U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No.: 50-440/92005(DRS)

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Licensee: Cleveland Electric Illuminating Company
Post Office Box 5000
Cleveland, OH 44101

Facility Name: Perry Nuclear Power Plant - Unit 1

Inspection At: Perry Site, Perry, Ohio

Inspection Conducted: May 11 through 15, 1992

Inspectors: _____ 6-3-92
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Approved By: _____ 6-3-92
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Materials & Processes Section

Inspection Summary
Inspection conducted May 11 through 15, 1992 (Report No. 50-440/92005(DRS))
Areas Inspected: Announced safety inspection of the licensee's program on check valves as directed by Temporary Instruction (TI) 2515/110, "Effectiveness of Licensee Activities Regarding the Performance of Safety-Related Check Valves". The check valve program review included the following: scope; management involvement; check valve reliability; design application; control, evaluation and implementation of industry information; testing program; maintenance program; corrective action program; preventive maintenance program; use of non-intrusive test methods; training; walkdown observations, and licensee self assessment.
Results: No violations or deviations were identified during the inspection. The licensee's formal check valve program was in the process of being developed at the time of the inspection. Many components of the program were already in place through the inservice test program (ISTP), surveillance instructions, generic maintenance instructions, and repetitive tasks, although no administrative procedure to control the check valve program had been developed.

The licensee demonstrated weaknesses in the following areas:

- No formal administrative procedure to control the check valve program including preventive maintenance, testing, trending, and maintenance history.
- No formal basis document for the ISTP.
- The lack of non-intrusive testing methods being performed in lieu of check valve disassembly.

The licensee demonstrated strengths in the following areas:

- The maintenance training program was a strength including comprehensive texts, challenging examinations, and practical training on sample check valves.
- A good engineering analysis and a comprehensive review of the valves included in the check valve program was performed. The documentation associated with this effort was very good and provides a good basis for the check valve program.

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DETAILS

1. Persons Contacted

Cleveland Electric Illuminating Company (CEI)

#S. F. Kensicki, Director, Perry Nuclear Engineering Department (PNED)
#V. J. Concel, Manager, System Engineering Section (SES), PNED
#W. E. Coleman, Manager, Quality Assurance Section (QAS)
#W. D. Dervey, Supervisor, Component Performance Unit, SES
#H. L. Hegrat, Supervisor, Compliance Engineering Unit
#J. J. Lausberg, Supervisor, Technical Quality Unit, QAS
#H. M. Coon, OER/CTS Lead, Operating Experience Utilization Unit, PNED
R. L. Scherman, Equipment Analysis Lead, SES
T. A. Lentz, Lead NSSS Design Engineer, PNED
D. B. Miller, Lead QA Engineer, QAS
#S. R. Seman, Lead ISI Engineer, SES
#B. L. Andrie, ISI/IST Engineer, SES
#G. O. Christen, Check Valve Coordinator, SES
#R. Gaston, Compliance Engineer, Compliance Engineering Unit
B. D. Boles, Auditor, Technical Quality Unit, QAS
C. M. Clifford, NSSS Design Engineer, PNED
#K. Filar, Licensing Engineer, Davis-Besse

U. S. Nuclear Regulatory Commission (NRC)

#P. Hiland, Senior Resident Inspector
A. E. Vegal, Resident Inspector
#F. T. Grubelich, Office of Nuclear Reactor Regulation

# Denotes those attending the exit meeting on May 15, 1992.

2. Scope

The licensee had performed an extensive study on check valves as part of their evaluation of INPO SOER 86-03, "Check Valve Failures or Degradation." This evaluation was well documented and provided a good basis for establishing which valves should be included in the check valve program.

On April 30, 1992, a memorandum was issued establishing the "Check Valve Program," Revision 0, and assigning an individual as the Check Valve Coordinator. The memorandum defined the intent and scope of the check valve program, delineated responsibilities and requirements, stated an intent to enhance predictive and preventive maintenance programs and, to identify plant and industry problems and take appropriate plant action. The check valve program

currently included some existing programs, such as surveillance instructions (SVIs), generic mechanical instructions (GMIs), inservice testing program (ISTP) and repetitive tasks (REPTs).

As an attachment to the memorandum, a listing of plant check valves in safety related and non-safety related systems was provided which showed the presence of the valves in either or both of the ISTP and INPO SOER 86-03 portions of the check valve program. The attachment will be incorporated into a formal plant procedure, however, a scheduled completion date had not been determined. In addition, the specific information and administrative requirements to be included in the procedure had not been established. No other document existed to establish a formally documented preventive maintenance program for check valves or to specify prioritization or frequency of performance monitoring or preventive maintenance activities. Although there was good basis already in place for the program, the licensee needed to incorporate program specifics and institute administrative guidance and interfaces in sufficient detail to form a comprehensive program document.

3. Management Involvement

The inspectors interviewed site personnel and reviewed a variety of documents to assess the degree of management involvement in the development and implementation of a comprehensive check valve program. Based on the responses to NRC Information Notice (IN) 82-20,"Check Valve Problems," INPO SOER 86-03, and NRC Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," significant effort to develop background information for the program was evident. However, there appeared to be a delay in implementing some of this information into the ISTP and developing a formal check valve program. Although the formal program implementation was in its infancy, there now appeared to be a good level of support for the program.

4. Check Valve Reliability Program

There were 380 check valves listed as SOER 86-03 program valves. Of these, 15 safety and non-safety related valves were disassembled and inspected for abnormal wear and degradation based on the engineering study prepared by the licensee in 1989 and 3 were disassembled and inspected based on licensee commitments. A memorandum dated May 15, 1992,

summarized the basis for establishing the frequencies of inspection for the valves identified in the engineering study. The memorandum and several of the repetitive task documents used to perform the inspections were reviewed and no deficiencies were noted.

An additional 46 valves were listed as requiring disassembly and inspection during refueling outages under the current requirements of the ISTP. These valves, along with the valves described above, were subjected to the disassembly, inspection, and measurement program detailed in GMI-013, "Check Valve Disassembly/Exercise Instruction," Revision 3 with TCN-2. According to the licensee, previous disassembly and inspection activities did not consistently require valve internals removal and measurement of critical dimensions, but this was now the practice.

All but 10 valves subject to the ISTP were also reviewed under the SOER 86-03 study. This was considered a good overlap of the two programs.

5. Design Application Review

The inspectors reviewed a document titled, "SOER 86-03 Engineering Check Valve Application Evaluation," which was issued for use April 12, 1990. This document presented the results of an engineering evaluation that was initiated in March 1988 in response to SOER 86-03. The evaluation employed the results of a previous study completed in 1983 by the Architect-Engineer, Gilbert Associates, which reviewed all safety related check valves in response to IN 82-20 concerning check valve misapplication.

The evaluation addressed 380 valves selected from plant systems corresponding to the systems identified in EPRI report NP-5479, "Application Guidelines for Check Valves in Nuclear Power Plants," and additional systems identified by the licensee as important to plant safety. Each identified valve was categorized based on frequency and type of operation (Category 1-5).

The design review performed for the selected check valves addressed the misapplication factors identified in the SOER 86-03 and EPRI documents, but did not specifically address additional considerations such as susceptibility to corrosion, incompatibility of materials, potential blockage due to siltation, relative importance to safety, effects of plant transients, or other factors which should be considered in a comprehensive assessment of check valve degradation or failure mechanisms. Check valves which were determined to have potential instabilities were classified in five groups (Class A-E).

The study identified a total of 92 valves in 15 systems as potential problems. Nine clearway check valves located less than 10 pipe diameters downstream from turbulence creators and/or had low fluid velocities and six tilting disk valves were included in the list of valves to be disassembled and inspected as part of the ISTP. No other preventive maintenance tasks were proposed for the remaining 77 potential problem valves that were not required to be disassembled and inspected on a periodic basis.

Except for the lack of consideration of check valve degradation factors beyond those addressed in INPO SOER 86-03, the inspectors found that the engineering evaluation was comprehensive, considered appropriate vendor and industry data and information, and provided a rational basis for screening potential problem valves from the total population of check valves analyzed.

6. Control, Evaluation and Implementation of Industry Information

The process of receipt, control, evaluation, and implementation of NRC generic communications, vendor reports, and industry information was reviewed. The process is controlled by procedure POP 1503, Rev. 2, "Evaluation of Operating Experience Reports (OER's)." The titles of the onsite groups controlling this process had been changed, however, the procedure was not updated to reflect these changes. This was only an administrative issue that the licensee had already identified. The Operating Experience Utilization Unit (OEUU) receives these type of documents for initial screening for applicability, priority determination, and assigning appropriate technical reviewers. The reviewers provide OEUU with their conclusions as to applicability and if required, commitment sheets with action items to be accomplished. A meeting is held to discuss the review groups' results and action items are then placed in the Perry Regulatory Information Management System (PRIMS) for tracking. Each action is assigned to a group with an associated closure date. When the required action is complete, the assigned group provides OEUU with a closure document.

A sample of Information Notices (IN) and a 10 CFR 50, Part 21 reports associated with check valves were reviewed to evaluate the process. It appeared that information was being received, evaluated, tracked, and implemented in an adequate manner.

7. Check Valve Testing Program

The inspectors reviewed a number of selected check valves in the plant systems. The reviews were conducted to verify that selected valves were included in the ISTP, test procedures reflected all safety-related function testing requirements, and the guidelines and issues of GL 89-04 were addressed in the valve testing.

A total of 43 check valves were selected for review from the standby liquid control, condensate transfer, low pressure core spray (LPCS), high pressure core spray (HPCS), reactor core isolation cooling, suppression pool makeup, feedwater, demineralized water, and emergency service water systems. The standby diesel generator and associated support systems and the control rod hydraulic control units (HCUs) were also reviewed to assess the degree to which safety-related skid mounted check valves were addressed in a testing program.

Testing was being performed under Revision 2 of the ISTP plan. This plan was revised in accordance with the guidance of GL 89-04 and submitted to NRC for review in accordance with the GL 89-04 requirements for plants without a Safety Evaluation Report (SER). The licensee provided documentation of a meeting held between NRC and licensee representatives in March 1991 concerning the ISTP and the degree of compliance to NRC guidance and requirements. Revision 3 to the program plan was submitted to the NRC on July 30, 1991, and incorporated the resolutions agreed to in the March 1991 meeting and subsequent discussions. As a result of the status of the ISTP, the review was limited to selected valve tests and the skid-mounted packages identified above.

The four ball check valves associated with each of the 177 hydraulic control units (HCUs) were reviewed to determine if they were incorporated in a testing program. Three of the four valves were included in the ISTP and had appropriate testing requirements, but valve 1C11-0137 was not identified in any testing program. GL 89-04, Position 11, requires that skid-mounted valves that perform a safety function be included in a testing program. The licensee committed to incorporate the missing valve in the appropriate test procedure to verify its proper operation.

Similarly, the check valves associated with the standby diesel generators were reviewed and discussed with the responsible system engineer. The system engineer identified additional check valves associated with the fuel oil filters and the lube oil system that were not included in the testing program, and stated that additional check valves would probably be identified following a detailed review of

the fuel oil, lube oil and other skid-mounted support systems. As with the HCU valves, the licensee committed to perform a review of the three diesel generators and include all identified check valves associated with the safety-related function of the diesel generators in the appropriate test procedures.

Based on the review of ISTP test procedures for the selected sample of valves, the inspectors found that, typically, full flow exercise testing of check valves did not meet the guidance of the NRC's response to Question 7, Position 1 as stated in the minutes of public meetings on GL 89-04. The response stated that tests should be run at the pump maximum flow rate. Flow rates were established based on achieving a pump differential pressure, and valves were deemed acceptable if minimum (alert) flows were achieved. Although flow rates were typically recorded during the tests, trending to determine if check valve degradation might be occurring may not be reliable based on minimum flow rates. The licensee should investigate means to achieve check valve degradation data from IST test information that would correspond to the cited GL 89-04 position.

A significant amount of alternative position testing of check valves was performed, some of which was in excess of ISTP requirements. This was considered a positive step by the licensee to encompass concerns of backflow testing mentioned in GL 89-04 and other concerns associated with testing all safety positions of check valves.

No formal document had been prepared to address each safety-related, ASME Code Class 1, 2, and 3 valve and provide the basis for its presence in or absence from the ISTP and the basis for the types of testing performed on the valves. The licensee expressed confidence that all safety-related active valves have been included in the ISTP, based on the detailed review with the NRC in March 1991 and reviews performed by the licensee and its contractors. The need for such a document was recognized by the licensee, but the preparation effort had not received a high priority to date. At the exit meeting, the licensee presented documents that might provide this basis for the ISTP, however, this documentation was not reviewed by the inspectors. The development of this document would provide additional assurance that all valves were included in the ISTP and that appropriate testing was being conducted.

8. Maintenance Program

The performance of any physical maintenance on equipment at Perry plant required initiation of a Work Request or input from the product of the Repetitive Task Program computer.

In either case, the document passed through an organized process for integration into the plant work schedule. The work was recorded in the Perry Plant Maintenance Information System, which was widely accessible by computers around the plant. Most maintenance of check valves involved procedure OM9B: GMI-0013, "Check Valve Disassembly/Exercise Instruction" and guideline PPTD: PEG-106, "Post Maintenance/DCP Testing".

Hard copies of the completed work packages were retained in the individual valve files and duplicates were kept on microfilm.

Instruction GMI-0013, paragraph 6.0, indicated that post maintenance requirements were "N/A". PEG-106 suggested a flow test or exercising of the valve, but did not indicate how this was to be accomplished. The NRC position on disassembly/exercise and inspection of check valves is that it is a substitute when full flow testing cannot be accomplished, rather than a replacement for full flow testing. Following reassembly, a partial flow test or some other positive means is expected to be performed to ensure that the disk is still free to travel.

9. Trending Program

The licensee had no formal program to control the trending of check valve maintenance, repairs, test results and records from disassembly. However, much of this information was recorded and stored in a computer program identified as, "Check Valve Trending Information". Any testing which produced unusual results was also recorded there. The computer program provided only a brief resume of the work performed. Details of the activities were stored in individual, hardcopy files. The files also included the physical dimensions of pertinent parts of the valve recorded when they were disassembled for periodic inspection to demonstrate operability.

The licensee's inability to determine degraded check valve condition based on flow tests run in accordance with the ISTP was discussed in paragraph 7. Inclusion of this information into the trending program would not be appropriate until a method is developed to generate reliable information.

As a part of the IST program, periodic leak testing results of check valves were also recorded and trended. Although these records were separate from those in the Check Valve Trending Information program, any rework caused by exceeding the leak rate limits was captured by that program.

In essence, the licensee was recording and analyzing much of the required data to the essentially the same extent as would be expected from following a formal trending program. Although the current system appeared to be effective in achieving the desired objectives, the licensee was encouraged to formally define the program in order to ensure that it would present a tangible basis for providing necessary recognition to the effort and to ensure the allocation of appropriate resources to it.

10. Corrective Action Program

The inspectors reviewed several check valve failure documents (condition reports, nonconformance reports and NPRDS data) to evaluate the actions taken to identify the root cause and corrective actions taken. It appears that adequate evaluations were completed to identify the root cause and to provide immediate corrective actions. The Perry Component Failure Analysis Report compared the average failure rates of standard components industry wide (within the NPRDS scope) to Perry components during the 18 month period of 4/1/90 through 9/30/91. The LPCS isolation check valve and 8 other check valves were identified as contributors to failure rates in excess of the industry average. The inspectors reviewed the corrective actions proposed to reduce the incidence of failures in these valves and found them to be appropriate. One valve, 1C11F0122, the control rod drive hydraulic system inboard containment isolation valve, was replaced during the current outage with a different type valve to eliminate continuing local leak rate test (LLRT) failures. The replaced valve will be disassembled in an attempt to determine the root cause for its repeated failures.

11. Preventive Maintenance Program

Preventive Maintenance was controlled in the same way as normal maintenance except that work was normally initiated through the Repetitive Task Program computer output. Some information was made available through the disassembly and exercise instruction. This instruction was designed to record the changes in dimensions of critical valve components in order to predict valve deterioration. Additional information was also available through the leak testing information trended for valves for which such testing is required by the inservice testing or LLRT

programs. Formal guidance for preventive maintenance of check valves was lacking, even though some of the essential elements of such a guidance were already being executed. The development of the check valve program to control preventive maintenance for check valves should be considered. This segment of the program would be expected to prescribe such things as:

- o the modification of the program to accommodate the plants experience with valve failures
- o the methods for adding and deleting valves
- o the criteria for designation of priority of valves and the frequency of testing

12. Use of Non-Intrusive Test Methods

The inspectors reviewed the use of non-intrusive testing (NIT) in determining valve position for ISTP testing and extension of its use to measuring check valve degradation under a preventive maintenance program. NIT was not being performed to verify valve position and only limited use for valve degradation. An Independent Safety Engineering Group report reviewed the status of acoustical NIT monitoring as of May 1991. This report concluded that technology was not reliable and that Perry should wait until the industry confirms a good methodology.

Disassembly and inspection (D/I) of valves, as was being performed extensively in the ISTP, did not provide dynamic valve information, and thus may not indicate problems which exist during operation which could be determined with NIT. Some valves were observed to be removed from the requirements for D/I as a result of design changes, additional review of testing requirements and removal of internals, but a significant number remained. The Nuclear Industry Check Valve Committee (NIC) had published results of Phase 1 water testing which indicated that acceptable methods existed to determine valve open/closed positions in order to satisfy IST program requirements and eliminate the need for D/I. The licensee indicated at the exit meeting that planning was in progress to purchase acoustical monitoring equipment and begin employing it in the testing and preventive maintenance programs.

13. Training

The training program for personnel involved in maintenance and repair of check valves was reviewed. The course material and the time necessary to properly assimilate it were considered appropriate. The written examinations were considered appropriately challenging. The texts given to the student contained more material than was covered in

class so that it would serve as a reference book in the future. Qualification records and examinations were properly stored in locked file cabinets. All training included handling appropriate hardware and the training area had samples of the various valves with which the trainee might come in contact. The current program provided for periodic training of personnel, but did not specify what material was to be covered. Although this should be covered, the need is not yet crucial. The oldest advanced valve training course provided to any maintenance personnel was provided in 1990. The training program was considered a strength.

14. Walkdown Observations

The plant was nearing the end of its 3rd refueling outage at the time of the inspection, and no maintenance or testing was being conducted on check valves. Walkdowns were conducted on parts of the service water and diesel generator system to assess the material condition and installed configuration. No concerns were noted.

15. Licensee Self Assessment

During the last several years the Quality Assurance Section (QAS) has conducted several audits and surveillances of the ISTP program and check valves in general. The inspectors reviewed the results and concluded that the scope and performance of the assessments were of good quality with several good findings. Finding examples included incorrect orientation for 10 of 84 TRW Mission 'Duo Chek' valves during initial installation, minimal effort in updating the ISTP program per GL 89-04, and inadequate testing of the HPCS storage tank test thermo expansion check valve, 1E22-F039 per procedure SVI-E22-T2001. All findings were adequately dispositioned.

16. Exit Meeting

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on May 15, 1992. The inspectors summarized the purpose and scope of the inspection and the findings. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection.