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NUCLEAR REGL

IN THE MATTER OF:

PUBLIC SERVICE COMPANY OF
OKLAHOMA, et al.

Docket Nos. 50-556
50-557

Place - Tulsa, Oklahoma

Date - Wednesday, February 28, 1979

Pages 8500 - 8601

7903080531

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the matter of:	
PUBLIC SERVICE COMPANY OF OKLAHOMA ASSOCIATED ELECTRIC COOPERATIVES, INC.,	Docket Nos. 50-556
-and-	50-557
WESTERN FARMERS ELECTRIC COOPERATIVE	
[Black Fox Station, Units 1 and 2]	

United States Courthouse
Courtroom No. 3
333 West 4th
Tulsa, Oklahoma

Wednesday, February 28, 1979

Hearing in the above-entitled matter was reconvened, pursuant to recess, at 9:05 a.m.

BEFORE:

SHELDON J. WOLFE, ESQ., Chairman,
Atomic Safety and Licensing Board.

DR. PAUL W. PURDOM, Member.

FREDERICK J. SHON, Member.

APPEARANCES:

JOSEPH GALLO, ESQ.
Isham, Lincoln & Beale
1050 - 17th Street, N.W.
Washington, D. C.,

-and-

[Appearances, continued:]

GLENN NELSON, ESQ.,
Isham, Lincoln & Beale
4200 First National Bank Building
Chicago, Illinois,

Counsel for the Applicants.

JOE FARRIS, ESQ.
Green, Feldman, Hall & Woodard
816 Enterprise Building
Tulsa, Oklahoma,

Counsel for the Intervenors.

DOW DAVIS, ESQ.,
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Bethesda, Maryland,

Counsel for the NRC Staff.

CHARLES ROGERS, ESQ.,
Office of the Attorney General
State of Oklahoma,

Counsel for the State of Oklahoma.

* * *

C O N T E N T S

Witness:	Direct	Cross	Redir.	Cross	Board
[Staff]					
Laurence Phillips	8503	8510	8543	8548	
Ronald Gamble	8558	8564	8577	8578	
[Applicant]					
Dr. John West	8581	8583			

EXHIBITS:	Ident.	Rec'd.
Draft NUREG 0531	8561	8561

P R O C E E D I N G S

OPEN SESSION

(9:05 a.m.)

CHAIRMAN WOLFE: The hearing is resumed in open session. The Staff has a witness to present on the Board Question 1-1 relating to loose parts monitoring? Is that correct, Mr. Davis?

MR. DAVIS: Yes, Mr. Chairman.

The Staff would call Laurence E. Phillips to the stand.

MR. NELSON: Mr. Chairman, if I might, while he is taking the stand, Applicants have a prefiled objection to the prefiled testimony by Mr. Minor on behalf of the Intervenors, but I would propose to argue that objection at the time that Mr. Minor's testimony is offered.

MR. DAVIS: Mr. Chairman, Mr. Phillips has not been previously sworn.

Whereupon,

LAURENCE E. PHILLIPS

was called as a witness on behalf of the Nuclear Regulatory Commission Staff and, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. DAVIS:

Q Would you state your name and address and where

you are employed, please?

A My name is Laurence Phillips. My address is Route 2, Box 661, Harpers Ferry, West Virginia. I am employed with the United States Nuclear Regulatory Commission in Bethesda, Maryland.

Q Mr. Phillips, would you explain to the Board and the parties how your duties at the NRC bring you into contact with the subject of loose parts monitoring?

A Yes.

I am a section leader in the Analysis Branch of the Division of Systems Safety. One of our responsibilities is to review Section 4.4 of all license applications.

The Standard Review Plan of the Nuclear Regulatory Commission includes loose parts monitoring systems within the review scope of Section 4.4, which is the thermal hydraulic design of the reactor.

Q I am handing you a copy of a document entitled "Testimony of Laurence E. Phillips on Board Question 1-1." It consists of two pages of text, one page of professional qualifications, and an attachment -- a five-page attachment that is entitled "Regulatory Guide, Reg Guide 1.133," and ask if you recognize that document?

(Handing document to witness.)

A Yes, I do.

Q Do you have any corrections to that document in

terms of, first, the testimony?

A. No.

Q. And do you have any corrections to your professional qualifications?

A. None.

Q. Are those two documents true and accurate to the best of your knowledge?

A. Yes, they are. The status of the -- as outlined on the initial document, is a little bit out of date. It had been prepared sometime ago.

Q. You prepared your testimony in September of this year? Is that correct?

A. That's correct.

CHAIRMAN WOLFE: Of 1978?

MR. DAVIS: Excuse me.

September of last year?

THE WITNESS: Right.

BY MR. DAVIS:

Q. In regard to the Regulatory Guide attached to your testimony, has there been any subsequent intervening actions which have a bearing on your testimony and the content of the regulatory guide attached to your testimony?

A. Yes.

Q. Would you please list what has happened in the area of loose parts monitoring and bring the Board and the

parties up to date on the status of this Regulatory Guide?

A Well, the primary action has been in the area of the ACRS review of the guide.

In May 1978, as indicated in the testimony, the guide -- that is, draft two, revision one of the guide -- was brought before the ACRS Subcommittee on Regulatory Activities.

At that time, it was referred to the ACRS Subcommittee on Electrical Equipment Instrumentation and Controls for further study in order that the ACRS could gain a better understanding of the basis for the staff positions taken in the guide, and in order that they could evaluate the state of the art of commercially available systems to determine if they were consistent with the guide, and also to study public concerns with such systems and with the guide.

In June 1978, there was a public meeting in Washington of this ACRS Subcommittee for that purpose. LPMS suppliers and users participated in that meeting.

There was a subsequent meeting held by the same subcommittee in July 1978 in Los Angels -- also a public meeting -- and users and suppliers also participated in that meeting.

In October of 1978, based on the recommendation of this ACRS Subcommittee, the Full ACRS voted unanimously to accept the proposed guide, with the position on seismic design modified to address only components of the system

within containment.

This revision is acceptable to the staff and is reflected in Draft 4 of the proposed guide. Draft 4 is not substantially different from Draft 2, which I believe was submitted with my original testimony.

There is, additionally, ne status, the next requirement to put the guide into force is a review of the guide before the RRRC, which is the Regulatory Requirements Review Committee of the NRC.

They must approve it, and they have considered it before it was sent out for draft comments originally, and the final consideration of the guide is eminent.

The implementation report on the guide has been drafted. It recommends that the guide be implemented in full on all reactors scheduled for full fuel loads one year or more after the adoption of the guide.

end #1

I think that Black Fox clearly falls within the scope of full implementation.

Additionally on the status of task action -- of the task action plan, although there is no formal action on the task action plan B-60 as a task action plan, the problem addressed by task action B-60 has to a great extent been resolved in the technical activities in connection with adoption of the regulatory guide.

The NRC has a continuing research program under contract with ORNL to improve the calibration and interpretation of LPMS signals to aid in the location and diagnosis of the safety significance of loose parts, by the signals from the system itself.

The guide addresses the detection of loose parts. We feel that that technology is fully developed.

That concludes my testimony updating on the current status.

MR. DAVIS: Mr. Chairman, the Staff would request that the testimony of Laurence E. Phillips, together with his professional qualifications and attached regulatory guide as amended by his oral comments this morning, be introduced into evidence and bound into the record as if read.

MR. NELSON: No objection.

MR. FERRIS: No objection.

MR. ROGERS: No objection.

CHAIRMAN WOLFE: No objection, Mr. Rogers?

MR. ROGERS: No.

CHAIRMAN WOLFE: All right. The documents will be incorporated into the record as if read.

[The documents follow:]

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
PUBLIC SERVICE COMPANY OF OKLAHOMA ASSOCIATED ELECTRIC COOPERATIVE, INC. and WESTERN FARMERS ELECTRIC COOPERATIVE, INC.	)	Docket Nos. STN-556 STN-557
(Black Fox Station, Units 1 and 2	)	

TESTIMONY OF LAURENCE E. PHILLIPS
ON BOARD QUESTION 1-1

My name is Laurence E. Phillips. I am employed by the U.S. Nuclear Regulatory Commission as a Section Leader in the Division of Systems Safety. My Professional Qualifications are attached.

The purpose of this testimony is to address the Board's Question 1-1 concerning the capability of a loose parts monitoring system. The Board's Question 1-1, as stated in its Order Ruling on Motions for Summary Disposition dated September 11, 1978, is as follows:

> Is the capability of a loose parts monitoring system the subject of TAP B-60 and of an ACRS investigation? How do these matters bear upon Black Fox Station and what is their status?

The capability of a loose parts monitoring system (LPMS) is addressed in proposed Regulatory Guide 1.133 and is the subject of Task Action Plan B-60.

Task Action Plan B-60 has as its purpose the resolution of any outstanding issues related to the proposed Regulatory Guide, including the development of staff positions and guidance with respect to upgrading loose parts detection systems at operating facilities. The proposed guide was considered by an ACRS subcommittee in May 1976 and released in September 1977 for public comment (copy attached). The applicants have agreed to install a loose parts monitoring system on the Black Fox Station plants to satisfy one of the staff interface requirements listed in the Safety Evaluation Report for GESSAR-238. We plan to review the final design of the system against the guidelines of Regulatory Guide 1.133, as appropriate, during the operating license stage of review.

Laurence E. Phillips

ANALYSIS BRANCH
DIVISION OF SYSTEMS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

I am employed as a Section Leader of the Reactor Analysis Section in the Analysis Branch of DSS.

I graduated from the University of Cincinnati with a Chemical Engineering degree in 1954. After serving two years as an officer in the United States Army, I have been continuously employed in the nuclear engineering profession since January, 1957. I received a M.S. degree with nuclear physics major from Union College of Schenectady, N.Y., in 1961. I am a registered Professional Engineer, Certificate #E-026547, in the state of Ohio.

In my present work assignment at the NRC, I have supervisory responsibility for the review of the reactor core thermal-hydraulic design submitted in all reactor construction permit and operating license applications. In addition, my section participates in the review of analytical models used in the licensing evaluation of the core thermal-hydraulic behavior under various operating and postulated accident transient conditions. The latter responsibility includes technical review of Emergency Core Cooling System (ECCS) evaluation models for conformance to Commission regulations.

Prior to joining the NRC staff in December, 1974, I was employed by NAI Corporation as a Senior Associate. In this capacity, I was responsible for the development and application of computer codes for analysis of nuclear reactor cores. I acted as a consultant to nuclear operating utilities in the use of these codes for analysis of their operation, and in the solution of general nuclear engineering problems. My tenure at NAI was from 1967 through 1974.

From 1962 to 1967, I was employed by Allis Chalmers Mfg. Co. My assignments during that period included supervisory responsibility for the safety analyses and licensing of the LaCrosse Boiling Water Reactor.

From 1958 to 1962, I was employed by Alco Products where I was project manager for the design, development, and fabrication of heat exchange equipment for nuclear liquid metal projects. Prior to that I was with the Nuclear Division of the Martin Company.

U.S. NUCLEAR REGULATORY COMMISSION

September 1977

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.133

LOOSE-PART DETECTION PROGRAM FOR THE PRIMARY SYSTEM OF LIGHT-WATER-COOLED REACTORS

A. INTRODUCTION

Criterion 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed and that a quality assurance program be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions.

Criterion 13, "Instrumentation and Control," requires, in part, that instrumentation be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions to ensure adequate safety, including those variables and systems that can affect the fission process, the integrity of the core, and the reactor coolant pressure boundary.

Section 50.36, "Technical Specifications," of 10 CFR Part 50 requires the applicant for a facility operating license to provide proposed technical specifications. Paragraph (c)(2), "Limiting Conditions for Operation," identifies a proposed technical specification relating to the lowest functional capability or performance levels of equipment required for safe operation of the facility. Paragraph (c)(3), "Surveillance Requirements," identifies a proposed technical specification relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained, that facility operation will be within the safety limits, and that the limiting conditions of operation will be met. Paragraph (c)(5), "Administrative Controls," requires an applicant for a facility operating license to provide proposed technical specifications relating to reporting necessary to ensure operation of the facility in a safe manner.

Paragraph 20.1(c) of 10 CFR Part 20, "Standards for Protection Against Radiation," states that, in addition to complying with the requirements set forth in that part, licensees should make every reasonable effort to maintain exposures to radiation as far below the limits specified in that part as is reasonably achievable.

This guide describes a method acceptable to the NRC staff for implementing the above regulatory requirements with respect to detecting a potentially safety-related loose part in light-water-cooled reactors during normal operation. This guide also outlines a program that can help licensees to meet the Part 20 criterion that exposures of station personnel to radiation during routine operation of the station will be "as low as is reasonably achievable" (ALARA).

B. DISCUSSION

The presence of a loose (i.e., disengaged and drifting) part in the primary coolant system can be indicative of degraded reactor safety resulting from failure or weakening of a safety-related component. A loose part, whether it be from a failed or weakened component or from an item inadvertently left in the primary system during construction, refueling, or maintenance procedures, can contribute to component damage and material wear by frequent impacting with other parts in the system. A loose part can pose a serious threat of partial flow blockage with attendant departure from nucleate boiling

(DNB) which in turn could result in failure of fuel cladding. In addition, a loose part increases the potential for control-rod jamming and for accumulation of increased levels of radioactive crud in the primary system.

The primary purpose of the loose-part detection program[1] is the early detection of loose metallic parts in the primary system. Early detection can provide the time required to avoid or mitigate safety-related damage to or malfunctions of primary system components.

The loose-part detection program also serves a second purpose since it can minimize radiation exposure to station personnel by providing for the early detection and general location of abnormal structural conditions. Information from the program can be used by station personnel to focus their efforts when taking remedial action to minimize the formation of wear-generated radioactive crud and to minimize the need for extensive structural repairs. The second purpose is consistent with the guidance contained in Regulatory Guide 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable." which provides guidance to licensees for maintaining occupational doses to individuals as far below the permissible limits specified in the NRC regulations as is reasonably achievable while, at the same time, providing guidance on methods to ensure that the sum of the doses received by all exposed personnel is also at the lowest practical level.

The Advisory Committee on Reactor Safeguards (ACRS) and the NRC staff have, for the past several years, been encouraging applicants to employ online loose-part detection systems in an attempt to stimulate technological development in that area. This approach has resulted in a substantial increase in industry-wide experience and confidence in these systems and has resulted in the commercial production of loose-part detection systems by several engineering and manufacturing organizations. All applicants for a construction permit or an operating license are required to describe the loose-part detection program for the proposed reactor (Section 4.4.6, "Instrumentation Requirements." of Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants").

An improperly developed and poorly implemented loose-part detection program may require excessive attention by plant operating personnel and can result in increased radiation exposure due to more frequent inspections of the primary system. For this reason, this guide emphasizes the need for providing system features that will minimize false alert signals and for developing diagnostic procedures that can be quickly implemented to supplement information from the loose-part detection system to determine the short- and long-term safety significance of a loose part. A well-developed loose-part detection system should enable discrimination of the signal induced by the impact of a loose part from those signals induced by normal hydraulic, mechanical, and electrical background noise and large amplitude electrical transients.

The loose-part detection program outlined in this regulatory guide includes both automatic and manual modes of data acquisition. The automatic data acquisition mode provides for continuous monitoring of signals, but data are recorded only when the detection system senses that a predesignated alert level has been reached or exceeded. An alarm alerts control room personnel when the alert level is reached or exceeded. The manual data acquisition mode provides periodic monitoring to determine system operability (including calibration), establish the alert level, and alert the licensee to data that require evaluation but are of insufficient magnitude or incorrect character to otherwise initiate alert procedures.

The loose-part detection program outlined herein is not intended to be a research program. Instrumentation and procedures that will result in the need for a disproportionate amount of attention by control room personnel are not encouraged. Instrumentation that can be used to approximate the size and location of a loose part but that does not interfere with the normal alert and false signal rejection function of the detection program would be useful in complementing other instrumentation to determine the safety significance of a detected loose part. Loose parts traveling through the primary system will generally accumulate, at least for a time, in such natural collection areas as the plenums in reactor vessels and steam generators. Therefore, this guide recommends that sensors be located at these and other natural collection areas. No benefit is seen in instrumenting straight lines of pipe or other areas through which a loose part will quickly pass. Close scrutiny of a relatively small amount of clearly relevant data is considered a better detection program than cursory review of a large volume of less significant data.

A prime consideration in developing the loose-part detection program is the avoidance of procedures requiring excessive attention by control room personnel and excessive reporting by the licensee. The recommended program would require operator action or engineering review only when the alert level is reached or exceeded or when confirming the

[1] In this guide, the phrase *loose-part detection program* encompasses system hardware, programmatic, and reporting recommendations. *Loose-part detection system* refers only to system hardware.

operability of the instrumentation system. Licensee reports to the Commission during operation are necessary when defining the alert level, when a loose part is confirmed to be present, or when the associated technical specification is violated.

Although loose-part detection systems can, in a large number of cases, detect and indicate the approximate location and weight of a loose part, other information (e.g., that obtained from plant process signals, from an inspection of the facility, or from prior operating history) will be necessary in most instances to determine the safety implication of the loose part. Therefore, no action with respect to reactor operation is recommended based on the information obtained from the loose-part detection system alone. An alert resulting from the loose-part detection system is considered a warning, and it is important that followup steps (e.g., acquisition of additional diagnostic information) be taken to determine the significance of the alert signal. If a loose part is shown to be present, its short- and long-term safety implications need to be determined.

The potential for damage initiated by a loose part is not necessarily proportional to the impact energy of the loose part. For example, a small piece of flat metal plate may impart little impact energy but could restrict local flow to the reactor core. However, there are technical difficulties in trying to distinguish very-low-energy impact signals from the normal reactor acoustic noise. Experience with loose-part detection systems for operating pressurized and boiling water reactors provides the basis for establishing an impact energy of 0.5 ft-lb (0.678 joules), e.g., the kinetic energy of a 0.5 lb (0.227 kg) part traveling at 8 ft/sec (2.44 m/sec), as the recommended system sensitivity in Regulatory Position 1.b. Experience shows that signals resulting from metallic-object impacts of that magnitude are distinguishable from the normal background noise.

In order to ensure that, as a minimum, each loose-part detection system has the ability to detect what the staff considers to be the most significant range of loose-part weights, the staff recommends (Regulatory Position 1.b) that each loose-part detection system be capable, in conjunction with the 0.5 ft-lb energy criterion, of detecting loose parts that weigh between 0.25 (0.114 kg) and 30 lb (13.6 kg). The specified weight range is considered to be representative of the most common and significant class of loose parts.

The high radiation and thermal cycling environment to which most of the primary system is subjected could in time alter operating characteristics of the loose-part detection system so that surveillance becomes ineffectual either by causing excessive alert signals or by decreasing sensitivity to loose parts. Therefore, in Regulatory Position 1.f the staff recommends that provisions be incorporated into the system to permit channel operability (including calibration) tests. Regulatory Position 5 addresses operability tests as part of a surveillance requirement for a proposed technical specification.

Since an earthquake is an event that could induce a loose part in the primary system, it is desirable that the loose-part detection system be designed to function following all seismic events that do not require plant shutdown. Recording equipment, however, need not be designed to function without maintenance following such seismic events provided the system retains audio or visual alarm capability.

C. REGULATORY POSITION

An inservice loose-part detection program should be implemented for the primary system of light-water-cooled reactors during preoperational testing and the startup and power operation modes in accordance with the following guidelines:

1. System Characteristics

The following features should be incorporated into each loose-part detection system.

a. *Sensor Location.* Sensors capable of detecting acoustic disturbances should be strategically located on the exterior surface of the reactor coolant pressure boundary. A minimum of two sensors, suitably located to provide broad coverage, should be located at each natural collection region (e.g., reactor vessel upper and lower plenums and each PWR steam generator reactor coolant inlet plenum).

b. *System Sensitivity.* The online sensitivity of the system should be such that, as a minimum, the system can detect a metallic loose part that weighs from 0.25 (0.114 kg) to 30 lb (13.6 kg) and impacts with a kinetic energy of 0.5 ft-lb (0.678 joules) on the inside surface of the reactor coolant pressure boundary within 3 feet (1 meter) of a sensor. An acceptable method for verifying this online sensitivity is to demonstrate (1) the basic system sensitivity during plant shutdown and (2) that the background noise measured during plant operation is no greater than 20 percent of the signal associated with the specified detectable loose-part impact.

c. *Channel Separation.* The instrumentation channels (e.g., cabling, amplifiers) associated with the two sensors recommended at each natural collection region should be physically separated from each other starting at the sensor locations to a point in the plant that is always accessible for maintenance during full-power operation.

d. *Data Acquisition System.* The system should include both automatic and manual startup of data acquisition equipment (see Regulatory Position 3). In

the event the alert level is reached or exceeded, the data acquisition system should automatically activate, and an audible or visual alarm should alert the control room personnel of that condition. The data acquisition system should provide for the simultaneous recording of all sensor signals and be capable of immediate visual and audio monitoring of these signals. (An acceptable alternative to the simultaneous recording of all sensor signals in the automatic mode is the recording of event-related parameters that characterize the loose-part condition, e.g., sensor-signal arrival time sequences, rate of occurrence of impacts, number of "ringdown" oscillations.)

e. *Alert Level.* Provision should be made for incorporating into the system a reference signal level (alert level) that is indicative of the presence of a loose part consistent with Regulatory Position 1.b. Depending on the alert logic (i.e., internal processing of system signals), raw or processed signals should be automatically and continuously compared to the alert level. Points to be considered in establishing the alert level are noted in Regulatory Position 2.

f. *Capability for Sensor Channel Operability Tests.* Provision should be made for periodic online channel check and channel functional tests and for offline channel calibration[2] during periods of cold shutdown or refueling (see Regulatory Position 3.a(3)).

g. *Operability for Seismic and Environmental Conditions.* The loose-part detection system should be capable of performing its function following all seismic events that do not require plant shutdown, i.e., up to and including the Operating Basis Earthquake (OBE). The system should be shown to be adequate for the OBE by analysis or test, guidance for which may be obtained from Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants." Recording equipment need not function without maintenance following the specified seismic event provided the audio or visual alarm capability remains functional. The system should also be qualified according to the recommendations of Regulatory Guide 1.89, "Qualification of Class IE Equipment for Nuclear Power Plants," but the qualification program need not include the environment existing during or after accident conditions (e.g., loss-of-coolant accident, steam line break).

h. *Quality of System Components.* Components should be of a quality that is consistent with minimum maintenance requirements and low-failure rates. Components should be compatible with the 40-year design life of the reactor system. Provision should be made for replacing parts that are anticipated to have limited service life.

i. *System Repair.* The system should be designed to facilitate the recognition, location, replacement, repair, and adjustment of malfunctioning components. Equipment, procedures, and layout should facilitate maintenance to minimize personnel time in high radiation areas and minimize occupational radiation exposure.

2. Establishing the Alert Level

In all cases, the alert level should be consistent with Regulatory Positions 1.b and 1.e and should include the effects of background noise.

The following points should be considered when establishing the alert levels:

a. The alert logic should incorporate suitable internal criteria to distinguish the transient signal due to the impact of a loose part from the signals associated with normal hydraulic, mechanical, and electric noise and large-amplitude electrical transients. For example, it may be desirable to include logic that requires the comparison of two or more sensor signals with the alert level.

b. False alert signals resulting from deliberate plant maneuvers (e.g., control-rod stepping) and other sources that cannot be avoided by the procedures associated with Regulatory Position 2.a may be avoided by automatic procedures that momentarily disable the alert-level alarm.

c. The alert logic may provide for the alert level to be a function of the normal steady-state operating condition.

d. As appropriate, it may be desirable for the alert logic to provide for the alert level to vary from sensor to sensor to compensate for the inherent level of background noise at a specific transducer location.

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[2] The standard technical specifications define *channel check*, *channel functional test*, and *channel calibration* as follows:

A *channel check* is the qualitative assessment of channel behavior during operation by observation, including, where possible, comparison of the channel indication or status with other indications or status derived from independent instrument channels measuring the same parameter.

A *channel functional* test for analog channels is the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify operability, including alarm and trip functions; for bistable channels it is the injection of a simulated signal into the channel sensor to verify operability, including alarm and trip functions.

A *channel calibration* is the adjustment, as necessary, of the channel output so that it responds with the necessary range and accuracy to known values of the parameter that the channel monitors. The channel calibration encompasses the entire channel, including the sensor and alarm and trip functions, and includes the channel functional test. The channel calibration may be performed by any series of sequential, overlapping, or total channel steps so that the entire channel is calibrated.

3. Using the Data Acquisition Modes

The loose-part detection program should include data acquisition in automatic and manual modes. The automatic mode is for online detection of loose parts. The manual mode is for determining system operability (including calibration), establishing the alert level, and detecting significant safety-related trends in the sensor signals.

a. *Manual mode.* This mode of data acquisition should be used at the following times for the indicated purpose.

(1) Preoperational testing: Establish alert level for this test phase.

(2) Startup and power operation.

(a) Establish alert levels for startup and power operation. The alert level for power operation should be submitted to the Commission (in the startup report when one is provided) within 90 days following completion of the startup test program if the alert level is for power operation following initial startup or there is a change to the preexisting alert level for power operation.

(b) At least once per 12 hours: Perform channel check.

(c) At least once per 31 days: Perform channel functional tests.

(d) At least once per 92 days: Verify that alert levels are consistent with the normal background noise and that the data do not indicate the presence or possibility of a loose part, anomalous behavior, or a significant trend that may be safety related. The alert level and alert logic may be revised to provide for the background noise of these later measurements. The details of such a revision should be submitted within 60 days to the Commission as an amendment to the program description.

(3) Cold shutdown or refueling: At least once per 18 months, verify channel calibration using a controlled mechanical input (e.g., weight falling through a known distance). Channels should, as necessary, be recalibrated at this time. If recalibration is necessary, consideration should be given to replacement of unstable components.

b. *Automatic mode.* The automatic mode should be activated automatically when the predesignated alert level is exceeded. Activation should comprise an audible or visual alarm to the control room operator and simultaneous initiation of data recording equipment. Data should be acquired for a sufficient period of time to properly characterize the signals from all sensors. Each alert should be documented with regard to time and plant condition.

If the alert level is exceeded or if the quarterly measurements indicate the presence or possibility of a loose part, anomalous behavior, or a significant data trend that may be safety related, diagnostic steps should be taken within 72 hours to confirm the presence of a loose part and determine its safety implication or to determine the nature of the anomalous data or data trend.

4. Content of Safety Analysis Reports

A description of the loose-part detection program should be submitted to the Commission in response to the NRC staff request for information on loose-part detection systems in Section 4.4.6, "Instrumentation Requirements," of Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."

The program description should include those items covered in Regulatory Positions 1, 2, and 3. Special attention should be given to the following items:

a. Sensor types, mounting locations, and mounting procedures, including criteria for choice of sensor and mounting locations.

b. Data acquisition, recording, and calibration equipment.

c. Anticipated major sources of external and internal extraneous noise.

d. Precautions taken to ensure acquisition of quality data.

e. Description of the manner in which the alert level will be determined and also the alert logic (if any) employed by the system hardware and software in generating an alert signal. This should include a description of the program capability for distinguishing between a loose part and normal background noise.

f. Reference to the technical specification (see Regulatory Position 5).

g. Summary of supplemental data and diagnostic procedures that are available and that can be used as part of a diagnostic program to confirm the presence of a loose part. The summary should address the use of information from plant process signals, radiation leakage monitors, operating history, exercising of control rods, cycling of primary coolant pumps, and inspection of the primary coolant system.

h. Procedures for performing channel check, channel functional test, and channel calibration.

i. Procedures for minimizing radiation exposure to station personnel during maintenance, calibration, and diagnostic procedures. (Reference in Chapter 12, "Radiation Protection," of the Safety Analysis Report.)

j. Training program for plant personnel that addresses operation of the system hardware and the purpose and implementation of the loose-part detection program. (Reference in Chapter 13, "Conduct of Operations," of the Safety Analysis Report.)

5. Technical Specification for the Loose-Part Detection System

A technical specification for the loose-part detection system should be provided. The technical specification should include:

a. The location of the sensors.

b. A limiting condition for operation requiring the loose-part detection system to be operable during startup and power operation; and, if one or more required loose-part detection system channels are inoperable for more than 30 days, a special report to be prepared and submitted to the Commission within the next 10 days outlining the cause of the malfunction and the plans for restoring the channel(s) to an operable status.

c. A surveillance requirement that each channel of the loose-part detection system be demonstrated operable by a channel check performed at least once per 12 hours, a channel functional test performed at least once per 31 days, and a calibration test performed at least once per 18 months.

6. Notification of a Loose Part

If the presence of a loose part is confirmed, the Commission should be notified according to the guidelines for reportable occurrences that call for "prompt notification with written followup" as summarized in Regulatory Guide 1.16, "Reporting of Operating Information—Appendix A Technical Specifications."

The followup report to be submitted to the Commission within 2 weeks of the initial notification of the presence of a loose part should include (1) a summary of data obtained in the manual and automatic data acquisition modes; (2) a summary of the analysis, inspections, and correlations with operating data that were performed to evaluate data from the loose-part detection program; and (3) a summary of conclusions and a description of modifications or other actions planned or already performed to evaluate the safety implication of the loose part or to ensure that system and component safety functions are not impaired.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants regarding the NRC staff's plans for using this regulatory guide.

Except in those cases in which the applicant proposes an alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used in the evaluation of submittals for operating license or construction permit applications docketed after June 1, 1978.

If an applicant wishes to use this regulatory guide in developing submittals for applications docketed on or before June 1, 1978, the pertinent portions of the application will be evaluated on the basis of this guide.

MR. DAVIS: Mr. Chairman, the witness is available for cross-examination by the parties and questioning by the Board.

CHAIRMAN WOLFE: Mr. Nelson?

MR. NELSON: Yes, sir.

CROSS-EXAMINATION

BY MR. NELSON:

Q Mr. Phillips, has an effective loose parts monitoring system been demonstrated for the boiling water reactor?

A Yes, it has. We have had loose parts monitoring systems installed on boiling water reactors in the United States; I think probably our most demonstrative experiences is from Germany, where loose parts have been detected on a boiling water reactor, and corrective action was taken.

Q What are the limits of detectability for the loose parts monitoring systems for BWRs?

A The regulatory guide sensitivities apply equally to BWRs and PWRs. The sensitivity is stated in the regulatory guide -- I believe I had best refer to it.

Q Please.

[Pause.]

A It would detect an impact energy of 0.5 foot-pounds, which is a kinetic energy of a half pound part traveling at 2 feet per second. That is the recommended system sensitivity

Different reactors have different background noises, and the background noise, of course, does affect the sensitivity with which the metal-to-metal impact can be detected.

Generally the reactor coolant pumps provide some additional noise above the background of the PWR. This can be filtered out.

However, we do provide that for any particular plant, if it cannot meet the sensitivity requirements of the guide, they may state what sensitivity they will meet for that plant, at which point it would become subject to Staff review.

In general the BWR detection is comparable to that of a PWR.

Q Now the sensitivity level that you described, does that represent the state of the art at this time?

A Yes. The state of the art is at least that good. Yes.

Q For a BWR as well as a PWR?

A Yes.

Q Has a loose parts monitoring system with this sensitivity limit actually been put into operation at any BWR?

A I can only state there that I believe the systems that are in operation, at least in the German BWRs, are that sensitive. I don't recall having checked the actual levels.

I believe they are that sensitive; the ones in this country, I don't know off the top of my head what the sensitivity is on the ones that are in service, have been demonstrated.

There are systems which have been procured for BWRs which meet that sensitivity, specified to meet that sensitivity.

Q When you say that the system is demonstrated, then, are you accepting a method of demonstration other than actual operation in an operating reactor?

A Yes. The calibration is based on impact energy, metal-to-metal impact, and basically that is how the system is calibrated, and that is how it meets its sensitivity requirements.

Q Would you explain how the system is capable of distinguishing between the noise created by loose parts moving around in the reactor as compared with the background noise?

A Yes. Simply with the noise level in the reactor, you have a certain amplitude of noise level. When you get a metal-to-metal impact, you get the amplitude increasing. If it increases to the alarm level, you get a loose part alarm.

In addition, the loose parts monitoring systems have audio provisions and in the regulatory guide, we require periodic audio monitoring.

We have found that the audio monitoring is very sensitive and in many instances, you can hear metal-to-metal impact and distinguish it at levels which are not even above the background noise of the BWR, or rather of any reactor.

So, essentially those are the two provisions. you are more sensitive with audio monitoring and you have an alarm level which is based on increased amplitude.

Q In your opinion, Mr. Phillips, is it really more difficult to detect loose parts in BWRs than in PWRs?

A In my opinion, no. I see no reason why it should be. It is more difficult if you should detect one at the lower limit of the BWR, it is more difficult possibly to do something about it. But, no, I see no reason it should be more difficult.

Q Mr. Phillips, are you aware of whether the Applicant has committed to install a loose parts monitoring system representing the state of the art?

A Yes. They are committed, yes.

MR. NELSON: No further questions, Mr. Chairman.

CHAIRMAN WOLFE: Mr. Farris?

BY MR. FARRIS:

Q Mr. Phillips, you just stated, and you stated in your prefiled statement that Applicants have agreed to install the loose parts monitoring system.

You also stated that you plan to review the final design of the system against Reg Guide 1:133, but have in fact the Applicants committed to install a loose parts monitoring system that will comply in all respects with Reg Guide 1:133?

A To the best of my recollection, they have not.

Q Can you characterize the type of loose parts

monitoring system or the sensitivity, for example, of the loose parts monitoring system that the Applicants will install at Black Fox?

A The loose parts monitoring system that the Applicant will install at Black Fox will be reviewed against the requirements of Regulatory Guide 1:133. I am sure the Applicant is aware of this and it will meet the requirements of that regulatory guide.

Q Regulatory guides are not binding upon the Applicant?

A That is true. It is a guideline and in general it has -- in general the Applicants follow the guidelines of a regulatory guide or provide fairly substantial justification of why they have not done so.

In this instance I suspect that the system will comply fully with the reg guide. If it does not, it will be minor deviations.

Q Mr. Phillips, what is the Staff's opinion of the effectiveness of the loose parts monitoring system under the present state of the art?

A The Staff feels that the state of the art of the equipment is very good, very effective. The Staff feels that the past operating experience, the past operation of the systems, the mode of operation, the intelligence concerning the systems by the users, have left a lot to be desired.

Part of the purpose of the regulatory guide is

to beef up loose parts monitoring programmatic aspects, such that they are used to the extent of their capabilities.

In many instances, in past experience, due to improper settings and spurious alarms, the operators have turned the systems off and failed to use them. So, again, equipmentwise, we feel that they are very effecti .

Q Do you know if industry shares your view, Mr. Phillips?

A By the industry, do you mean the users or the suppliers?

Q Users.

A Opinions vary. Some of those who have not used them properly don't share our view. Some of those who have and have had good experience with them, do.

Q How about vendors of the NSSS system?

A The vendors have just about unanimously, I believe it is unanimous -- contend that they have no problem meeting all of the requirements of the regulatory guide. Vendors of the NSSS systems, you say? Excuse me.

I was addressing vendors of the loose parts systems.

Vendors of the NSSS systems, to some extent, object to the systems from the standpoint that they don't feel that they are needed for reactor safety.

I haven't heard any objections on the grounds that

the systems are not capable of doing what they are supposed to do, except for possibly one vendor who feels that -- who has argued that they are in a developmental stage.

That vendor has not specifically said that the provisions of the guide could not be met.

I believe that they are probably referring to the diagnostic -- the diagnostics that the equipment could be used for in the location and evaluation of the safety significance of a loose part.

We agree that that is in a developmental stage.

As far as loose part detection, I doubt that this vendor would dispute that they can be detected.

Q Are you speaking of General Electric Company?

A Yes, I am.

Q Were you at the ACRS meeting in Los Angeles last July -- I believe it was July 20th -- Mr. Phillips?

A Yes.

Q And do you recall a representative of GE being there?

A My recollection isn't that good.

Q Do you know a Mr. Robare with General Electric Company?

A I don't recall, no.

Q You do recall the meeting, don't you?

A Yes, I do.

Q Do you recall Mr. Robare saying, "It is GE's opinion that the loose parts monitoring systems of" --

MR. NELSON: Objection, Mr. Chairman, I move to strike the question.

MR. FARRIS: I haven't finished the question.

BY MR. FARRIS:

Q Do you recall Mr. Robert saying, "It is GE's opinion that loose parts monitoring systems of previous and perhaps even current technology would not provide a significant improvement over BWR systems already provided in General Electric's reactors for the following reasons:

"First, existing BWR instrumentation and control systems have often provided a satisfactory indication of the loose parts condition;

"Secondly, the internal vibration startup program performed during the startup phase of all plants provides an assurance of additional design integrity;

"Third, visual inspection during normal outages have also been an effective vehicle for loose parts detection;

"Fourth, BWR design velocity is to minimize mechanical joints and therefore potentials for loose parts occurrences.

"Lastly, it is not clear that any currently available loose parts monitoring system would have provided an improvement for the deduction or resolution of any known

BWR loose parts occurrence."

Do you recall that statement by a representative of GE?

MR. NELSON: Objection, Mr. Chairman. I move to strike the question. That is a highly improper form to submit evidence for the record. It is hearsay, it is irrelevant, and perhaps it is objectionable on grounds of asked and answered.

The witness has already testified as to the state of his information about GE's position on this. He not only stated what he had heard, but what he doubted that he would hear in the future.

I move to strike the entire question as an improper way of submitting evidence for the record, and I would ask you to decide that motion first.

MR. FARRIS: Mr. Chairman, the question is not evidence. A question is a question. The question hadn't been asked before. Mr. Phillips was at the meeting. The question is simply does he recall the representative of GE in particular, Mr. Robare, making that statement.

CHAIRMAN WOLFE: Backing away from that, I have a question, Mr. Phillips.

What was your immediate prior statement with regard to -- I think there was a question, do you recall that Mr. Robert was at the meeting, at the ACRS meeting? What is that question put to you?

THE WITNESS: Yes, it was, and I don't recall the gentleman's name. I don't specifically recall at this time that someone from GE was there, but I am fairly confident that they were.

[Board conferring.]

CHAIRMAN WOLFE: Let me put this question to you, Mr. Farris:

The witness has said that he doesn't recall that Mr. Robare was there, and now you ask didn't Mr. Robare state such and such during the course of this meeting. What is the purpose of the question?

The witness' earlier answer, he said he didn't recall --

MR. FARRIS: I am entitled to refresh the witness' recollection, and perhaps that statement will refresh his recollection, and then he will recall such a statement.

CHAIRMAN WOLFE: All right. There is an outstanding motion to strike, Mr. Farris, on the grounds of hearsay, and on the grounds of irrelevancy. What is your response to that?

MR. FARRIS: Hearsay, as Mr. Nelson has been wont to say throughout these proceedings, is expressly admissible, and I don't see any question about it being unreliable in this case. This is an ACRS meeting. I am quoting from the transcript, and asking for the witness' recollection. His memory jibes with that transcript, and it appears to be

clearly relevant in impeaching the witness' testimony, in that he stated that the effectiveness for BWRs has been demonstrated, whereas the vendor of the BWRs has apparently taken a position that they haven't been so demonstrated.

MR. NELSON: Could I comment on that, Mr. Chairman?

The grounds of the irrelevancy objection is based on the fact that GE has not been shown to be the vendor for the loose parts monitoring system that Black Fox Station will have, and until a foundation is laid, it is obviously irrelevant.

MR. FARRIS: I didn't indicate that GE was the vendor of the LPMS system. The vendor of the nuclear steam supply system.

MR. NELSON: It bears upon the question, Mr. Chairman, because of the difference in the system that is supplied.

[Board conferring.]

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CHAIRMAN WOLFE: Let me pursue this a bit more, Mr. Farris.

Despite what you say, that Applicants' counsel oftimes relies on hearsay, et cetera, et cetera, what is your position with regard to this immediate question of whether or not it is hearsay or not?

And if it is, why is it admissible?

MR. FARRIS: Mr. Chairman, if I asked the witness to state what GE said, that would clearly be hearsay.

On the other hand, if I read a statement, or represent to the witness that a statement was made, and does that refresh his recollection, that is not hearsay because I am not giving testimony; I am asking for the witness's testimony.

If the witness aid "yes," he recalls such a statement being made, that might be hearsay. My question can't be "hearsay."

CHAIRMAN WOLFE: No.

Mr. Nelson's objection is that you are seeking to elicit hearsay information. If the witness were to say "yes, this was said," this would be testifying to it on the basis of hearsay information.

MR. FARRIS: Yes, sir, which is expressly admitted unless it is unreliable. I have objected on hearsay on points throughout this hearing when it is unreliable. I am

asking about a transcribed meeting at which the witness was in attendance, a meeting of the ACRS which is the subject -- the status of the ACRS investigation is the subject of this Board's inquiry.

For that matter, I assure that the Board would take judicial notice of that meeting.

MR. NELSON: If I could comment on the statement he just made, I don't believe it is the rule that hearsay is expressly admitted unless it is unreliable, if I understood him correctly.

I do recognize that there is some flexibility to admitting hearsay in administrative proceedings of this nature. I believe Mr. Farris incorrectly represented that there may be a rule.

MR DAVIS: Mr. Chairman, the definition of "hearsay" of course is an out-of-court statement made by a third party introduced in a proceeding to show the truth of the matters asserted therein.

What we have here is a question designed to impeach the witness on his knowledge of the area. The crucial distinction to be made is: What is the use of the material?

As I have maintained before, impeaching material is not substantive evidence. They are questions elicited to show credibility and knowledge of the area and cannot be used to support someone's case in chief.

If we accept that premise, then Mr. -- the Intervenors' question is not hearsay, but is designed for a different use.

[Board conferring.]

CHAIRMAN WOLFE: This is interesting.

If the witness were to say "yes," that he was aware that such-and-such statement was made, or -- back off that. Strike that.

Let's say that he says that no such statement was made. How does that serve to impeach his credibility?

MR. FARRIS: If he says "no," Mr. Chairman, it wouldn't impeach his credibility.

CHAIRMAN WOLFE: And if he says "yes"?

MR. FARRIS: If he says "yes," it indicates that there is clearly disagreement, I think, in the industry, and I include the NRC in the industry -- not facetiously -- and then we can explore further this witness's basis for his statement, since there appears to be conflicting viewpoints among those people who are interested.

CHAIRMAN WOLFE: The motion to strike is denied. Answer the question.

THE WITNESS: All right.

The position that you have espoused is not foreign to me, and I believe it is consistent with my earlier testimony.

I attended many, many meetings, and the distinction of who was at what meeting and gave what testimony, without referring to notes of particular meetings, is beyond my recollection.

BY MR. FARRIS:

Q Mr. Phillips, what exactly is a "loose parts monitoring system" designed to detect?

A Free and drifting loose parts which impact on metal.

Q Only "free and drifting"? It couldn't be a part that is still attached, to some extent, to its original --

A The Regulatory Guide addresses only the free and drifting loose parts. Loose parts systems -- many do have the capability of detecting parts which are only enhanced. That experience has been shown in the German reactor, a part of this type, a pump flange, broken at one end, and vibrating was detected through a loose parts monitoring system.

Q What are the potential sources of a loose parts -- that a loose parts monitoring system would be expected to pick up?

A Would you repeat the question?

Q What are the potential sources for a loose parts within the NSSS?

A Potential sources are -- many of the loose parts are detected after -- when a reactor is started up, when

foreign objects have been inadvertently left in the system. Many of the loose parts have been from connections which were not properly made. In many instances, threaded connections; other loose parts have been from -- detected from fragments of pieces which have failed in-service.

Q Fragments of pieces of core internals that have failed?

A Among other things, yes.

Q In particular, are you aware of any core internals or parts of core internals that have failed and become loose parts?

A Yes.

Q Could you identify those for me?

A The poison rods on the Crystal River Reactor.

Q Is that the only one you can think of?

A We have had sample holders which have failed. I wouldn't classify them, I suppose, as a "core internal," but in the general vicinity of the core.

Q Any other core internals?

A I can't place any at the moment.

Q Have flow-induced vibrations been the cause of any loose parts?

MR. DAVIS: Objection, Mr. Chairman. I believe that we are getting away from the thrust of the Board's Question. And that is, the capability to detect. We are now

getting into areas of what causes a loose part. Does vibration cause a loose part?

The witness has recognized that loose parts do exist, and supposedly he is supposed to be testifying on capability to detect those, not as to their particular source.

MR. FARRIS: Mr. Chairman, I think the source is relevant in order to show what sort -- what the magnitude of the loose part may be.

How frequently they may see them; what size they may be; and in order to determine that I think that we have to look at what might be the source of a loose part -- what sort of problem might create a loose part, whether we are talking about very small parts, or something as large as part of the core plate.

MR. NELSON: Mr. Chairman, if I might, Applicants join the Staff's objection. The question is within the scope of the original contention number one, which related to flow-induced vibration.

That contention was dismissed in the motion for summary disposition, and all that was left was Board Question 1-1, raising two or three subsidiary questions relating to the loose parts monitoring system.

And in that connection, it is clearly within the scope of the contention that has been dismissed.

MR. FARRIS: Mr. Chairman, the counsel for both the Staff and the Applicant let the witness identify three, possibly more, sources of loose parts before they objected.

Their sensitivity arose apparently only when the flow-induced vibrations arose. I can understand that sensitivity, because in our opinion it was the most serious potential source for loose parts that could impact the system.

Having said -- and let me identify three possible sources -- I think it is incumbent upon them now to let me identify the rest of the possible sources of loose parts in the system.

[Board conferring.]

CHAIRMAN WOLFE: Objection sustained.

The Board's question is narrowed down to detection. Now you may plumb that as far and as wide as you want to as to how good the detection is. Beyond that, no.

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MR. SHON: Mr. Farris, I take it your present line of questioning is an effort to probe whether or not the sensitivity specified in 1.133is adequate to take care of conceivable or imaginable loose parts. Is that it?

MR. FARRIS: And vibrations, too. We are interested in seeing if they can detect abnormal vibrations that may precede loose parts. We have something vibrating excessively --

The witness, if you recall, earlier, I asked him if there were things detected that hadn't broken loose yet, that would be in danger of breaking loose.

MR. SHON: He said in one case such a thing had happened.

MR. FARRIS: And I wanted to get into that.

MR. SHON: This is not a potential loose parts monitoring system. It is a loose parts monitoring system, is it not?

I think no one has represented that it would detect an incipient part failure of any kind.

MR. FARRIS: That is what I want to find out, Mr. Shon, if it would.

[Board conferring.]

MR. NELSON: Point of clarification, Mr. Chairman. If I correctly understood what Mr. Farris was saying, I understood him to reject the decision you made on the objections.

I would like to have that clarified, whether he feels that --

CHAIRMAN WOLFE: Mr. Shon merely asked him a question. This was his response to Mr. Shon's question. The objection was sustained, so proceed.

MR. SHON: You have clarified it for me. I see where you are going, and I think it is proper that we stopped you at the point that we did.

BY MR. FARRIS:

Q Mr. Phillips, you indicated that the poison rods or a portion thereof had become a loose part at Crystal River?

A Yes.

Q Can you describe exactly how that happened and how it was detected?

MR. NELSON: Objection, Mr. Chairman, on the grounds of irrelevancy. I don't believe a foundation has been laid that the poison rods at a PWR have any application to the Black Fox Station, which will be a BWR.

MR. FARRIS: I think I can lay a foundation. I will withdraw the question.

BY MR. FARRIS:

Q Mr. Phillips, is there any significant difference between the detection systems in the BWR and PWR?

A No.

Q Mr. Phillips, could you describe for me the occurrence at Crystal River and how those poison rods

became a loose part there, and how they were detected?

A Well, again I would have to draw fairly heavily on my recollection, although I wasn't involved in the review of that incident, and I didn't prepare to testify on it here.

To the best of my recollection, there was an evaporation problem which as a result it didn't wear and release the hold-down spider, which permitted the hydraulic forces to release the poison rods.

There was an impact which was detected on the loose parts monitoring system. It was not repeated. It carried through to the steam generator inlet plenum where it broke up and there was considerable impact in there at some later time.

The plant was shut down, inspected and they found the poison rods.

Q Did the loose parts monitoring system detect the poison rods in the steam generator portion of the PWR?

A I am fairly certain it did. Again, I am drawing on my recollection.

Q You said that it was detected when it broke loose and impacted at first?

A Yes, that was reported. It was reported that it was detected. They had a rather large impact, but it was a single impact.

Q And the plant was not shut down?

A No, it was not shut down, no.

Q Was there any further investigation made?

A Only after they got -- some time later they got further indications.

Q Do the loose parts monitoring systems traditionally give off a lot of false alarms?

A They give what I would characterize as spurious alarms, some of them do.

Q Has it been your experience, Mr. Phillips, that spurious alarms tend to create the "crying wolf" syndrome to the plant operator?

A Yes, that is true, and this is the reason that we have attempted to improve the programmative aspects of the implementation of the systems.

Q Does the NRC Staff have an ongoing investigative program in this area?

A Pardon?

Q Does the NRC Staff have an ongoing investigative program concerning loose parts monitoring?

A We have theprogram which I described earlier under contract with Oak Ridge.

Q Mr. Phillips, how big a piece of fuel channel would have to be broken off before it would be detected by the loose parts monitoring system?

A The detection depends on impact energy and there

is an example given in the guide. Kinetic energy of a half pound part traveling at 8 feet per second is the example given to generate the required energy.

Q And this detection ability has to be capable of distinguishing between background noise, does it not?

A Yes.

Q In assessing the capability of any particular loose parts monitoring system to be able to detect a loose part against background noise, have you taken into account the noise that is occurring as a result of flow-induced vibrations?

A Yes. The stated sensitivity is the detection capability which the system is supposed to have in service. That is in the operating background including all noise.

Q Mr. Phillips, do you know if the Cooper Plant in Nebraska has a loose parts monitoring system?

A Not off the top of my head. I suspect that it does.

Q Are you aware of any particular tests from the Cooper Plant that has significance on the ability of a loose parts monitoring system to perform its function in accordance with the requirements of Reg Guide 1.133?

MR. NELSON: Objection, Mr. Chairman. Irrelevancy. We would object to any further questioning about the Cooper Plant as having no relevance to Board Question 1-1 relating to the Black Fox application.

[Board conferring.]

MR. DAVIS: I notice the witness responded that he wasn't familiar with the Cooper situation. We may have a moot point.

CHAIRMAN WOLFE: Exactly so. I will allow the question. I think we allow it because, if there is any similarity at all, we want to hear about it. And I trust that if the answer is "yes," then we will go into the similarity, but we will hear the answer. Go ahead.

THE WITNESS: I seem to recall that the Cooper Station, I believe, was one of the users who testified at one of the ACRS Subcommittee meetings. I don't recall the details of their testimony.

However, the system in the Cooper Station would not have been designed nor operated in accordance with the guide. There were essentially no requirements on that system.

BY MR. FARRIS:

Q Mr. Phillips, if Cooper had had a loose parts monitoring system that met the requirements of Reg Guide 1.133, do you think such a monitoring system would have protected the loose parts and in-core vibration problems at Cooper which led Nebraska Public Power to sue General Electric for $25 million?

MR. NELSON: Objection, Mr. Chairman. I find that question highly prejudicial. I think the reference to the lawsuit has no bearing on this case, and I move to strike the question.

MR. DAVIS: I object to about half of the question, that part having to do with detection of the vibration. The testimony has been fairly clear that we are concerned with detection of loose parts, and not vibration.

So I would not object to any hypothetical, although speculative, question about whether Cooper would have a loose parts monitoring system in accordance with the Reg Guide, if it would have detected loose parts.

MR. FARRIS: I would change that question to say that the loose parts caused by vibration, rather than "and vibration."

MR. NELSON: I wish to have the question stricken. It is prejudicial. I am not representing GE, but in the last two days we have had to wear a GE-type hat for certain

purposes, and I find this question highly objectionable from GE's point of view.

I will state their position, if I may.

[Board conferring.]

CHAIRMAN WOLFE: The Board finds the question very speculative. Our question is directed toward Black Fox Station and the capability of a proposed loose parts monitoring system to detect loose parts.

Now that sort of question addressed to another plant, and speaking about what might have happened and what has in fact happened, there is nothing in the record to support such a question.

So we grant the motion to strike.

BY MR. FARRIS:

Q Mr. Phillips, in coming up with the requirements for the smallest size you would want the loose parts monitoring system to detect, did you arrive at that size because that was the smallest size the state of the art could detect? Or because that was the smallest size which should be detected because that size could cause damage to the NSSS system?

A Both factors were considered.

Q You stated in response to one of Mr. Nelson's questions that the state of the art is at least good enough to meet the sensitivity requirements of Reg Guide 1.133.

Is the state of the art -- Could the state of the

state of the art meet higher sensitivity requirements right now, in your thinking?

A Yes, it is capable, under certain conditions, of detecting -- of having more sensitivity than required by Reg Guide 1.133.

Q Couldn't a multitude of loose parts that are too sensitive individually to cause a loose parts monitoring system to detect or alarm, couldn't a multitude of such parts have the cumulative impact on the safety systems as one large part?

A I can't think of an instance. If you were to pose a hypothetical specific situation, perhaps I could offer an opinion.

Q Let's say one of the workmen leaves a case of empty beer cans in the NSSS system. Would a beer can be picked up by the loose parts monitoring system under the Staff's requirements?

A I believe that it would, yes.

MR. SHON: A beer can doesn't weigh anywhere near a quarter of a pound, does it?

THE WITNESS: No, it doesn't. But I think, audio-wise, you would pick it up.

MR. FARRIS: Full, they probably weigh a quarter of a pound, Mr. Shon.

MR. SHON: Yes, but who would leave a full beer

can on a construction job?

(Laughter.)

BY MR. FARRIS:

Q How about a bunch of small parts such as screws, an inch and a half, two-inch screws, or nuts? Would they be picked up?

A Not likely.

Q Could a multitude of such small parts have safety implications for an NSSS system?

A I wouldn't recommend putting them in the system.

Q Is the possibility of a number of small parts such as screws or nuts being left in an NSSS system beyond something you would reasonably expect to happen in the construction of a nuclear power plant?

A Yes. I wouldn't expect it to happen. A "multiplicity of them" you say?

Q Mr. Phillips, do you consider the presence of a loose parts monitoring system important to safety?

A I consider it to provide what we call "defense indepth." It does have -- it is safety-related. It does provide an early warning of a potential problem.

From there, it is a question of proper diagnosis and proper actions.

Q Would you say it is potentially significant from a public-safety viewpoint?

A Well, I would stand on my previous statement.

Q Is the NRC going to take action in this regard in the future?

A In what way?

Q Implementation of a Reg Guide flushing out TAP B-60, making definite requirements?

A Yes. As I indicated, the adoption of the Reg Guide is eminent. The Task Action Plan, the B series of Task Action Plans, are relatively low priority and no action is being taken on them as such.

As I indicated in my earlier testimony, the actions that have gone on in support of the Regulatory Guide, the adoption of the Regulatory Guide, and our continuing research program at Oak Ridge is addressing the problems identified by Task Action Plan B-60.

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I doubt that any action will ever be taken on it because the problem will be solved by the time it comes up on the priority shelf.

Q Would you expect, Mr. Phillips, that the most significant, from a safety viewpoint, the most significant time for a loose parts monitoring system would be at initial startup and later in the life of the plant where there might be some degradation of the core internals?

A I believe that initial startup is the most important time and other important times are after refuelings.

Q How about toward the end of the plant's life? Would you expect that the loose parts monitoring system might play an important part at that point?

A The plant is designed for its full lifetime, so I wouldn't anticipate any significant increased importance at that time.

Q Are you aware of any discreparcies in the nuclear industry between what a plant was designed to do and what, in fact, it has been capable of doing?

A I guess without a more specific question, I can't answer that.

[Pause.]

MR. FARRIS: No further questions, Mr. Chairman.

CHAIRMAN WOLFE: Mr. Rogers?

BY MR. ROGERS:

Q It is my understanding that the loose parts monitoring system, the electronic ones, are they a required part of equipment of a nuclear reactor?

A In our review of the plants, yes. We require a loose parts monitoring system. We don't have definitive requirements on the specification of such systems at the present time. When the regulatory guide is implemented, that will provide that -- meet that need.

Q Is it against the NRC regulations to switch one of these systems off?

A It is not. The technical specifications for plant operation do not presently address loose parts monitoring systems.

Q Even during the initial startup or after refueling?

A That is correct. However, in our review of the systems currently we ask them to address how they will be used and operated.

Q Was it my understanding -- or was my understanding correct that you said that it is possible for a loose parts monitoring system to detect loose parts which have not actually become detached?

A It is possible for them to do so. That is not --

Q Not required?

A -- not required. The regulatory guide does not

address that aspect of it.

Q The way the systems work, you say there is an audio portion and then there is another portion that sets off an alarm if the noise level goes up to a certain point; is that correct?

A That is essentially correct, yes.

Q So it requires an operator to sit there and listen?

A Normally they periodically monitor this system, say, once a shift or once a day for any unusual noises.

Q And the part that is not actually -- the part of the system that is not human-dependent operates on the principle that if the noise level goes above a certain point, then an alarm goes off?

A That is correct.

Q And is the background noise of a nuclear reactor a constant?

A It is constant at any given time. It can change with each refueling, any time you change the characteristics of a core, or if you are, of course, even operating possibly at a different power level.

Q Excuse me. Is it necessary to readjust the system after a refueling to reflect the background noise at that time?

A In order to operate them properly.

Q But over the lifetime of the core load, it doesn't

vary up and down, does it?

A Not significantly. Not if everything is as it was. If it does, that is cause for concern.

MR. ROGERS: Those are all the questions I have. Thank you.

CHAIRMAN WOLFE: Redirect, Mr. Davis?

REDIRECT EXAMINATION

BY MR. DAVIS:

Q Mr. Phillips, would Black Fox have a loose parts monitoring system similar to that that was installed at Cooper and/or Browns Ferry -- excuse me, essentially the same system that is installed at Cooper or Browns Ferry?

A I don't know. Black Fox hasn't described their system, and I couldn't recall off the top of my head what Cooper and Browns Ferry has, anyway.

Q Would you expect that the Black Fox system would be technologically more advanced than Cooper or Browns Ferry installations?

MR. FARRIS: Objection, Mr. Chairman. He doesn't know what Cooper has.

MR. DAVIS: Mr. Chairman, I believe it is within the general knowledge of the witness, even though he doesn't know the exact particulars of Cooper, that he is aware generally of the state of the level of technology of loose parts monitoring systems of that vintage, and could -- would be able

to comment as to their degree of sophistication and whether or not there have been improvements made since that.

MR. FARRIS: Mr. Chairman, we don't know that Cooper doesn't have the latest technology installed there. They may not have the original loose parts monitoring system at all.

A lot of the problem they have had in this area, I would suspect they probably have it very highly refined in the loose parts monitoring system.

MR. DAVIS: Let me withdraw the question and see if I can build a foundation.

BY MR. DAVIS:

Q Mr. Phillips, are you generally aware of the vintage of the loose parts monitoring system at Cooper?

A I would have to say no. If they have one, I am fairly confident it is of early vintage, but I don't recall the specifics of Cooper.

Q Would you know within a couple of years when the Cooper system would have been installed?

A I wouldn't hazard a guess on that.

Q How about the Browns Ferry system? Would you know approximately when that would have been installed?

A No.

Q You testified that the ACRS had reviewed the new Reg Guide 1.133. Was an ACRS letter on that review issued?

A Yes, it was.

Q And has the RPRC reviewed the proposed reg guide?

A They reviewed it originally before it went out for comment. After comments were resolved, it is to go to the RRRC again. Primarily to review the implementation requirements; that is the remaining step in the adoption of the guide.

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Q What type of a timetable would you see for the implementation of this Reg Guide?

A Very soon, within the next three months I would say.

Q Is it a general practice that the provisions of a Reg Guide be incorporated into the Standard Review Plan?

A We reference the Reg Guide in the Standard Review Plan and, yes.

Q Then would you expect that the Black Fox operating license application would be reviewed in accordance with Standard Review Plan and/or the Reg Guide?

A Absolutely.

Q Reference was made to the existence of TAP 60. In view of your testimony on the implementation of the Reg Guide, do you expect more work on TAP 60 in the future?

A No, I do not. I expect that, when B category items are presented as formal Task Action Plans, that all of the problems indicated in the problem description for that particular task will have been resolved. Most of them are now.

Q Is the resolution of those issues covered, in your opinion, by the proposed Reg Guide?

A Yes.

Q Reference was made to the Crystal River incident. What provisions, if any, will the Reg Guide have as far as reporting instances of loose parts monitoring systems activation?

A When the presence of a loose part is confirmed, the Commission is to be notified according to the guidelines for reportable occurrences that call for prompt notification with written followup.

The followup report is to be submitted to the Commission within two weeks of the initial notification of the presence of a loose part.

Q Was this particular guideline in effect on the date of the Crystal River incident?

A No.

Q Would you expect that provision to be incorporated in the technical specifications for Black Fox?

A The technical specifications will include a limiting condition for operation on the loose parts system requiring it to be operable during startup and power operation.

The notification provisions for reportable occurrences, I don't believe are addressed in technical specifications, but it is a requirement.

Q Mr. Phillips, is the purpose of a loose parts monitoring system for diagnosis?

A No. It is for detection.

Q You mentioned at one point, in response to a question by Mr. Farris, that loose parts monitoring systems were part of the defense indepth concept.

Would you explain what other safeguards exist in the area of loose parts monitoring in terms of defense indepth?

A I am not sure I understand the question. The loose parts monitoring system is designed to detect the presence of a loose part. If the part is free and drifting, depending on the nature and the location, generally it will give repeated indications when it gets into a natural collection region.

It is then up to the operating staff of the plant, the plant safety committee, to assess the implications of the loose part, and where it is located.

Now let me say that, although the guide is addressed to detection with the requirements for placement of sensors, et cetera, it is fairly simple to determine the general location of a loose part by the signals on the various sensors.

The defense indepth is that the problem is assessed and a determination is made of the safety need for immediate action, or of any precautions in operation, or of continuing operation with -- that would lead to the characteristics of a particular loose part to see that it stays where it is and where it is not doing any damage, until the normal shutdown is effected and an inspection can be undertaken at that time to further evaluate the significance

of the part.

Q Are there other methods of detecting loose parts besides the loose parts monitoring system?

A Yes. The normal plant instrumentation can, in many instances, detect an abnormal occurrence caused by the presence of a loose part.

MR. DAVIS: Mr. Chairman, the Staff has no more redirect.

CHAIRMAN WOLFE: Any other questions on recross?

MR. NELSON: Yes, sir.

RECROSS-EXAMINATION

BY MR. NELSON:

Q Mr. Phillips, in response to questioning by Mr. Farris, I believe you stated that the state of the art is in fact more sensitive than the sensitivity level given in Regulatory Guide 1.133. Is that correct?

A I stated that many of the systems were capable of detecting to a clearer level than that. I guess I would have some hesitancy to specify a requirement that all plants meet a sensitivity level which is even better than that, but many of them can and do.

Q Are you aware of whether any system has been demonstrated in a BWR to operate at a sensitivity level better than the sensitivity level of the Regulatory Guide?

A No, I can't say that with a certainty. I have

seen and heard demonstrations of sensitivity of loose parts monitoring systems in BWRs where they have been extremely sensitive, but I don't know the relation of the values there to the sensitivity we have specified. They are certainly on that order of magnitude; it may be more so.

Q I am sorry? What is the source of the data that you were relying on in that answer?

A This was in some inspections of foreign BWRs and systems that they have installed there, and calibrations that they've performed there -- in Germany, specifically.

end #8

Q Inspections performed by the U.S. NRC?

A Yes. I personally visited those plants.

Q You have?

A Yes.

Q Do you know the sensitivity level of loose parts monitoring systems used in those plants?

A Not off the top of my head. As I said, they are comparable with what we have specified.

Q Do you know how well the loose parts monitoring systems at those plants have operated?

A They have -- on one operating BWR, they have detected a pump covered flange that was broken on one side. As I previously stated, they also detected some linkages that broke off in the steam generators, so they have performed their function.

Q How do these objects with the sensitivity level of the regulatory guide?

A Well, the instance concerning the pump covering is, of course, not directly comparable since this was a vibration. I don't know what the level of the impact energy was due to that vibration. If I may refer to my notes, I might be able to give you a better answer on that.

Q Yes, please do.

[Pause.]

A In the one instance there was a broken weld at one

site of the handle of the unp cover ring. The free end of the handle knocked against the cover ring introducing amplitude excesses from the signals of sensors located at the lower end of the reactor pressure vessel.

A second example consisted of an evaluation of change in the burst forms from those obtained during pre-operational vibration measurements.

The measurements indicated knocking in the area, the steam separator above the core. The following inspection revealed torn-off connection links between two rising tubes of the emergency core cooling system in the cyclone tubes of the steam separator.

I have no specific information on the energy levels.

Q So then are you unable to determine from this information how the objects described compare with the sensitivity levels in the regulatory guide?

A From these two examples of in-service -- or in-service failures, yes. I cannot determine how those compare.

However, the system calibrations are of a very sensitive level and comparable to those that we require by the regulatory guide.

Q Does the U.S. NRC receive routine operating reports with respect to the loose parts monitoring systems in the

foreign BWRs?

A No.

Q Are there any BWRs in the United States which employ loose parts monitoring systems that meet the regulatory guide?

A We have cases of loose parts monitoring systems currently under review which are claimed to meet the regulatory guide, all requirements of the regulatory guide. Since previous systems, all those that are installed and operational, of course, I would say that many of them, substantially, are consistent with the requirements of the regulatory guide, at least equipmentwise, many of them.

Q Mr. Phillips, I meant the question to refer to plants in actual operation.

A Yes, that is what I am addressing in my second part here. I say that many of the systems that are in operation substantially meet the requirements of the regulatory guide.

Q Well, by substantially meeting, do you mean that they would in fact operate at a sensitivity level which was not as good as the sensitivity level of the regulatory guide?

A Let me again state that I am speaking about equipmentwise, equipment capability. Programmaticwise, and the means of the operation. I wouldn't put that statement in the same vein.

Q I am not quite clear as to how you came out on the

question. Do the BWRS now in operation having loose parts monitoring systems detect parts at a sensitivity level which conforms with the regulatory guide?

A They have accelerometers and equipment installed which is capable of detecting parts to such a sensitivity level, and the way that they are operated, they, for the most part, do not.

We have no requirement on them to do that at the present time, and no substantial monitoring of the operation of the systems.

Q So are you saying, then, that the systems you have just described have this capability, but in fact the capability has not been demonstrated in actual operation?

A That is a fair statement.

MR. NELSON: Could we have a moment, Mr. Chairman?

CHAIRMAN WOLFE: Yes.

[Pause.]

THE WITNESS: Mr. Chairman, may I amend my last statement?

CHAIRMAN WOLFE: Certainly.

THE WITNESS: When we say it hasn't been demonstrated, perhaps that is not quite accurate. If we go to the experience related in the supporting documents to regulatory guide 1.133, you will find many,, many, many instances of detection of loose parts. Some of them are very small.

I believe that in many instances you can show that the parts would not have been detected, if the systems weren't operating somewhere in the neighborhood of the sensitivities required by regulatory guide 1.133.

BY MR. NELSON:

Q Mr. Phillips, are these many, many instances you are referring to in the cases of PWRs or BWRs?

A PWRs.

Q Exclusively?

A I believe so. The loose parts monitors we have had installed on BWRs are limited. We have not had nearly so many installed on BWRs as we have on PWRs. I can't recall any instance of loose parts detection on United States reactors, on United States boiling water reactors.

Q So it is fair to say, than, that your experience is predominantly based on experience with PWRs?

A And with German BWRs, yes.

MR. NELSON: No further questions at this time, Mr. Chairman.

BY MR. FARRIS: Mr. Phillips, isn't the installation of a loose parts monitoring system merely attempting to treat a symptom because we don't know what to do about the cause of loose parts?

MR. DAVIS: Mr. Chairman, I am going to have to object to that question. We are getting back to the cause

of the parts and not the subject of capability of detection.

CHAIRMAN WOLFE: Sustained.

MR. FARRIS: No further questions.

MR. ROGERS: No questions.

CHAIRMAN WOLFE: The Board has no questions. The witness is excused.

[Witness excused.]

CHAIRMAN WOLFE: Mr. Farris.

MR. FARRIS: Mr. Chairman, in light of the, we feel, unduly restrictive attitude of the Board about this contention, the Board's question, we are withdrawing Mr. Minor's testimony. The reason is that Mr. Minor's testimony went more to the cause of the problem of loose parts and not just to the capability of the loose parts monitoring system to detect the loose parts. We are withdrawing Mr. Minor's testimony.

CHAIRMAN WOLFE: All right.

Mr. Davis -- before we proceed to that, we will have a 10-minute recess, until 11:00 o'clock.

[Recess.]

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CHAIRMAN WOLFE: The hearing is resumed.

Mr. Davis?

MR. DAVIS: There have been certain logistical problems with the IGSCC, so counsel have agreed that we would proceed with the recall of, I believe, Messrs. Gang, and there is one other person that was going to be recalled, Mr. Fuller, to cross-examine on the Reed Report.

CHAIRMAN WOLFE: This will be in camera?

MR. DAVIS: Yes, sir.

CHAIRMAN WOLFE: All right, we will proceed to in camera session.

The courtroom will be cleared of the public, and those remaining will be those that have signed protective agreements.

(Whereupon, at 11:02 a.m., the hearing was recessed, to reconvene in an in camera session.)

END #10

* * *

AFTERNOON SESSION

[2:30 p.m.]

MR. DAVIS: My colleague, Mr. Paton, will be handling IGSCC.

CHAIRMAN WOLFE: All right.

MR. PATON: Mr. Chairman, I have a letter that I would like to distribute to the Board. May I approach the bench?

CHAIRMAN WOLFE: All right.

MR. PATON: Copies of this letter, dated February 28th, have been distributed to all parties.

When the Board completes reading the letter, Mr. Chairman, I would like to approach the bench with other counsel.

[Pause.]

[Board conferring.]

CHAIRMAN WOLFE: All right, counsel.

[Bench conference.]

MR. PATON: I would like to call Mr. Ron Gamble. He has not previously testified in this hearing.

Whereupon,

RONALD M. GAMBLE

was called as a witness on behalf of the Staff and, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PATON:

Q Would you state your name and your occupation, please.

A My name is Ronald Gamble. I am an engineer with the Nuclear Regulatory Commission.

Q Mr. Gamble, do you have with you a one-page copy of your professional qualifications?

A Yes, I do.

Q I want to ask you to read that into the record, and I also want to advise the reporter that she has before her a copy of what you are about to read.

A Professional qualifications of Ronald M. Gamble.

I am employed by the Nuclear Regulatory Commission as a section leader, Materials Integrity Section, in the Materials Engineering Branch, Division of Systems Safety, Office of Nuclear Reactor Regulation.

I am responsible for supervising safety reviews and evaluations concerning the materials performance, component integrity and in-service inspection aspects of the primary coolant pressure boundary and safety-related systems.

I have an MBA in operations analysis from the American University, 1977; a Master's degree in engineering mechanics from the University of Florida, 1972; and a Bachelor's degree in engineering mechanics from Pennsylvania State University, 1965.

Since 1965, I have been involved in evaluating materials performance and the integrity of flawed components for aerospace, fossil fuel and nuclear power applications. I have been employed by the NRC since 1964.

I was a member of the 1978 NRC Pipe Crack Study Group that evaluated the engineering and safety aspects of intergranular stress corrosion cracking (GSCC) in boiling water reactors.

As a member of the study group, I traveled to Japan and participated in discussions with representatives from Japanese utilities, design and fabrication firms, and government agencies concerning IGSCC in BWRs.

I also prepared sections of the Study Group report containing evaluations of the recent IGSCC incidents in Germany and at Duane Arnold.

Q Mr. Gamble, did you bring to the witness stand a copy of what you have referred to as the pipe crack study?

A No, I did not.

Q Would you get it?

[Pause.]

Mr. Gamble, do you now have with you a copy of a report entitled "Investigation and Evaluation of Stress Corrosion Cracking in Piping of Light Water Reactor Plants. January 1979, Pipe Crack Study Group, Nuclear Regulatory Commission"?

A Yes.

Q Also marked NUREG 0531.

Is your copy marked draft?

A Yes, it is.

Q Tell us what is that report.

A The report contains a review and evaluation of intergranular stress corrosion cracking in BWRs.

Q What information did the report consider?

A The report primarily considered information on recent cracking incidents. Recent being from 1975 or the last of the, last pipe crack study group report, up until January of 1979.

In addition, it also considered information that was available on intergranular stress corrosion cracking since 1965.

Q How many people were on the pipe crack study group?

A There were six members and probably 10 or 12 different consultants and other people who assisted in the preparation of the report.

Q What generally were the qualifications of these six members? How did they -- what qualifications did they have that got them put on the study group?

A All six members were engineers. I think the great majority of the members had degrees in metallurgy or metallurgical engineering.

Two people had degrees in mechanical or engineering mechanics, and two of the members had participated on the previous pipe crack study group.

MR. PATON: Mr. Chairman, I offer in evidence as Staff Exhibit No. 13 the pipe crack study that has been described by the witness and I have supplied the reporter with three copies.

CHAIRMAN WOLFE: Any objection to the admission of Staff Exhibit 13?

MR. GALLO: No objection.

MR. FARRIS: No objection.

MR. ROGERS: No objection.

CHAIRMAN WOLFE: Staff Exhibit No. 13 is admitted into evidence.

[The document referred to was marked Staff Exhibit No. 13 for identification and received in evidence.]

BY MR. PATON:

Q Mr. Gamble, can you tell us what -- referring you to page 13 of the report, can you tell us, was NUREG 0313 -- what is that document that is referenced at the bottom of page 13 on the report?

A NUREG 0313 is the licensing implementation document that came out of the original pipe crack study report in 1965.

Q Has the Staff required the Applicant in this case comply with NUREG 0313?

A I'm sorry, I did not hear the entire question.

Q The question is, has the Staff required that the Applicant in this case comply with NUREG 0313?

A Yes, it has.

Q Does the pipe crack study assess the adequacy of NUREG 0313?

A Yes, it did.

Q What did it say?

A The pipe crack study group concluded that NUREG 0313 was adequate to address the subject of IGSCC for BWRs.

Q There has been introduced into the record in this proceeding a copy of Branch Position 5-7. Can you tell me the relationship between Branch Position 5-7 and NUREG 0313?

A They are the same document, the same content.

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Q Does the pipe cracks study make recommendations that could change the requirements of NUREG-0313?

A Yes, it does. The pipe crack study group has one recommendation concerning classification of riser piping that could conceivably in the future change 0313.

Q Has the staff implemented any change as a result of that recommendation in the pipe crack study?

A No. The present pipe crack study group report is not yet published, and the staff has not yet -- it has not yet been made available to the staff in general, so the staff has not been able to review this report.

Q Do you have any idea when it will be published and made available to the staff?

A Within a week.

Q Does this pipe crack study address intergranular stress corrosion cracking that occurred at the Duane Arnold Plant?

A Yes, it does.

Q Does it make recommendations in that regard?

A Yes, it does.

Q What are those recommendations?

A It recommends that thermal sleeve to safe end attachment geometries that produce crevaces or result in crevaces be eliminated for use in BWRs.

Q Has that recommendation been implemented by the

staff?

A No, it has not.

Q The pipe crack study did indicate the adequacy, however, of NUREG-0313 at the present time? Is that correct?

A Yes.

Q Do you know where in the pipe crack study that statement is made?

A If you give me a minute, I can find it. It makes that statement in the section labeled "Conclusions and Recommendations," page XIX.

MR. PATON: That's all I have, Mr. Chairman.

CHAIRMAN WOLFE: Mr. Gallo?

CROSS-EXAMINATION

BY MR. GALLO:

Q Mr. Gamble, what is the change on riser piping that you referred to?

A The study group report recommends that riser piping be considered a service-sensitive line.

Q Assuming that that recommendation was accepted by the staff, what are the ramifications of that?

A In accordance with NUREG-0313, what that would mean was that -- there are several classes of plants.

For plants under construction, it would mean that you would have to use corrosion resistant materials in that line.

For operating plants, it would mean you would have to have an augmented in-service inspection.

MR. GALLO: May I have a moment, Mr. Chairman?

(Pause.)

BY MR. GALLO:

Q As I understand the report, Mr. Gamble, it addresses itself to such piping materials as 304 stainless steel, and 316L stainless steel. Is that correct?

A That's correct.

Q Are you aware of a low carbon nitrogen strengthened material that I understand has been designated by GE as 316K?

A Somewhat familiar, yes.

Q Was this a material that was discussed by the study group members?

A No, not this specific material; no.

Q Are you aware of this material's properties in comparison with those in 316L?

A I am aware that it is a low carbon grade of stainless steel similar to 316. That is about what I know about that material, specifically.

Q It is my understanding that this low carbon nitrogen strengthened steel is more able to meet the stress limits of the ASME Code, and therefore it might be called a stronger material than, say, 316L. Do you have any

understanding in this regard?

A I understand the 316L generally has a lower code allowable stress limit than 316, yes: but I am not familiar with the stress-allowables of 316K.

MR. GALLO: I have nothing further, Mr. Chairman.

CHAIRMAN WOLFE: Mr. Farris?

BY MR. FARRIS:

Q In the Japanese experience, Mr. Gamble, did you learn what the Japanese attributed the cause of IGSCC?

A I have been advised that the information relating to the Japanese or German experience is classified, and I have been advised that I cannot discuss that information.

Q Do you consider the information learned in Japan and Germany applicable to domestic BWRs?

MR. PATON: I objection, Mr. Chairman. I object because the question will require the witness to consider the information that is classified.

MR. FARRIS: I didn't ask for any specifics; just whether they consider that information relevant to their evaluation here.

CHAIRMAN WOLFE: May I have that question back, precisely, Ms. Reporter?

(The reporter read from the record as requested.)

MR. PATON: Mr. Chairman, I think the question gets too close to a consideration of what the information

was. I would not object to a question of whether or not the Staff considered the information they got from Germany and Japan, but I think if we are getting into an area of whether or not it is applicable, I think we are now getting into an area of what specifically the information was.

MR. FARRIS: I think it is self-evident that they considered it. They prepared a task group study that studied the information.

My question, and the only question possibly relevant to Black Fox, is: Is this information helpful to the Board, and would it be helpful for the Board to analyze in terms of the Black Fox Station.

CHAIRMAN WOLFE: Well, we haven't gotten there quite yet, Mr. Paton.

You may answer the question. Objection overruled.

THE WITNESS: I think the information we learned was certainly relevant to the subject of intergranular stress corrosion cracking.

BY MR. FARRIS:

Q Without identifying any particular conditions, are you aware of any conditions in either Germany or Japan that would contribute to intergranular stress corrosion cracking that you wouldn't expect to find in an American BWR?

MR. PATON: I object. That calls for direct information from those reports which are classified. We have

been instructed, Mr. Chairman, that all of the information in those reports is classified.

MR. FARRIS: I prefaced that by saying "without identifying any particular conditions," to tell me if there are any conditions in Germany or Japan that would make it more likely for IGSCC to occur in either or both places than it would be in the domestic BWR.

MR. PATON: Could I ask that that question be repeated?

CHAIRMAN WOLFE: All right, Ms. Reporter.

(The reporter read from the record as requested.)

CHAIRMAN WOLFE: The objection is overruled.

We will hear a "yes" or "no" answer, and that is about it.

end #18

THE WITNESS: No.

BY MR. FARRIS:

Q Would you therefore conclude, Mr. Gamble, that American BWRs or domestic BWRs are susceptible to IGSCC to the same extent that Japanese and German reactors are?

MR. PATON: I object, and the reason for the objection is tnat we should be considering here Black Fox. The last question in my own opinion elicited a misleading answer in that it was addressed to all American plants.

I think the only issue before this Board is the Black Fox case, and I object to the question as a very general question, and if acceptable at all, it should be limited to Black Fox.

MR. FARRIS: I will so limit the question.

MR. PATON: Could we hear the question again with that amendment, Mr. Chairman?

CHAIRMAN WOLFE: And the amendment is with respect to the Black Fox BWR?

BY MR. FARRIS:

Q And we would conclude that Black Fox is susceptible --

MR. PATON: I object to the most recent question because its premise is the answer to the previous question. The answer to the previous question was not as to Black Fox. It was as to American reactors generally, and therefore I think the answer is misleading in the Black Fox case. The

preceding question was not limited.

CHAIRMAN WOLFE: I thought your objection was to the latest question, was that it was directed generally to BWRs, and now when the question has been amended to apply specifically to Black Fox, now you say that that is objectionable.

MR. PATON: I think so, Mr. Chairman, because the question itself is premised -- the question is do you now agree, based on your previous answer, and the problem with the previous answer was that it also did not limit itself to Black Fox.

CHAIRMAN WOLFE: All right. State the question differently so then we have it before us without any problems here.

MR. FARRIS: I think I see Mr. Paton's problems.

CHAIRMAN WOLFE: Yes.

BY MR. FARRIS:

Q Assuming Black Fox Station utilized the same piping materials as in the German and Japanese BWRs, would you therefore conclude that Black Fox Station would be as susceptible to IGSCC as the German and Japanese reactors?

MR. PATON: I object, Mr. Chairman. He might as well ask the question about the German reactor, assuming that Black Fox uses the same material as the German reactor. That is a good way of leaping over Black Fox and asking about

the German reactor.

MR. FARRIS: I could care less about the German reactor per se. The question is, has there been anything -- what I'm trying to get at is is there anything particular identified in Germany and Japan that may not be applicable to Black Fox Station.

I understand that we are going to attempt to some IGSCC-resistant materials for Black Fox, but I am saying if we don't, is there anything else that would make the study not relevant to the Black Fox Station.

MR. PATON: If you would indulge us just a minute, Mr. Chairman. The Chairman allowed the question if you would limit it to Black Fox.

Is there anything that happened in Germany that is not applicable to Black Fox?

The problem I had is that you said it was not applicable to American reactors generally. If you go back and ask that question again about Black Fox, I wouldn't object.

MR. FARRIS: I thought my last question did.

MR. SHON: No, I think your last question introduced another element in the chain of logic in that you said assuming that Black Fox used the same materials as the German reactor, which is a different matter. Perhaps it does, perhaps it does not.

I think you should ask the question about Black Fox

as it is planned, rather than Black Fox as you might hypothetically re-plan it.

MR. GALLO: Mr. Chairman, could I get in my two cents' worth, so we can ask questions, so I can refrain from objecting?

If we are going to compare materials, I am wondering if his questions on material comparisons include or exclude mitigating measures.

CHAIRMAN WOLFE: I am going to sustain the objection to the question as posed.

BY MR. FARRIS:

Q Do you expect the information that the NRC has learned from its review of Japanese and German experience with intergranular stress corrosion cracking will be helpful in review of Black Fox Station?

A I think, as I mentioned before, the study group considered all information it had available to it, concluded that NUREG 0313 was adequate to address the subject of IGSCC. From reading the past testimony I conclude that Black Fox Station in fact meets the requirements of 0313.

Therefore, I think Black Fox meets the requirements necessary to assure intergranular stress corrosion cracking has been adequately addressed.

Q Do you know if 316k Stainless steel meets the requirements of the NUREG to which you refer?

A I do not know if 316k meets those requirements. All I know about 316k is that it is a low carbon grade stainless steel.

Q If Black Fox Station uses, in fact uses 316k stainless steel, you cannot say that it met the requirements of the NUREG?

A NUREG 0313 says that the corrosion-resistant materials will be evaluated on a case-by-case basis. It is my understanding that Black Fox, from the testimony, has not committed to any material. When they commit to the material, we will review it on a case-by-case basis and determine whether in fact that material meets the corrosion-resistant standards that we consider necessary for prevention os IGSCC.

Q Does the Staff have any plan to augment their inspections of BWRs to ensure that the materials selected as corrosion-resistant materials will in fact bear up in actual operating experience?

A I think 0313 states that if the plant has acceptable corrosion-resistant material, that no augmented in-service inspection program is required or necessary.

Q How will you know that this materialis in fact proving itself to be corrosion-resistant if you don't inspect?

A Inspections are in fact carried out periodically in accordance with Section XI of the ASME Code. The Staff's position is that if there is a generic problem

with IGSCC cracking or any cracking, that the code requirements for inspection are adequate to find that problem or define that problem.

Q Mr. Gamble, in previous testimony on this subject, it was brought to light that the Germans had experienced a crack in a 20-inch or greater diameter pipe. Do you know if that particular pipe was subjected to anything, any environmental condition that would be different from the condition likely to be present at Black Fox Station?

A I have been advised that that is classified information and I cannot discuss the details of that.

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Q Are the details of the Duane Arnold Plant classified, Mr. Gamble?

A No, they are not.

Q Is the Duane Arnold, in fact, shut down at this point because of IGSCC?

A I don't know whether Duane Arnold has started back up or not. I just don't know.

Q When was Duane Arnold shut down, Mr. Gamble?

A June 1978.

Q Mr. Gamble, have you read Mr. Martin Fate's testimony in response to the Board's Question 15-1?

A That testimony was October -- the October testimony?

Q Yes.

A Yes, I have read that.

Q Are you aware that Mr. Fate committed to whatever generic issue the staff recommends to resolve IGSCC?

A I don't remember the specific wording, exactly what you are referring to.

I remember discussions along those lines, but I don't remember those specific words.

Q Is the staff participating in any tests to test the adequacy of 316L, 316K, or 304 stainless steel which has been treated with one of the so-called "mitigating IGSCC mitigating measures"?

A. To my knowledge, the NRC is not directly participating in any tests.

Q. Is your approval of these materials based upon data submitted by the utility?

A. Yes.

Q. Is this data empirical data, as opposed to analytical data?

A. Well, the industry and the NRC are doing many studies, both of which are empirical and analytical. So generally they will be both.

Q. Do you personally have a preference for the type of piping materials to be used as the most effective materials to resist IGSCC, Mr. Gamble?

A. There are a lot of selections.

Q. The best, in your opinion?

A. I think there are several materials that the NRC considers have the potential to resist intergranular stress corrosion cracking. I don't think the staff has a "best material."

Q. Mr. Gamble, is it your testimony that the use of IGSCC-resistant materials would absolutely preclude IGSCC at Black Fox Station?

A. No. I couldn't say that it would absolutely preclude it, no.

Q. Could it be that new materials and processes, at

cetera, could turn out to actually delay the onset of IGSCC?

A If it doesn't absolutely preclude it, I would say, yes, that is certainly a possibility.

Q In fact, the materials are referred to as "IGSCC-resistant" materials, aren't they?

A Yes.

Q And other than for the materials themselves, the same conditions that contributed to IGSCC will still be present at Black Fox Station, won't they?

A To the best of my knowledge, yes.

MR. FARRIS: No further questions.

CHAIRMAN WOLFE: Mr. Rogers?

MR. ROGERS: No questions.

CHAIRMAN WOLFE: Mr. Paton?

MR. PATON: Yes, one or two, Mr. Chairman.

REDIRECT EXAMINATION

BY MR. PATON:

Q Mr. Gamble, Mr. Farris asked you a question about the Staff acceptance of new material, and whether that was based on data from Applicants. Do you recall that question?

A Yes.

Q Is your acceptance of new material based solely on data from Applicants?

A No. There is experience. There has been for example, L-grade stainless steels that have been used in

other industries outside of the nuclear industry for many years wherever IGSCC was a problem, and have performed successfully.

So there is a service experience in other industries.

Q Within the nuclear industry, do you rely solely on the applicant for your information?

A No.

Q Mr. Gamble, I think I forgot to ask you: With respect to the statements in the pipe crack study, to the best of your knowledge, information, and belief, are those statements true?

A Yes.

MR. PATON: That's all I have, Mr. Chairman.

MR. GALLO: I have a question.

RECROSS-EXAMINATION

BY MR. GALLO:

Q Does NUREG-0313 require the qualification of new material from the standpoint of corrosion resistant properties?

A No, it doesn't say anything specifically about qualification. It just says that the staff will review them on a case-by-case basis.

Q If we wanted to use 316R in Black Fox, would we need staff approval?

A According to 0313, yes, you would.

Q We would simply make a proper application to the project manager? Is that how it is done?

A There are various ways to do it. That would be one of them.

Q And are you experiencing how it is done under the implementation of NUREG-0313?

A I'm sorry? I don't --

Q Are you familiar with the -- strike that.

In your normal duties on the staff, are you involved in the implementation of 0313?

A Yes.

Q Have you had occasion to review new materials for a determination of whether or not it is acceptable from the standpoint of corrosion-resistant properties?

A Yes. We have had proposals made to us for various plants using different corrosion resistant materials.

end #20

Q Are you aware of whether or not such a proposal was made by the operator of the Limerick plant to the NRC Staff?

A I am not familiar with that, no.

Q Are you aware of the water quality specifications that will be used for the Black Fox Station?

A No I am not.

Q Are you aware of any oxygen -- are you aware of the oxygen specifications for the Black Fox plant?

A No, I am not.

MR. GALLO: I have nothing further.

CHAIRMAN WOLFE: Mr. Farris?

MR. FARRIS: No, sir.

CHAIRMAN WOLFE: Mr. Rogers?

MR. ROGERS: No.

CHAIRMAN WOLFE: The Board has no questions. The witness is excused.

[Witness excused.]

CHAIRMAN WOLFE: Mr. Gallo,you have supplementary testimony?

MR. GALLO: I would like to call Dr. John West to the stand.

Dr. West has been previously sworn.

Whereupon,

JOHN B. WEST

was recalled as a witness on behalf of the Applicants and, having been previously duly sworn, was examined and testified further as follows:

DIRECT EXAMINATION

BY MR. GALLO:

Q . Would you state your full name and address and occupation for the record, please.

A My name is John B. West. I reside at 7901 South Yukon, Tulsa, Oklahoma. My position is manager of Black Fox Station Engineering with Public Service Company of Oklahoma.

Q Dr. West, have you had occasion to prepare supplemental testimony for this proceeding?

A Yes.

Q I show you a three-page document entitled "Supplemental Testimony of Dr. John B. West Concerning Contention 15-1," and ask if this is the supplemental testimony prepared by you for this proceeding?

[Document handed to witness.]

A Yes, it is.

Q Are there any additions or corrections?

A Not to my knowledge.

Q Is it accurate and complete, to the best of your

knowledge and belief?

A It is.

Q Would you look at page 2.

A Yes.

Q In the middle of the first full paragraph, I notice a gap right in the middle there. If you would explain how that happened to occur.

A There was redundant wording in this sentence, the words "in the field" were deleted. They occurred previously in the sentence. It is not really good grammar, so I asked that they be deleted.

MR. GALLO: At this time I would like to introduce into evidence the supplemental testimony of Dr. John B. West.

CHAIRMAN WOLFE: Any objection?

MR. FARRIS: No objection.

MR. ROGERS: No objection.

MR. PATON: No objection.

CHAIRMAN WOLFE: Said supplemental --

MR. GALLO: Excuse me, Mr. Chairman. 20 copies have been furnished to the reporter, and I would like to have it introduced -- bound into the transcript as if read.

CHAIRMAN WOLFE: Without objection, said testimony is incorporated into the record as if read.

[The document follows:]

SUPPLEMENTAL TESTIMONY

OF

DR. JOHN B. WEST

CONCERNING CONTENTION 15-1

In my previous testimony concerning the piping material to be used in the recirculation system for the Black Fox Station and the so-called measures to mitigate the effects of intergranular stress corrosion cracking (IGSCC), I stated that I had the matter under study. (Please refer to the transcript at pages 5941-5943). It is the purpose of this supplemental testimony to update the status of that evaluation.

Public Service Company is continuing to investigate the type of material to be utilized for the recirculation pipe at the Black Fox Station. 304, 316L and 316K stainless steel are under consideration. We, of course, would only use 304 stainless steel material with the implementation of appropriate mitigating measures, a subject I will discuss later in my testimony. As I previously testified, 316L appears to be resistant to IGSCC but the ASME Code allowable stress levels for the piping are lower than for 304 stainless steel. 316K stainless steel appears to have the necessary properties to

overcome this problem and we are examining the possibility of using this material in the recirculation pipe at the Black Fox Station.

The IGSCC mitigating measures discussed by Dr. Gordon in his testimony are solution heat treatment, corrosion resistant cladding and heat sink welding. I continue to believe that solution heat treatment and corrosion resistant cladding can be effective mitigating measures. However, I do have some reservations with respect to heat sink welding. Specifically, I am concerned about field fabrication methods, the lack of field performance data and the fact that approval by the NRC Staff is still outstanding. Heat sink welding is intended for application in the field and it could be a difficult procedure to properly implement. My concern is that despite the best efforts of a welder, the technique might still result in some sensitizing of the metal. Consequently, it appears that until further information becomes available, heat sink welding should be used on only a limited basis and we are reviewing the selection of materials and fabrication methods for the recirculation pipe on the Black Fox Station to eliminate wherever possible the need to use heat sink welding. I understand that GE and the NRC Staff are actively reviewing this matter and as more information becomes available, my concerns on the use of heat sink welding may disappear. However, it is my

present belief that of the materials available, 316K or 304 stainless steel using primarily solution heat treatment and corrosion resistant cladding as mitigating measures, will provide a solution to IGSCC and a recirculation system that will meet the requirements of the NRC Staff.

MR. GALLO: The witness is available for cross-examination.

CHAIRMAN WOLFE: Mr. Paton?

MR. PATON: No questions, Mr. Chairman.

CHAIRMAN WOLFE: Mr. Farris?

MR. FARRIS:

CROSS-EXAMINATION.

BY MR. FARRIS:

Q Are you concerned about the availability of qualified welders in utilizing 304 in conjunction with heat sink welding?

A In utilizing heat sink welding as a construction technique in the field, it will be necessary to prepare special procedures which are applicable to that technique, to train and qualify welders to utilize that technique.

I am not concerned that this can be done, and I am not concerned that it will be done, should we utilize the technique, we will do this.

Q Would that be expensive to PSC as opposed to using 316L or one of the other low carbon steel materials, rather than 304?

A The training and qualification of that welding procedure and utilization certainly would be more expensive than the standard technique for welding 304 or 316L.

However, I would point out that in those cases,

welders will also be qualified to use whatever material is being welded.

Q Would that welding be considered spacial process, in your opinion?

A It would not be my understanding that this would be classified a special process in the context that special processes have been discussed in these hearings.

Q You state that your concern is that despite the best efforts of a welder, the technique might still result in some sensitizing of the metal. Are you assuming that this welder has been trained by your qualified personnel?

A Yes.

Q In your opinion, would 304, the use of 304 stainless in conjunction with heat sink welding, provide the best results assuming it was done properly?

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A I have a problem, as have others, in the testimony with the use of the word "heat."

Q As compared to the use of 316K, or 316L, without a mitigating measure?

In other words, would it be better than those other two methods?

A In my testimony, Mr. Farris, I have indicated that I have a personal reservation in the construction and field fabrication utilization of heat sink welding until the procedures have been developed and submitted and reviewed and the welding defined in terms of those construction techniques which lead to the actual welding process, because this does require the addition of water, and does involve some special construction techniques.

I simply am not as comfortable with the process as I am with some of the other techniques. This does not mean that it isn't as good. It simply means that I personally have not yet been satisfied in my own mind that it is as good.

Q Who first suggested the use of 316K to you, Dr. West?

A In the discussions with the General Electric Company, and in -- as I testified, I think, in the October hearings, we were considering the utilization of 316L stainless steel.

This material has, in my understanding, a lower stress allowable than does the 304. In this context, the material which has been described as 316K was suggested as a possible alternative, having the same corrosion-resistant properties as 316L. But because of the nitrogen content, it was strengthened and met similar stress allowables to that of 304.

Q What is the difference in ASME Code allowable stresses for 316K and 316L?

A My understanding is that 316K can be strengthened so that the stress allowables would be higher in 316K than they would be in 316L.

Q Would the nitrogen strengthening process give rise to any new phenomena that may affect the safety of the-- or the integrity of the reactor coolant pressure boundary?

A I am not aware of any such effects.

Q Do you know if 316K has ever been used in this particular application before?

A It is my understanding that 316K has been suggested and proposed and is being utilized in the Limerick Nuclear Station.

I am also aware that some other utilities are seriously considering using it in whole or in part in this application.

Q Do you know how long it has been in use in any

particular reactor?

A I do not; no, sir.

Q Is this your first experience, Dr. West, with 316K?

A Yes, sir.

Q Had you ever heard of it before?

A Prior to, let's say, this last fall? No, sir.

Might I interject that what we are discussing here is that we are considering it as a possible material.

Q What are the sources of 316K? In other words, what vendors? Who are the possible vendors for 316K?

A I do not know who the original vendor of the material is.

I would point out that in the Black Fox Station, the General Electric Company is responsible for providing the recirculation system piping. Therefore, as far as we are concerned, literally the General Electric Company would be the vendor.

end #22

Q What is the percentage of carbon in 316K, Dr. West?

A My understanding is that it is .02 percent.

Q Is that less than in 316L?

A My understanding is that 316L carries a .03 percent carbon.

Q Dr. West, are you aware of the use of 316K in any reactor that is presently operating?

A No, sir.

Q Has General Electric Company provided you with any test data regarding the corrosion resistance of 316K?

A I understand from discussions that it has essentially the same corrosion resistant properties as 316L. This would also be indicated by its composition.

I have not, however, seen any specific data that would corroborate this at the present time. As I said, we are merely at the present time considering it as a possible material.

Q Dr. West, does your testimony in any way change the commitment made to this Board by Martin Fate back in October?

A No, sir.

Q You were present when I cross-examined Mr. Fate?

A Yes, sir.

Q And you heard me ask him if any of the language in

his prefiled testimony in any way qualified his oral testimony of an absolute commitment to implement this Staff generic solution to this problem.

MR. GALLO: Objection. I think the question is unfair and potentially prejudicial. If counsel has the transcript and wishes to show it to the witness to verify that it is a correct quote and he can refresh his memory, I have no objection.

MR. FARRIS: Dr. West is intimate with this and was present when the statement was made. As an expert witness he will correct me if I mischaracterize the testimony. I do not have the transcript.

CHAIRMAN WOLFE: Doesn't the transcript, the statement of Mr. Fate speak for itself?

MR. FARRIS: My question was, does he in any way change the commitment?

MR. GALLO: He answered that question, Mr. Chairman. He said no.

May we have the most recent question back, Ms. Reporter?

[The reporter read the pending question, as requested.]

[Board conferring.]

CHAIRMAN WOLFE: I think the transcript speaks for itself. The question will not be allowed.

BY MR. FARRIS:

Q Are you attempting by your testimony in any way, Dr. West, to qualify the commitment made by Mr. Pate on that day?

A No, sir, it is my understanding that we have an obligation to keep the Board informed on developments. This has been further amplified in the letter which all operating utilities received, with regard to the timely giving of information.

My counsel advised me that this is a subject which we should inform the Board of, even though the change in status to date is of relatively minor nature. My purpose was to simply inform the Board pursuant to the study that I had referred to in my previous testimony in October as to our status.

[Pause.]

MR. FARRIS: No further questions.

CHAIRMAN WOLFE: Mr. Rogers?

MR. ROGERS: No questions.

CHAIRMAN WOLFE: Mr. Gallo?

MR. GALLO: No redirect.

CHAIRMAN WOLFE: All right. There are no Board questions. The witness is excused.

[Witness excused.]

Is there any other direct testimony?

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[No response.]

Supplementary testimony?

MR. GALLO: I have nothing, Mr. Chairman.

CHAIRMAN WOLFE: Is there any rebuttal testimony?

MR. GALLO: I have none, Mr. Chairman.

MR. FARRIS: I have none.

MR. ROGERS: I have none.

MR. PATON: No, Mr. Chairman.

CHAIRMAN WOLFE: Then I take it there is no surrebuttal?

MR. GALLO: No surrebuttal, Mr. Chairman.

CHAIRMAN WOLFE: All right.

MR. GALLO: Mr. Chairman, there is one other matter. It regards the status of a supplement to the Staff's Safety Evaluation Report.

Perhaps Mr. Davis can address that.

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MR. DAVIS: Mr. Chairman, as the Board knows, it is the practice of the Staff to issue an SER Supplement once it has concluded all of the reviews of the various issues and signed off on them.

Since several of the issues were litigated in the case, and the regulations require that we put the SER Supplement into the record, counsel have stipulated that the Staff would submit the SER Supplement to indicate that we had, solely for the purpose -- to indicate that we had completed our review, and that it would not be considered as being substantive evidence on the various issues contained therein.

That is, we thought, since there would be no opportunity for cross-examination, and all the procedural safeguards that accompany testimony in a hearing, that we would just submit it to the Board, if the Board could keep the record open, solely for the purpose of -- close the record -- let me see.

We could either close the record and reopen it for the purpose of admitting Staff's SER Supplement No. 2; or we could leave it open until we submit Staff's Supplement-- SER Supplement No. 2.

At any rate, the idea was that the parties --

CHAIRMAN WOLFE: Would you ask that it be admitted, then, pursuant to the stipulation? It would be admitted into the record? Shall we assign a Staff Exhibit number to it,

then?

Did you intend to incorporate that into the record? It would probably be better as a staff exhibit, I would think.

MR. DAVIS: We could make it Staff 14.

MR. FARRIS: There is no stipulation to admit this into the record.

MR. DAVIS: To have it physically accompany the record, but not be introduced into the record as evidence, as such.

MR. FARRIS: That is my understanding.

The Staff cannot, in order words, use this to prove or disprove any of the matters in issue before this Board. It cannot be used as evidence for that purpose.

If there are other issues that the Staff wants to advise the Board on that were not an issue in this hearing, we have no objection to it being used for that purpose, but not without the benefit of cross-examination.

MR. DAVIS: That is the substance of our agreement.

So that I, for instance, would not put some information in the SER Supplement, and then refer to it in my findings of fact as being in evidence.

CHAIRMAN WOLFE: To make a tidy record, why not give it a number and put the limitation on it that it is only introduced for the limited purpose? Do you want to make

that offer?

MR. DAVIS: Yes, I would. And I am not sure of the time schedule, but I am advised that this would probably come out mid-April, and that would be Staff Exhibit 14.

CHAIRMAN WOLFE: And it is for the limited purpose of showing what, now?

MR. DAVIS: Of showing that the Staff has completed its review of the issues in Black Fox.

MR. FARRIS: Wait a minute. Not for the issue. Not generally the issues of Black Fox, but the noncontested issues of Black Fox; that the matters not in issue before this Board --

MR. DAVIS: Matters not in issue. The Staff review of the matters in issue were presented as testimony. So that --

MR. GALLO: Mr. Chairman, I thought the stipulation was that the purpose of the supplement was to show compliance with Commission regulations, and not for the truth or falsity with respect to any material contained therein -- much like the ACRS letter is treated.

end #24

MP. DAVIS: That was my intention. We are probably going to have a writeup on a couple of issues that were not contested, and a sign-off on some of the issues that we testified to here.

MR. FARRIS: If the purpose of any part of the SER is to bring up the Staff's review on any item that is in issue here, then we would have to make -- we would have to open up the record again for cross-examination on those issues. I say again if it is some matter that is not in issue and wasn't litigated before this Board, I have no objection to it being used in the record for that purpose.

But if the Staff or the Applicant, for that matter, intend to use it to argue their substantive case on any issue including the Staff's -- adequacy of the Staff's review under ALAB 444, then I would object to it.

MR. GALLO: Mr. Chairman, could we go off the record and have counsel talk about this again?

CHAIRMAN WOLFE: All right.

[Discussion off the record.]

MR. DAVIS: Let me make another crack at the stipulation.

The stipulation is, I believe, that the SER supplement No. 2 will be submitted and will not be used (1) as substantive evidence on any contested issue or (2) contain any more information that might be argued later on to be

for the purpose of compliance with River Bend.

CHAIRMAN WOLFE: All right. Hopefully I can restate it correctly.

When submitted to the Board, Supplement 2 to the SER will be, the record will be open for the purpose of putting Staff Exhibit 14 into the record, and it is agreed that that exhibit will not be used as substantive evidence on the controverted issues, and will not be used to show compliance with the River Bend opinion.

The record will be closed shortly today, but it will be reopened for the limited purpose of putting Staff Exhibit 14 into the record.

All right. If there are no other matters, do the parties have any short closing statements to make?

MR. GALLO: I have no statement, Mr. Chairman.

MR. FARRIS: Mr. Chairman, in a normal trial this would be a case, I guess, where the parties would argue for a directed verdict. I would urge the Board and move the Board at this point as a matter of law, based upon the evidence that has been adduced in this hearing to find that a construction permit for Black Fox Station should not issue because of the many and numerous safety issues that are still unresolved, unverified designs, untested materials, and the unproven capability of the Applicant to be able to pull all of these things together in time.

They clearly demonstrate in the opinion of the Intervenors that there is no reasonable assurance that Black Fox Station can be built in order to adequately protect the public health and safety.

I would so move the Board without further consideration so rule.

And I would also thank the Board for their attention during these hearings, and hope that we meet again one of these days.

MR. DAVIS: Mr. Chairman, the Staff would ask that the instant motion be denied to be considered upon submission of the appropriate findings of fact on a schedule that has been agreed to by the parties.

MR. GALLO: Mr. Chairman, I would also ask that the motion be denied. The many and numerous safety issues referred to by Mr. Farris were not specifically identified. I suspect that was because they can't be specifically identified.

Applicant is completely confident that we have met the burden of proof on each and every issue in this proceeding, and that a construction permit should issue.

MR. ROGERS: The State of Oklahoma wishes to express no opinion.

CHAIRMAN WOLFE: All right. The motion is denied.

This is a very complex case and we will review the expert testimony and the exhibits and the proposed

findings of the parties in the briefs, conclusions of law, and at that time we will arrive at our decision and not prejudge at this time.

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The Board has specific instructions for the parties before formally closing [illegible].

The Applicant shall, within 24 days after the record is closed, file proposed findings of fact and conclusions of law and briefs and a proposed form of order decision.

The Intervenors and the State of Oklahoma may file proposed findings of fact and conclusions of law, and briefs, and a proposed form of order or decision within 24 days after the record is closed.

However, the Staff may file the aforementioned submissions within 44 days after the record is closed.

The State of Oklahoma's proposed findings of fact and conclusions of law shall be limited to addressing those matters heard in the open sessions of the hearing which were so heard after the State was orally admitted as an interested State under Section 2.715(c), and limited to addressing the Reed Report matters which were heard in the in camera sessions of the hearing.

The Applicant may reply within 10 days after the service of the proposed findings and conclusions of law, and briefs, by the other parties and the State of Oklahoma.

20 copies of the aforementioned submissions of the parties and of the State of Oklahoma which address those matters heard in the open sessions of the hearings shall be mailed to the Atomic Safety and Licensing Board Panel,

Attention: Chief, Docketing and Service Section, United States Nuclear Regulatory Commission, Washington, D. C. 20555.

Three copies of the aforementioned submissions which address those matters heard in the in camera sessions shall be mailed in envelopes marked "Confidential" to the attention of Sheldon J. Wolfe, Atomic Safety and Licensing Board Panel, United States Nuclear Regulatory Commission, Washington, D. C. 20555.

An inner envelope containing these submissions shall contain the wording "confidential." One copy each shall also be mailed to other counsel for the parties in envelopes marked "confidential, to the attention of the addressee."

I might advise and suggest, and indeed direct the parties and the State of Oklahoma, to read the provisions of Section 2.754(c). These provisions should be adhered to.

The Board would like to compliment the counsel for the parties. This has been a long and involved case, and in all circumstances you have acted professionally and competently, and we were very pleased with the conduct of counsel, even though at times in the midst of an adversary proceeding there are abrasive situations. But that comes with the practice of law.

All right, if there are no other matters to be attended to, the hearings are formally closed.

But as I have indicated before, they are subject to reopening when the Staff submits to the Board Supplement 2 to the SER which has been admitted as Staff Exhibit 14.

Thank you.

(Whereupon, at 3:50 p.m., the hearing was adjourned.)

* * *