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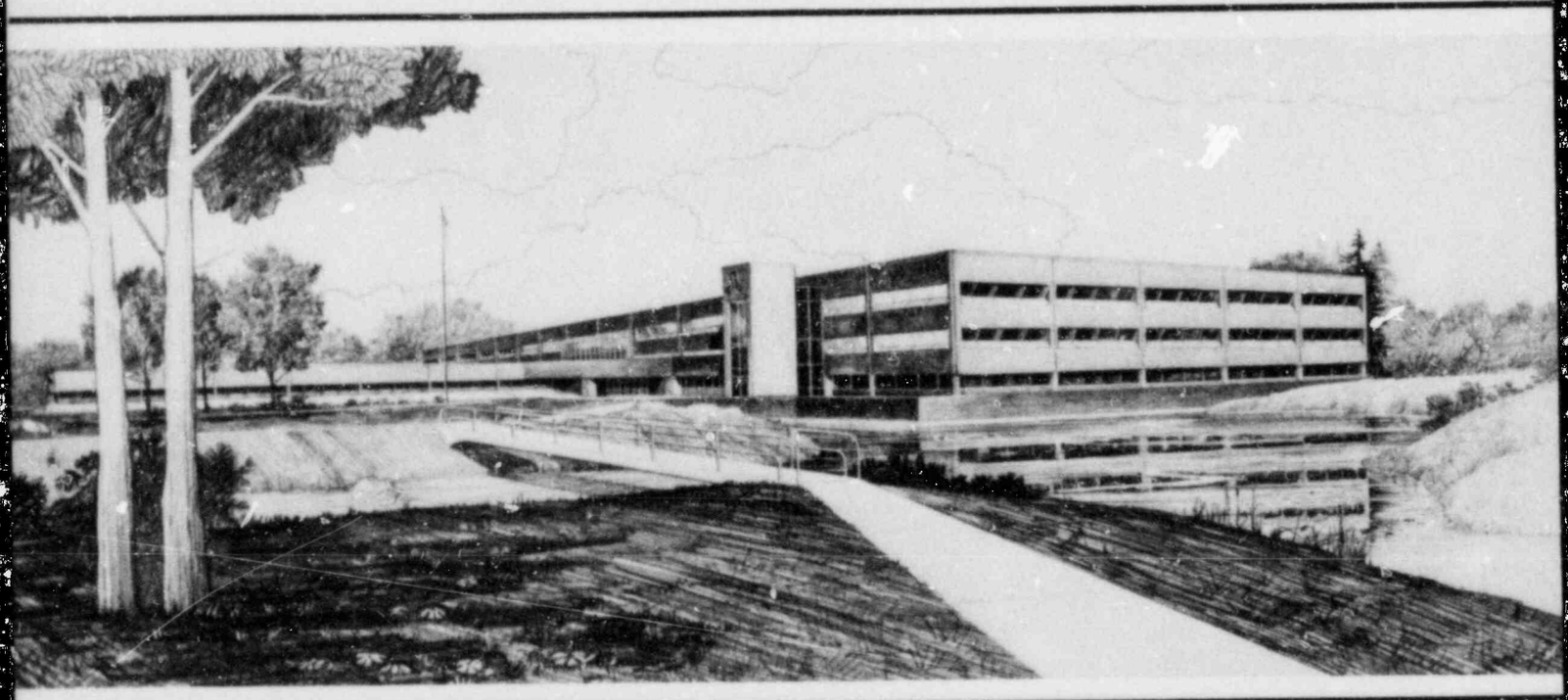
AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE PERRY NUCLEAR POWER PLANT UNIT 1

C. Kido
C. F. Miller

Idaho National Engineering Laboratory
Operated by the U.S. Department of Energy

Informal Report



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Docket No. 50-440

C. Kido
C. F. Miller

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Reliability and Statistics Branch
Engineering Analysis Division
EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

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ABSTRACT

The Perry Nuclear Power Plant Unit 1 was audited August 14 to 17, 1984 to determine the adequacy of their Pump and Valve Operability Assurance Program. The results of this audit indicate that the applicant has established and is implementing a program that will track all pumps and valves important to safety from manufacture and in-shop testing through qualification, installation, testing, maintenance, and surveillance for the purpose of assuring continued operability of these components over the life of the plant.

FOREWORD

This report is supplied as part of the "Equipment Qualification Case Reviews" project that is being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Engineering, Equipment Qualification Branch by EG&G Idaho, Inc., Engineering Analysis Division, Reliability and Statistics Branch.

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SUMMARY

The Pump and Valve Operability Assurance Review Team (PVORT), comprised of one member of the Nuclear Regulatory Commission (NRC) staff and two EG&G personnel, conducted an on-site audit of the Perry Pump and Valve Operability Assurance Program during the week of August 14 to 17, 1984. A representative sample of active pumps and valves was selected for review and evaluation. These components are categorized as either Nuclear Steam Supply System (NSSS) or Balance of Plant (BOP), based upon which organization was responsible for the purchase and installation of the component. General Electric is Perry's NSSS vendor while Gilbert Associates, Inc., an architectural engineering firm, is responsible for the BOP components.

The process used to evaluate the plant's overall Pump and Valve Operability Assurance Program includes: (a) becoming familiar with each selected component and the system in which it is installed, (b) understanding the component's normal and safety function, (c) visually inspecting the component's configuration and mounting, (d) reviewing those documents relating to the operability of each selected component, (e) assuring the applicant has an adequate file system for document retrieval, and (f) reviewing the applicant's preoperational testing and maintenance/surveillance programs.

The results of the evaluation process are two-fold. Component specific deficiencies or concerns can be identified and documented. Of greater importance are any generic findings that are identified which may affect other components in the plant or possibly even extend to other plants.

During the PVORT review a number of concerns were raised. All of the specific concerns were satisfactorily resolved during the audit. The applicant resolved these concerns by supplying additional information or by demonstrating that the appropriate commitments were already addressed by administrative programs. The staff identified three generic concerns as a

result of the audit which will require the applicant to confirm that prior to fuel load (a) all pumps and valves important to safety are qualified, (b) all required preoperational tests are completed, and (c) all new loads are verified to be less than those originally used to qualify the equipment. Other generic topics discussed are of a positive nature.

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TABLES

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE PERRY NUCLEAR POWER PLANT UNIT 1

1. INTRODUCTION

The Equipment Qualification Branch (EQB) performed a two-step review of the Pump and Valve Operability Assurance Program being implemented by the Perry Nuclear Power Plant. The purpose of this review was to determine whether Perry's program is adequate to ensure that pumps and valves important to safety will operate when required during the life of the plant under normal and accident conditions. (Perry is a 1205-MW boiling water reactor (BWR) located ~37 mi east of Cleveland, Ohio.)

The first step was a review of Section 3.9.3.2 of the applicant's Final Safety Analysis Report (FSAR). However, the information provided in this section of the FSAR is general in nature and by itself is not adequate to properly determine the scope of the applicant's overall equipment qualification program as it pertains to pump and valve operability. Therefore, in addition to an FSAR review, a Pump and Valve Operability Review Team (PVORT) consisting of engineers from the EQB and the Idaho National Engineering Laboratory (INEL-EG&G) conducted an audit on August 14 to 17, 1984, of a representative sample of installed pump and valve assemblies and supporting documentation at the applicant's plant site. Table 1 presents the audit components selected by the PVORT.

This on-site audit was a necessary second step that permitted the PVORT to assess the applicant's overall program, as implemented, and thereby determine whether the program meets the intent of the current licensing criteria presented in Section 3.10 of the Standard Review Plan (SRP). Conformance with SRP 3.10 criteria is required in order to satisfy the applicable portions of General Design Criteria (GDC) 1, 2, 4, 14, and 30 of Appendix A to 10 CFR 50 as well as Appendix B to 10 CFR 50.

Section 2 of this report presents the basic methodology used to evaluate Perry's overall equipment qualification program as well as the

TABLE 1. PUMPS AND VALVES SELECTED FOR PVORT AUDIT

NSSS Components		BOP Components	
1E51-C0001	Reactor Core Isolation Cooling Pump	1M16-F0020[a]	Drywell Vacuum Relief Valve
1E21-C0001	Low Pressure Core Spray Pump	0P47-C0001A	Chilled Water System Pump
1E22-F0010	High Pressure Core Spray Test Bypass Valve	1P50-F0140[a]	Containment Vessel Chill Water Isolation Valve
1B21-F0047A[b]	Safety/Relief (ADS) Valve	1M51-F0110	Combustible Gas Control Backup H_2 Purge Valve
1C11-F0180[a,c]	Scram Discharge Volume Vent Valve	1E12-F0048	Residual Heat Removal Balancing Valve
		1E22-C0003[c]	High Pressure Core Spray Water Leg Pump

Note: The applicant has six weeks to prepare the document packages for all but the surprise components; for those he has only three days. The contents of the document package for the surprise components will be an indicator of: (a) the applicant's ability to retrieve documents, and (b) the completeness of his central files.

a. A walkdown was completed for these components; however, the length of the applicant's presentations precluded a complete document review for these components.

b. Applicant provided a separate presentation for the ADS valve (1B21-F0047A).

c. Surprise component--applicant is told about this component on the Friday preceding the on-site audit.

specific concerns raised during the evaluation of each audited component. Section 3 presents the generic concerns resulting from the overall evaluation process. Section 4 presents the staff's conclusions concerning the audit. Sections 5 and 6 present the references for the NSSS and BOP components, respectively.

2. EVALUATION METHODOLOGY

In order to evaluate the adequacy of Perry's Pump and Valve Operability Assurance Program and the extent to which it is being implemented, the PVORT conducted an audit at the Perry site. The first phase of the on-site audit consisted of the applicant presenting the major elements of his overall equipment qualification program. The remainder of the audit consisted of determining whether the major elements of the program had been (or would be) implemented for the set of selected components, see Table 1. By performing a detailed review on a diverse set of components, the PVORT can identify component specific concerns as well as concerns which are generic to the applicant's overall program.

As the first step of the detailed review of the selected components, the PVORT conducted a plant walkdown of each component accompanied by Perry personnel. One purpose of this walkdown was to obtain information that could later be compared with the evidence of qualification contained in each component's document file. Some examples of walkdown information that was compared with relevant documents are: (a) name plate data versus design and purchase specifications, (b) installed configuration and mounting versus the configuration and type of mounting that was tested (or assumed in an analysis), (c) local equipment environment (including the environment that could result from an accident) versus the environment enveloped during required testing, (d) system interfaces versus energy or fluid requirements, and (e) installed functional accessories versus actual equipment tested. In addition, a second purpose of the walkdown was to evaluate each selected component in order to determine whether any operability concerns may have been overlooked up to that point in time. Examples of such concerns are: (a) the potential for flooding, (b) component misapplication, (c) the potential for pipe whip or missile damage, and (d) the potential for personnel interactions that could inadvertently cause a component to become inoperable.

The document review portion of the audit was conducted after the completion of the applicant's program presentation and the walkdown of the selected components. One purpose of the document review was to verify that

the principles established in Perry's program had been (or would be) uniformly implemented. Therefore, the document file for each of the audit components was reviewed to ensure that, as a minimum, each file contained the following:

- o A purchase specification that reflects design and functional requirements
- o Results of applicable in-shop tests
- o Evidence that the component was subjected to a qualification plan that addressed:
  - Pre-aging
  - Significant aging mechanisms
  - Normal and accident loads (including seismic and hydrodynamic loads)
  - Acceptance criteria requiring operability both during and after an event
  - Identifiable margins
- o Applicable preoperational test procedures
- o Similarity statements (if applicable)
- o Evidence that Perry maintenance/surveillance practices incorporates qualification and operability concerns.

In addition, a second purpose of the document review was to ensure that an auditible link existed between the documents in a file and that all documents had been reviewed and approved by personnel having a working knowledge of equipment qualification issues and concerns. Those documents

not present in the audit component document file were requested by the PVORT. Perry's timely response to these requests and their ability to compile a complete file for the surprise components were considered to be positive indicators of the acceptability of the applicant's central file system.

The remainder of Section 2 is devoted to describing each of the audited components and discussing any concerns raised by the PVORT as a result of the equipment walkdown and document review portions of the on-site audit.

2.1 Nuclear Steam Supply System (NSSS) Components

2.1.1 Reactor Core Isolation Cooling Pump, 1E51-C0001, (Audit Status: Closed)

2.1.1.1 Component Description. This component is a four-stage centrifugal pump manufactured by the Bingham-Willamette Co. (Model 6 x 6 x 10-1/2 D) and driven by a steam turbine manufactured by the Terry Corporation (Model GS-2N). The component is part of the Reactor Core Isolation Cooling (RCIC) system and is located in the reactor building at the 578-ft level (N9°). The pump is normally in standby. Its safety function is to start and pump water from the condensate storage tank (alternate supply is the suppression pool) to the reactor vessel to ensure adequate core cooling in the event of low reactor water level.

2.1.1.2 Component Walkdown. The walkdown of this component revealed that the pump was bypassed from the RCIC system so that the rest of the system could be flushed. In addition, it was noted that the turbine had numerous deficiency tags attached. Four of these deficiency tags dealt with insufficient environmental qualification for certain functional accessories on the Terry turbine. The applicant explained that the reason for these tags was to indicate that the environmental qualification documents for the accessories had not yet been reviewed and approved by Perry personnel. A subsequent review of the Quality Control tagging procedures provided confidence that all deficiencies would be adequately resolved prior to tag removal.

Another concern involved the oil level in the pump bearing housings. Instructions indicated that an oil level of 2-15/16 in. be maintained. However, there did not appear to be any way of adequately checking for such a precise level. Further investigation, during the document review, revealed that the oil bulb which tapped into the bearing housing automatically controlled the proper oil level.

2.1.1.3 Document Review. The review of the qualification documents[1-7] indicated that qualification of this component was addressed by a combination of tests and analyses. Two concerns surfaced during the review, one involving the pump turbine interface and a second involving followup of the turbine test results.

The pump had been qualified by analyses while the turbine had been qualified by seismic testing, but neither had directly considered the coupling between the two. Discussions with General Electric and Perry personnel as well as a review of the vendor manual for the coupling confirmed that the coupling design would adequately handle the magnitude of expected deflections.

The second concern resulted from a review of the seismic test report. During the actual testing two failures occurred--one involving loose bolts and a second involving inadequate support for the turbine's lube oil piping. The objective of PVORT's concern was to ensure that the lessons learned by these failures had been adequately addressed by the applicant. The applicant responded by providing evidence that demonstrated that (a) the bolts in question were required by plant maintenance procedures to be periodically torqued and (b) a bracket had been installed on the turbine lube oil line at Perry as a result of the test failure. Based on these responses the PVORT considered these operability concerns to be closed.

2.1.1.4 Findings. No specific operability concerns remained after the evaluation of this component.

2.1.2 Low Pressure Core Spray Pump, 1E21-C0001, (Audit Status: Closed)

2.1.2.1 Component Description. This component is a vertical (deep draft) five-stage centrifugal pump manufactured by Byron Jackson (Model 30DX-20CKX-H4) driven by a 1750-hp induction motor manufactured by General Electric (Model 5K6347XC100A). The pump is located in the auxiliary building at the 574-ft level and draws water from the suppression pool (593-ft level). The pump is normally in the standby state. Upon indication of low water level in the reactor vessel or high pressure in the drywell the pump starts automatically to provide spray cooling and makeup water during large break accidents. The LPCS pump can also be operated by manual switches located in the control room.

2.1.2.2 Component Walkdown. The walkdown of this component did not reveal any operability concerns.

2.1.2.3 Document Review. The PVORT's review of the qualification documentation[8-19] revealed that operability was addressed by a combination of tests, analyses, and vendor operating experience. One of the PVORT's concerns was that the installed pump assembly did not have actual operating experience. Operability of the pump assembly was addressed by analyses, shop tests, and operating experience for a similar pump. The applicant explained that similar design units were installed at Grand Gulf and had successfully completed all required tests. Upon further investigation the PVORT assured themselves that the applicant had compared the results of shop tests for the similar pumps to analyses performed on the installed unit.[a] On the basis of this evidence and the applicant's commitment to complete site preoperational tests prior to fuel load, the PVORT's concerns were adequately addressed.

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a. The applicant based his analyses on manufacturer recommendations, such as pump/motor interface loading, bearing loads, operating vibration levels, clearances and deflections of rotating parts, and material selection.

The applicant's response to IE Bulletin 79-15, "Deep Draft Pump Deficiencies," was reviewed. The applicant had not yet acquired in situ operating data but indicated that performance tests at the vendor's shop confirm that the operating vibration levels were not excessive enough to be included with the vibration levels calculated for the dynamic analysis. The applicant also indicated that preoperational tests will be performed prior to fuel load and that the pumps will be tested quarterly to monitor bearing temperature, developed head, and vibration levels. Finally, although operating experience of a similar design pump at Grand Gulf provides further confidence that this component will function as required, the PVORT recommends that the applicant participate in forthcoming LRG-II meetings and comply with any requirements which address deep draft pump deficiencies.

2.1.2.4 Findings. No specific operability concerns remained after the evaluation of this component.

2.1.3 High Pressure Core Spray Test Bypass Valve, 1E22-F0010, (Audit Status: Closed)

2.1.3.1 Component Description. This component is a 10-in. ANSI Class 900 globe valve manufactured by the Anchor Darling Valve Co. (Model--none assigned) with a motor operated actuator manufactured by Limitorque (Model SMB-4-200). The valve is in the test return (bypass) line from the HPCS discharge to the condensate storage tank and is located in the auxiliary building at the 574-ft level. The valve is only open when the HPCS system is being tested for full flow and injection into the reactor vessel is not desired. If open, its function is to close to realign injection into the core in the event injection becomes necessary.

2.1.3.2 Component Walkdown. As was the case with many of the audited components, this component had a number of deficiency and other tags attached. These tags were noted and later confirmed to be correct and up to date, according to the applicant's tagging procedures and records. One minor concern was noted involving the valve's manual operating lever;

it did not have an instruction tag attached. Given that the manual operation of this valve was identical to those on numerous other valves throughout the plant, the PVORT felt that a trained operator would be able to correctly operate the valve. The applicant was apprised of this situation and he stated that the problem would be resolved at a later date.

2.1.3.3 Document Review. The review of the qualification documents[20-23] indicated that qualification of this component was addressed by a combination of test (actuator) and analyses (valve). The PVORT's primary concern relative to this component was to ensure that the valve would close, and close fast enough, so that the required HPCS flow would enter the reactor within design limits. The applicant's response to this concern was to point out that the probability of having a small break in conjunction with the HPCS system being in test is extremely small (i.e., $<10^{-7}$); therefore, the automatic operation of the test valve was not factored into the system design. In the event that this scenario did occur, other systems such as the ADS, LPCS, and RHR would be used to mitigate the consequences. Based on the response, the PVORT considered this concern to be closed.

2.1.3.4 Findings. No specific operability concerns remained after the evaluation of this component.

2.1.4 Safety/Relief (ADS) Valve, 1B21-F0047A, (Audit Status: Closed)

2.1.4.1 Component Description. This component is an 8 x 10-in. dual function safety relief valve manufactured by Dikkers (Model 6471-6/125.04) actuated by an electro-pneumatic actuator manufactured by Sempress/Seitz (Model VB 300/235 EWVS). The valve is located inside the drywell within the reactor building and is flange-mounted to the main steam line at the 630-ft level. The valve is normally closed for system integrity. Its safety function is to limit the peak pressure in the reactor vessel by automatically opening, thereby venting steam to the suppression pool, when the system pressure is too high. The valve also opens on a remote signal from the automatic depressurization system (ADS) to reduce the reactor

pressure, so that flow from the RHRS-LPCI mode and LPCS can be injected into the reactor vessel in time to cool the core and limit fuel barrier temperature. Upon loss of power to the actuator, the valve is still capable of opening in the safety mode.

This valve was selected because of its significance to plant safety; all safety-relief valves remained to be qualified since the Seitz solenoids failed environmental testing. A different model solenoid will be used during new qualification tests of the actuator. The retest sequence had not yet begun at the time of the audit. Consequently, the qualification and installation status of all safety-relief valve assemblies was also incomplete and precluded the usual PVORT evaluation of these areas. Instead, the PVORT evaluated the vendor's actuator qualification test program with the new solenoid and his commitments to qualify the valve assembly prior to fuel load. Section 2.1.4.2 reflects the extent to which the PVORT made a physical inspection of the component. Section 2.1.4.3 summarizes the qualification events already completed or remaining to be done.

2.1.4.2 Component Walkdown. As noted earlier, the installation of this component was incomplete pending qualification of the actuator and new solenoid. All safety-relief valves were stored in the warehouse and clearly identified. The applicant indicated that the new solenoids had been ordered and that the valve assemblies would be installed in the plant in anticipation of the approval of the qualification test results. The equipment will remain tagged out until such approval has been obtained.

2.1.4.3 Document Review. Because the qualification status of this component was incomplete, the applicant gave an overview of those qualification activities already completed (such as thermal and mechanical aging). Retesting of the new solenoid will resume with dynamic and seismic tests, accident simulation, and functional tests. Completion of the qualification testing of the assembly is expected by early April 1985. The applicant indicated that approval of the qualification report, in accordance with the Perry equipment qualification program procedures, is

scheduled for May 1985, shortly before the scheduled fuel load date of June 15, 1985. The applicant assured the PVORT that these safety-relief valves would be installed and completely qualified prior to fuel load.

2.1.4.4 Findings. No specific operability concerns remained after the abbreviated evaluation of this component.

2.1.5 Scram Discharge Volume Vent Valve, 1C11-F0180, (Audit Status: Closed)

2.1.5.1 Component Description. This component is a 1-in. globe valve manufactured by Hammel Dahl (Model 522FRR62HAZ9) and actuated by an air (diaphragm) actuator of the same manufacturer (Model A41ADB4ABZ). This air operated valve is located in the control rod drive system inside the containment building. The normal function of this assembly is to open to vent the control rod drive scram discharge volume (SDV) thus facilitating the draining of the SDV. The valve's safety function is to act as an isolation valve for the SDV vent line.

2.1.5.2 Component Walkdown. The walkdown of this component revealed one operability concern related to maintenance and surveillance. The valve actuator was located very close to a wall and its air pressure gauge on the controller was positioned between the actuator and the wall such that it was facing the wall. It was physically impossible to read the gauge without the aid of a mirror and then only with difficulty. The PVORT's concern was that if the purpose of this gauge was to permit maintenance personnel to periodically adjust the air pressure, the possibility of the pressure being set wrong was increased. The applicant researched the problem and found that the controller was preset by the vendor and the gauge was not used during maintenance activities; however, he did agree to move it such that it would could be easily read.

2.1.5.3 Document Review. The document review portion of the audit process was not conducted for this component due to a lack of time resulting from factors unique to this audit, (i.e., the length of the applicant's presentations and responses and the methods chosen by the PVORT to conduct the component walkdowns and caucuses).

The list of qualification documents[24-34] for this component was extensive and appeared to address all applicable issues.

2.1.5.4 Findings. No operability concerns remained after the abbreviated evaluation of this component.

2.2 Balance of Plant (BOP) Components

2.2.1 Drywell Vacuum Relief Valve, 1M16-F0020, (Audit Status: Closed)

2.2.1.1 Component Description. This component is a 10-in. class 150 check valve manufactured by GPE controls (Model LD-240-339). The valve is equipped with a pneumatic cylinder to test its capability to open/close. This arrangement is not required for the valve to perform its safety function. The valve is normally closed. Its first safety function is to remain closed in the event of a LOCA, high energy line break, or small line break, thereby allowing the steam buildup within the drywell to enter the suppression pool. Its second safety function is to open to provide vacuum relief whenever the drywell pressure drops below the containment pressure.

2.2.1.2 Component Walkdown. The walkdown of this component revealed a temporary support holding the pipe. The applicant explained that the construction activities for the piping supports were only ~75% complete at the time of the audit. The architect-engineer will verify the as-built configuration versus analytical model used for the piping before turning the equipment over for testing. In addition, the applicant's equipment qualification program includes independent walkdown inspections to confirm that the installed configuration of each piece of safety-related equipment matches its qualified configuration. Before the audit was concluded, the applicant reported that the installation of the permanent pipe support had been completed.

2.2.1.3 Document Review. The document[1-4] review portion of the audit process was not conducted for this component due to the lack of time resulting from factors unique to this audit (see Section 2.1.5.3.).

2.2.1.4 Findings. No specific operability concerns remained after the abbreviated evaluation of this component.

2.2.2 Chilled Water System Pump, OP47-C0001A, (Audit Status: Closed)

2.2.2.1 Component Description. This component is a double suction horizontal centrifugal pump manufactured by the Ingersoll-Rand Company (Model 8X14SD) and driven by a 100-hp electric motor manufactured by Westinghouse (Model Lifeline T). The pump and driver are located in the Control Complex at the 574-ft level. The component is one of three between which operating time is shared. When the component is in operation, it supplies chilled water to the control complex heating and ventilation system during either normal or emergency conditions.

2.2.2.2 Component Walkdown. The walkdown of this component revealed only one concern involving the armored conduit for the input power to the drive motor. The conduit had a hole burned through it which could have damaged (shorted) the cable within the conduit. However, there was a yellow hold tag on the motor and a nonconformance tag on the conduit indicating that the applicant was aware of the problem and did not intend to operate the motor until repairs were performed.

2.2.2.3 Document Review The review of the qualification documents[5-8] indicated that qualification was addressed by a combination of test (seismic on motor, environmental conditions on a motorette) and analysis (pump).

As was the case with the RCIC pump, this pump and prime mover were not tested or analyzed as an assembly. However, the PVORT was able to verify that the coupling (Falk 60T10) was adequate to handle over twice the shaft misalignment which was identified as a result of the analysis and test.

2.2.2.4 Findings. No specific operability concerns remained after evaluation of this component.

2.2.3 Containment Vessel Chill Water Isolation Valve, 1P50-F0140, (Audit Status: Closed)

2.2.3.1 Component Description. This component is a 6-in. class 150 butterfly valve manufactured by Contromatics (Model C-W2566-BB) with a motor operated actuator manufactured by Limitorque (Model SMB-000-2/HOBC). The valve is the inboard containment return isolation valve for the Containment Vessel Chilled Water System and is located in the reactor building at the 599-ft level. The valve is normally open allowing chilled water to flow to the air handling units which serve the containment vessel. Its safety function is to close to provide containment isolation in the event of a LOCA.

2.2.3.2 Component Walkdown. The walkdown of this component revealed (a) some loose cap screws on the actuator housing and (b) a set of four cap screws that were not lock wired. Normally this would not be a concern as equipment throughout the plant is typically in varying stages of completeness. However, this valve was tagged as already being turned over for system test. The applicant alleviated our concern by providing documentation (i.e., a work authorization) that confirmed that the valve actuator was being checked and refurbished as part of the applicant's Limitorque Rework Program and that this work was not yet complete.

2.2.3.3. Document Review. The document review[9-14] portion of the audit process was not conducted for this component (see Section 2.1.5.3).

2.2.3.4 Findings. No specific operability concerns remained after the abbreviated evaluation of this component.

2.2.4 Combustible Gas Control Backup Hydrogen Purge Valve, 1M51-F0110, (Audit Status: Closed)

2.2.4.1 Component Description. This component is a 2-in. class 1500 globe valve manufactured by Rockwell International (Model 15014MPT2) with a motor-operated actuator manufactured by Limitorque (Model SMB-000-2). The

valve is located in the auxiliary building at the 624-ft level on the backup hydrogen purge line immediately outside of containment. If there is a loss of power to the actuator, the valve will fail as is. There are redundant valves which can be used to achieve containment isolation.

2.2.4.2 Component Walkdown. The walkdown of this component revealed a number of equipment tags concerning qualification status. The applicant explained that the document package at the time of delivery did not contain the complete seismic review. The applicant provided an adequate explanation during the document review (see Section 2.2.4.3) regarding management of the equipment tags.

The walkdown also identified a pipe bracket, for which the horizontal restraint was not attached. The applicant identified the support as a hydraulic snubber. The applicant stated that the hydraulic snubbers in general are not installed until construction activities in that area have been completed in order to protect the integrity of the snubber. This response was satisfactory to the staff.

2.2.4.3 Document Review. The review of the qualification documentation[15-22] revealed that operability was addressed by a combination of tests and analyses. A number of concerns are raised during the document review. One concern was that the qualification status was apparently not complete. The vendor had withheld approval of the package pending completion of the static deflection tests for two similar motor operated valve assemblies. Based on the test results, the vendor indicated full approval of the documentation package in a letter June 22, 1984. At the time of the audit, the applicant had not yet completed his review of this documentation in accordance with the guidelines of the Perry equipment qualification program. This explanation, together with the review of the test results, adequately addressed the PVORT's concern.

During this document review, the PVORT noticed that the approval dates for some of the documents were very recent. When presented with this observation, the applicant said that he had prepared a special set of documents which summarized the results of the more extensive qualification

documents. The PVORT expressed their concern that the purpose of the audit was to determine the applicant's uniform implementation of his qualification program. A review of the original qualification documents revealed that the detailed results were consistent with the recently prepared summary documents. Thus, the PVORT was satisfied that the applicant had demonstrated an adequate qualification file. This concern arose in the review of other components as well and is discussed in the summary Section 3.2 as a general observation.

2.2.4.4 Findings. No specific operability concerns remained after the evaluation of this component.

2.2.5 Residual Heat Removal System Balancing Valve, 1E12-F0048A, (Audit Status: Closed)

2.2.5.1 Component Description. This component is an 18-in. class 300 globe valve manufactured by Borg Warner (Model 81340) with a motor-operated actuator manufactured by Limitorque (Model SMB-360). The valve is located in the auxiliary building at the 599-ft level. The valve is located in the RHR Pump A discharge line and is normally closed when the pump is not operating. The safety function of the valve is to open to provide low pressure coolant injection. During the post accident suppression pool cooling mode the valve throttles to the closed position, directing flow through the heat exchangers. If there is a loss of power to the actuator, the valve fails as is and an operator is dispatched to throttle the valve manually.

2.2.5.2 Component Walkdown. The walkdown of this component discovered that the handwheel was detached, the electrical cable connection was loose, and the junction box cover was missing several fasteners. None of these anomalies were tagged. The applicant responded that the equipment was still in the construction phase and had not been approved for turnover to the nuclear testing section.

The PVORT does not normally address such installation anomalies during the operability review as they are more appropriately handled by the applicant's quality control group. A review of the applicant's quality control procedures indicated that all equipment was required to be thoroughly checked prior to turnover. The applicant also stated that all equipment is also inspected during an independent walkdown by equipment qualification personnel. Although the equipment as installed was not manually operable, the PVORT believes that there are adequate administrative controls in place to ensure operability of the equipment before it is turned over for preoperational testing.

2.2.5.3 Document Review. The PVORT's review of the qualification documentation[23-26] revealed that operability was addressed by a combination of tests and analyses. One minor concern was that the installed actuator was not identical to the actuator that was tested. Upon questioning, the applicant presented evidence to show that seismic tests were performed on a smaller and larger actuator at acceleration levels which enveloped the design conditions. In addition, the applicant voluntarily followed the criteria of IEEE 382-80 for type testing. The PVORT's review of the test results and discussion with the applicant adequately demonstrated qualification of the actuator by similarity.

2.2.5.4 Findings. No specific operability concerns remained after the evaluation of this component.

2.2.6 High Pressure Core Spray Water Leg Pump, 1E22-C0003, (Audit Status: Closed)

2.2.6.1 Component Description. The component is a horizontal single-stage centrifugal pump manufactured by Bingham-Willamette (Model CAP) and driven by a 5-hp 182 T frame size induction motor manufactured by Siemens-Allis (Model Type RG, open drip proof). The component is located in the auxiliary building at the 568-ft level. The pump and motor are bolted to a single base plate on the floor. The safety function of the pump is to keep the discharge line of the HPCS pumps filled, thereby preventing water hammer conditions upon their start. The pump must remain operational 180 days following an event.

2.2.6.2 Component Walkdown. The walkdown of this component revealed a number of minor anomalies. Foreign items tags were attached to the pump to indicate that test gauges had been installed temporarily to support a system flush. The PVOPT assured themselves that the applicant's equipment qualification program includes quality control procedures (e.g., walkdown inspections) to verify that the proper configuration will be restored prior to fuel load.

The walkdown revealed that the oil reservoir used to lubricate the pump shaft was loose and leaking slightly and was not appropriately tagged. Upon questioning, the applicant explained that although the pump assembly had been turned over to the authority of the testing group, there had been some unrelated construction activity in the area. The applicant suggested that the oil bulb m[illegible] have [illegible]n bumped dur[illegible]ng t[illegible]ime. Upon completion of all construction in that a[illegible], an in[illegible] thoroughly examine the equipment t[illegible]verify configuration, in[illegible]th established qua[illegible]ity control pr[illegible]cedures. At the ti[illegible]t, this scheduled inspection had not be[illegible] completed. The [illegible] noted that although the reservoir was [illegible]owly leaking, th[illegible]till adequately lubricated by the autor[illegible]ic feed de[illegible]g[illegible]ne r[illegible] The PVORT was satisfied with the applicant's respo[illegible]nd consid[illegible]is to be as a random occurrence that should be addressed by the quality control group walkdown.

2.2.6.3 Document Review. The PVORT's review of the qualification documentation[27-30] revealed that operability was addressed by a combination of tests and analyses. One concern was that the PVORT did not find an analysis of the coupling. Instead, the applicant presented calculations of the maximum expected deflections of the motor rotor and pump shaft due to external dynamic loads. These deflections were compared to the tolerances recommended by the coupling manufacturer. The PVORT's review of the deflection calculations alleviated the concern involving alignment and vibration of the pump assembly.

A minor concern discovered during the document review was that the motor insulation was analyzed as Class F compared to the nameplate

specification of Class B. The applicant explained that although the purchase specification required Class B insulation, the motor manufacturer had delivered a Class F motor with a Class B nameplate, thus the installed component conservatively met the requirements of the purchase specification. Similar instances occurred during the audit, whereby the applicant satisfactorily clarified the apparent discrepancies between component nameplate and the purchase specification.

The PVORT gave the applicant only four days' notice before the audit of this component, in order to evaluate the applicant's ability to maintain and retrieve appropriate qualification records. The PVORT's review determined that the document package for this component was consistent with the document packages assembled for other components. On the basis of the overall document review and the applicant's ability to provide timely responses to the staff's questions, the qualification document files appear to be complete and properly maintained. Furthermore, the applicant has committed to update and maintain these records for the life of the plant.

2.2.6.4 Findings. No specific operability concerns remained after evaluation of the component.

3. GENERIC FINDINGS

In preparation for the Perry audit, the PVORT (a) reviewed the applicant's FSAR Section 3.9.3.2 and a master list of safety-related equipment and (b) conducted pre-audit meetings with those applicant personnel responsible for equipment qualification.

During the audit process, the applicant's responses to operability concerns regarding the specific components selected for audit were sufficient so that the PVORT considered the audit status of each of these components to be closed. However, as a result of the overall audit process, a few generic concerns and findings surfaced that merit documenting. These are discussed below.

3.1 Confirmatory Issues

The staff requires that all equipment important to safety be qualified and approved by the applicant prior to fuel load. However, the PVORT audit is typically conducted many months prior to the expected fuel load date before all of the equipment is qualified, tested, and in some instances, even installed. This was the case with Perry and although they were scheduled to complete all of their equipment qualification prior to fuel load, they did acknowledge that one valve (i.e., the Dikkers safety/relief valve) was not scheduled to be completed until the month prior to the expected fuel load date of June 14, 1985.

Secondly, although Perry was scheduled to complete all preoperational tests for those systems required to be operational prior to fuel load, they had only completed one minor preoperational test (Emergency Service Water Screen Wash) up to the date of the audit.

Lastly, the applicant had not reviewed the results of the new loads (hydrodynamic) analysis to ensure that the new loads did not exceed those used during the original qualification tests or analyses.

As a result of these findings the PVORT requires that prior to fuel load, the applicant provide confirmation in writing that (a) all pumps and valves important to safety are qualified, (b) preoperational tests for all pumps and valves important to safety are completed, and (c) none of the new loads exceed those used during the original qualification tests or analyses. The applicant shall provide justification for any deviations from these requirements.

3.2 Other Findings

During the audit process, the PVORT recognized that many of the documents being reviewed were dated just prior to the audit; in some instances the date was only a day of two earlier than the audit date. When questioned about this, the applicant confirmed that they had addressed the components selected for the audit somewhat uniquely, in terms of schedule, so that the PVORT would be able to see what a "typical" document package would look like. While the PVORT recognizes that all applicants desire to render their audit document packages as complete and comprehensive as possible, this practice, if applied only to those components selected for audit, can make the applicant's motives suspect and does require further investigation by the PVORT to verify that the pump and valve operability assurance program will be uniformly applied to all components.

The PVORT concluded, after discussing this finding with the applicant, that their program would be implemented uniformly for all pumps and valves important to safety. The PVORT will address this concern in future pre-audit meetings so that other applicants do not treat the audit components uniquely.

As has been the case with every pump and valve audit, the Perry audit had some unique features. These features were of a positive nature for Perry and involved their program presentation and method of responding to the PVORT's concerns.

Perry's presentation of their equipment qualification program was very comprehensive. In addition, their method of response to certain questions and concerns was to conduct a short presentation of the applicable aspect of their overall program. For example, short presentations were provided to the PVORT concerning:

- Walkdown procedures for component/system turnover
- Component tagging procedures and implementation
- Nonmetallic parts program (mild environment)
- Grease and oil qualification program (radiation).

As a result of these presentations, the PVORT was able to obtain an excellent perspective concerning Perry's overall equipment qualification program and its implementation. As discussed in Section 2.2.3.3, three of the document packages for this audit were not completely reviewed. The primary reason was the length of time spent evaluating the applicant's program presentations and responses. The PVORT feels that the benefits gained from applicant's presentations and responses compensated for any negative aspects of being unable to review the three document packages in detail.

4. CONCLUSION

The Equipment Qualification personnel for Perry are dealing with the equipment qualification issue in a very positive manner. The PVORT has reached this conclusion because the applicant has: (a) provided adequate documentation to demonstrate qualification of safety-related pumps and valves, (b) established administrative programs to determine, monitor, and maintain equipment operability for the lifetime of the plant, (c) demonstrated an adequate central file system by the timely retrieval of information requested by the staff during the audit, (d) corresponded closely with the architect-engineer and equipment suppliers to discuss and compare details of construction, utility policy, and plant operation, and (e) demonstrated overall accountability by committing the appropriate personnel to implement these programs.

Based on the results of the site review performed at Perry, the PVORT concludes that an appropriate pump and valve operability qualification program has been defined. As noted, the document reviews for three components were not performed in order that the PVORT could evaluate the applicant's presentations on important aspects of the Perry equipment qualification program. The continuous implementation of this program should provide adequate assurance that the safety-related functions will be performed as needed.

It is an NRC requirement that all equipment important to safety be qualified and approved by the applicant prior to fuel load. In order to satisfy this requirement, two subtasks must be performed, namely: completion of preoperational testing and confirmation of new loads. Therefore, based upon PVORT's evaluation of the Perry Pump and Valve Operability Assurance Program, the following confirmatory issues have been identified:

1. The applicant shall confirm that all pumps and valves important to safety are qualified prior to fuel load. At the time of the audit all pumps and valves important to safety had not been qualified.

2. The applicant shall confirm that all of the required preoperational tests are completed prior to fuel load. At the time of the audit most of the preoperational tests for those systems required to be operational before fuel load had not been completed.

3. The applicant shall confirm that the original loads used in tests/analysis to qualify pumps and valves important to safety are not exceeded by any new loads such as those imposed by a LOCA (hydrodynamic loads) or as-built conditions. If a new load exceeds that originally used, the impact of the new load on the qualification of the equipment must be assessed and reported to the NRC prior to fuel load.

5. REFERENCES (NSSS COMPONENTS)[a]

1. Bingham-Willamette Co., Certificate of Hydostatic Tests, AG-534.

2. Bingham-Willamette Co., Performance Test Data (VPF 4060-63-1), T-15210030-1, December 19, 1977.

3. General Electric, SQRT Technical Approach for Reevaluation of BWR Equipment, NEDE-24788-2, October 1982.

4. General Electric, Perry RCIC Pump Operability Analysis, DRF E51-127.

5. General Electric, Structural and Mechanical Loading Criteria, GE-22A2652, Revision 1.

6. General Electric, Purchase Specification (RCIC Pump), 21A9443AW, Revision 0.

7. General Electric, Seismic Design, GE-385HA603, Revision 0.

8. General Electric, Perry LPCS Pump/Motor Operability Assurance Analysis, DRF E21-36.

9. Byron Jackson, Technical Manual, VPF 3720-209-1, December 22, 1978.

10. General Electric, Interface Control Drawing Low Pressure Core Spray Pump/Motor, GE-105D5175, Revision 4.

11. General Electric, Design Certification, Data Sheet and Base Specification, DC21A9514AM.

12. General Electric, GE Regulation Guide Interpretation Document, GE-22A4159, Revision 0.

13. See Reference 6--NSSS.

14. Byron Jackson, Parts List, 283X429G006.

15. Byron Jackson, Pump Vendor Stress Report, VPF 3720-65-2, August 17, 1977.

16. See Reference 3--NSSS.

17. General Electric, GE Dynamic Methods Document, GE 385HA777, Revision 0.

18. General Electric, Motor Purchase Specification Data Sheet, 21A3504BC.

19. General Electric, LPCS Pump/Motor Dynamic Qualification, 283X236CA, Revision 12, July 1983.

20. Anchor Darling Valve Co., Design Calculation for 10-Inch 900-LB Globe Valve with SMB-4-200 Motor Operator, February 15, 1983.

21. Limitorque Corporation, Limitorque Valve Actuator Qualification, B0058, January 11, 1980.

22. Gilbert/Commonwealth, Specification--Nuclear Steam Supply System, SP-301-4508-00, Revision 1, October 11, 1973.

23. Limitorque Corporation, Hydrodynamic Vibration Testing (New Loads), B0115, June 24, 1982.

24. Wyle Laboratories, Qualification Testing of C°D Valves (Preliminary), 5884, July 5, 1983.

25. General Electric, Dynamic Qualification Report--CRD Scram Discharge Vent Valve (C11/12-F010,C11/12-F180), NEDE-30512, February 1934.

26. Hammel Dahl, Valve Outline/Assembly Drawing and Material List, VPF 3736-500, Revision 9.

27. Hammel Dahl, Valve Instruction Manual, VPF 3736-152, Revision 2.

28. General Electric, Air Operated Globe Valve, CRD Hydraulic Control System Purchase Specification, 22A6924, Revision 0.

29. General Electric, Air Operated Globe Valve, CRD Hydraulic Control System Test Specification, 23A1331, Revision 2.

30. General Electric, Air Operated Globe Valve, CRD Hydraulic Control System Purchase Specification Data Sheet, 22A6924AA, Revision 1.

31. Hammel Dahl, Qualification Testing of CRD Vent/Drain Valves, Vols. I and II, VPF 5485-71 (1 and 2), Revision 1.

32. General Electric/Gilbert, Perry NPP Equipment Qualification--Perry Acceleration Data per SQRT "Now" List, Gilbert Associates, Inc., PY-GAI/GEN-2279 Attachment 1, April 12, 1982.

33. General Electric, Seismic (ATWS) Test--Generic (Aging Analysis), DRF C00-00009, February 17, 1984.

34. General Electric, Perry Unique RRS for C11-F010/F180--Combination of Seismic and Hydrodynamic RRS by S. Y. Koh, DRF C11-00084, July 13, 1984.

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a. This list of references is not a complete list of those documents reviewed by the PVORT during the audit. The references listed are those supplied by the applicant on the component long form. Each component document file contains additional documents related to equipment qualification. The PVORT reviewed those documents from each file that pertained to the pump and valve operability assurance program.

6. REFERENCES (BOP COMPONENTS)[a]

1. Gilbert/Commonwealth, Containment and Drywell Vacuum Relief Valve Specification, SP-635 4599-00, Revision 7, January 5, 1982.

2. GPE Controls, Stress Analysis for Seismic and Operating Conditions of Model LD 240-339 Vacuum Breaker, LA-241-184-1, Revision 0, July 19, 1978.

3. GPE Controls, Hydro Test, LA-241-043, October 15, 1980.

4. GPE Controls, Leak Test, LA-241-044, October 30, 1980.

5. Ingersoll-Rand Co., Structural Integrity and Operability Analysis of 8 X 14SD Pump, 016-36421, November 23, 1982.

6. Westinghouse, Qualification Document Class 1E Medium A.C. Motors, MM-9112, January 18, 1980.

7. Ingersoll-Rand Co., Instructions for Installation, Operation, and Maintenance of "S" Line General Service Pumps, February 23, 1979.

8. Perry NPP, Pre-Op Test Plan, 3142.

9. Gilbert/Commonwealth, Specification--Design, Fabrication, and Delivery of Safety Related Butterfly and Ball Valves, SP-542-4549-000, Revision 14, July 30, 1981.

10. See Reference 21--NSSS.

11. Environmental Testing Corp., Report of Test for Dynamics Testing of 1, 8 Inch Contromatics Valve Assembly, 16243-1, July 31, 1981.

12. See Reference 23--NSSS.

13. Contromatics, Hydro Test, 84772-76-5, November 16, 1984.

14. Contromatics, Pneumatic Leak Test, NP84772-76-6, November 16, 1984.

15. Gilbert/Commonwealth, Specification--Design, Fabrication, and Delivery of Safety Related Gate, Globe, and Check Valves, SP-531-06-4549-000, Revision 6, January 27, 1984.

16. See Reference 21--NSSS.

17. Wyle Laboratories, Qualification of Five Motor Operated Valve Assemblies, WR-83-27, December 2, 1983.

18. Rockwell International, Static Deflection (Operability) Testing of Electric Motor Operated 1 1/2 Inch and 2 Inch C.S. ---, 84-04, June 21, 1984.

19. See Reference 23--NSSS.

20. Rockwell International, Hydro Test, 37-02.

21. Rockwell International, Seat Leakage Test, 37-03.

22. Rockwell International, Seat Leakage Test, 37-00.

23. Gilbert/Commonwealth, Specification--Design, Fabrication, and Delivery of Safety Related Gates, Globe, and Check Valves--2 1/2 Inch and Larger, SP-521-02, Revision 14, March 4, 1982.

24. Borg-Warner, Seismic Analysis of 18 Inch 300 LB. Carbon Steel, Motor Operated Globe Valve, NSR 81340, Revision D, March 7, 1983.

25. See Reference 21--NSSS.

26. See Reference 23--NSSS.

27. Siemens-Allis, Equipment Qualification for Class 1E Safety Related Service in Power Generating Stations Outside Containment Random Wound Motors, 8LR90318, January 24, 1983.

28. Bingham-Willamette Co., Installation, Operation, and Maintenance Instructions for Bingham CAP Horizontal Single Stage Pumps, April 19, 1978.

29. Bingham-Willamette Co., Seismic Analysis of Bingham-Willamette Co. 2 x 2 x 7 1/2 CAP, 4549-94Q-035-3-0, Revision 3, January 24, 1980.

30. Siemens-Allis, Seismic Stress Analysis of Horizontal Motor--182T Frame, ME 1009, May 4, 1983.

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a. This list of references is not a complete list of those documents reviewed by the PVORT during the audit. The references listed are those supplied by the applicant on the component long form. Each component document file contains additional documents related to equipment qualification. The PVORT reviewed those documents from each file that pertained to the pump and valve operability assurance program.

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13. ABSTRACT (200 words or less)

The Perry Nuclear Power Plant Unit 1 was audited August 14 to 17, 1984 to determine the adequacy of their Pump and Valve Operability Assurance Program. The results of this audit indicate that the applicant has established and is implementing a program that will track all pumps and valves important to safety from manufacture and in-shop testing through qualification, installation, testing, maintenance, and surveillance for the purpose of assuring continued operability of these components over the life of the plant.

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