prompted the change? Was the change made for this plant only?	In the specific case of CV-3025, a handwheel was added as an emergency operation measure. Based on poor performance of the original valves and as a result of the guidance from NUREG 1275 Vol 6, several solenoid valves throughout the plant were replaced with different models. Palisades has made changes to the air system as described in Attachment 4.
27	Does the plant follow EPRI/NMAC guidelines for maintaining AOVs and the air system(s)? If not, describe differences and reasons for the differences. Provide reference information, if possible.	Industry guidance, including EPRI/NMAC guidelines, are consulted when formulating plant procedures. Explicit compliance with industry guidance could not be determined. Palisades is part of an EPRI pilot program on AOVs similar to the one described to us in more detail at Fermi 2, and is using the ~~based on~~ EPRI's Performance Prediction Program devised for motor-operated valves. Palisades and EPRI are involved in a collaborative agreement to develop design basis AOV calculations. ~~EPRI is providing funding for analyses of the design of AOVs at Palisades.~~
28	What is the plant doing or planning to do in response to the recent Industry correspondence on AOVs. Provide reference information, if possible.	See item 27.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
29	Do you have any suggestions for improving the performance of AOVs, particularly in the areas of surveillance, testing, or maintenance?	Plant engineers discussed several updates to the air system that had been proposed to management to improve air quality and the subsequent performance of air-operated equipment. Among those were installation of a replacement ~~redundant~~ dryer for the instrument air system and relocation of filters in the high pressure air system. ~~However, plant management rejected the proposal to add a redundant dryer.~~ The licensee has ~~still not~~ relocated most of the high-pressure air system filters that were ~~found to be~~ downstream of the air regulators and the remaining filter relocations are scheduled to be completed before the end of 1999 (see item 24).
30	Provide a list of 10 CAR 50.59 and 10 CAR 50.72 reports on AOVs and AOV support systems (air or inert gas supply, etc.) that have been issued for this plant.	None provided beyond the LERs previously found by AEOD/INEEL.
31	What thrust or torque margins are expected for AOVs? Are different margins used for safety-related, important non-safety-related, or non-safety-related AOVs?	A number of "20%" was discussed as an acceptable margin. Details on existing margins for AOVs were not provided. Note: This question was asked to get an idea of what engineers considered to be an acceptable margin. There was no attempt to establish any sort of commitment to a particular value.
32	What maintenance or surveillance is done to AOV accumulators to ensure air/nitrogen quality and pressure? Were seismic considerations and size verified?	Surveillance on containment isolation valve accumulators are performed every outage. Accumulator leakage is monitored and trended. The testing validates that the accumulator can maintain the valve closed for up to 4 hours. ~~No surveillance.~~ Seismic design is in accordance with the design basis and FSAR commitments.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISIT TO THE PALISADES NUCLEAR PLANT		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION
33	Describe problems with pressure regulators, if any.	A significant and recent event of interest was the ~~common-cause/common-mode~~ failure of one ~~nine~~ high-pressure air regulators caused by contamination from rust in the air lines. This situation was originally reported to AEOD in April 1997 but was not covered by an LER. The conclusion was that the high pressure air system regulators were not being maintained and cleaned per the vendor's recommendations ~~was not delivering clean and dry air to the equipment it serves. We believe that this is a significant common cause failure and indicates the presence of corrosion products in the air system.~~
34	Describe problems with feedwater regulating valves, if any.	Not discussed.
35	What, if any, is your involvement with the AOV Users Group? Describe.	Gary Foster and Bob Gambrill are active participants in the AOV Users Group. Palisades personnel made presentations regarding diagnostic testing at the AUG. ~~and international (ICONE)~~ meetings.

ATTACHMENT 4

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

REVIEW AND COMMENTS ON DRAFT REPORT "EVALUATION OF AIR-OPERATED VALVES AT U.S. LIGHT-WATER REACTORS"

ADDITIONAL SUPPORTING INFORMATION ON IMPROVEMENTS TO THE AIR SYSTEM

3 Pages

ADDITIONAL SUPPORTING INFORMATION ON IMPROVEMENTS TO THE AIR SYSTEM

Significant improvements have been made to the Instrument Air System since 1978. A chronology of enhancements and list of operational improvements is provided below. The Instrument Air System is currently rated as satisfactory and stable on the most recent Palisades System Health Report.

1. Reversed the Inlet and Outlet piping to the Air Receiver Tanks to place the Outlets at the top of the tanks (1978 Specification Field Change SFC-78-100).

2. Installed air line blowdowns to remove accumulated moisture and foreign particles (1979 Specification Field Change SFC-79-046). Air Receiver Tanks were supplied with auto drain traps.

3. Replaced Instrument Air Dryer (M-2) with a near like for like purge replacement (1981 Specification Field Change SFC-81-130).

4. In 1986, FC-684 installed a new larger (300 scfm capacity) electrical desiccant heater air dryer. The new dryer has almost twice the capacity of the normal plant air flow. This FC also installed pre and post filters with the pre filter being a coalescing filter with drain valves on a timer.

5. In 1986, FC-675 installed nitrogen backup to Aux Feedwater Valves.

6. In 1986, FC-694 installed blowdown taps at selected low points on the Instrument Air lines.

7. In 1987, FC-722 installed 5 Nitrogen Stations as backup to Instrument and High Pressure Air Systems.

8. In 1988, FC-801 replaced one of the three Instrument Air Compressors with a high capacity compressor to supply full plant load. This provided a second train of Instrument Air. Previously, two of three compressors were required to be in operation.

9. In 1996 Palisades replaced the Instrument Air After Coolers and Separators (E-18 A and C) and initiated an annual preventive maintenance cleaning activity on the after coolers associated with Instrument Air Compressors C-2A and C-2C. These repairs/replacements have resulted in much better moisture removal. The after coolers are maintained in continuous service when C-2A or C-2C is in operation.

10. In 1996, C-2A and C-2C were placed in continuous operation to take advantage of the moisture reduction of the Instrument Air Aftercoolers (E18A & C).

ADDITIONAL SUPPORTING INFORMATION ON IMPROVEMENTS TO THE AIR SYSTEM

11. In 1996 the piping was sloped to ensure moisture would accumulate in the air receiver tanks where an auto drain system was previously installed to facilitate moisture removal. Hanger adjustments and pipe modifications were performed.

12. Instrument Air dew point is checked once per year by PPAC X-CHEM208. At atmospheric pressure the dew point is -95° F. When adjusted for line pressure, the dew point is approximately 0° F. Palisades is very comfortable with the dew point for the very limited amount of time that the Instrument Air Dryer (M-2) is out of service for maintenance. During winter months Service Water temperatures are low (32° F to 40° F) keeping the aftercoolers air discharge temperature below 40° F, this condition will provide drier air to the plant instruments. This is the best time to perform annual M-2 maintenance, provided Instrument Air Aftercoolers E-18A and E-18C are in service.

13. The M-2 Instrument Air Dryer crystals are inspected daily by Operations / Systems. The crystals color (blue or pink) indicate dryer performance.

14. Instrument Air System low points are blown down monthly. No moisture has been observed during these activities.

15. New after coolers initially produced more particulate material entering the prefilters. This is now trending down. This was an initial result of sending drier air from the compressors to the M-2 Air Dryer.

16. Instrument Air System leakage/usage since 1995 has been drastically reduced. The system flow rate went from 260 scfm to a total flow of 190 scfm.

17. Particulate size and moisture content of Instrument Air are well within specifications. Redundant coalescing prefilters with drain timers and redundant one micron post filters (one pre and post filter) are always in service.

18. We do not presently have a dual air dryer. Palisades understands the limitations of this design and maintenance is scheduled during periods of drier/cooler weather and cooler lake temperature.

19. Instrument Air Aftercoolers E-18A and E-18C are cleaned every year during annual PMs on the compressors. This has resulted in cleaner and drier service air to the Instrument Air Dryer (M-2). Palisades also observed improvements in M-2 performance and reliability and a reduction in maintenance of the M-2 switching valves.

ADDITIONAL SUPPORTING INFORMATION ON IMPROVEMENTS TO THE AIR SYSTEM

Summary

The Palisades Instrument Air System is significantly improved from the Instrument Air System of the early 1980's. Since these operational changes, the monthly blow downs of Instrument Air have resulted in less moisture being seen in the system. Instrument air low points have not generated any trapped moisture and measured dew points are exceptional.