

January 22, 1996

Mr. Stanley P. Johnson, CEO  
The Johnson Gage Company  
534 Cottage Grove Road  
Bloomfield, CT 06002-3032

Dear Mr. Johnson:

This letter provides you with NRC's evaluation of the list entitled "New Thread Failures," that you presented during the meeting between you and Chairman Jackson on October 10, 1995 (See Attachment). Many of the citations were previously submitted to the NRC staff and comments were sent to you in response to your September 1, 1994 letter to Brian Sheron. We evaluated a number of these citations in our November 3, 1994 letter to you from William T. Russell. NRC Inspection Reports 50-361/94-22 and 50-362/94-22 were provided to you in a letter from Jack R. Strosnider dated May 22, 1995. Several of the citations were general and no specific information related to fastener thread failure could be found.

The staff continues to be unable to conclude that there is any safety concern associated with the use of System 21 gaging, or that the use of other systems, such as Systems 22 or 23, will produce any substantial increase in public health and safety. The industry (the Nuclear Energy Institute and the Electric Power Research Institute) have also concluded that the use of System 21 does not create an unsafe condition in the nuclear industry. The American Society of Mechanical Engineers has determined that there is no requirement to use System 22 in the nuclear industry. No new information has been identified to change these conclusions. Therefore, the NRC staff continues to consider this matter closed.

Sincerely,

ORIGINAL SIGNED

BY:

Brian W. Sheron, Director  
Division of Engineering  
Office of Nuclear Reactor Regulation

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Stanley P. Johnson

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ATTACHMENT  
EVALUATION OF THE LIST ENTITLED  
"NEW THREAD FAILURES"

1) Browns Ferry

An inspection report was found with this Docket number and date that had nothing to do with fasteners. Unless you can provide us with more specific information regarding how this citation is related to thread fastener failures, we cannot pursue this further.

2) Information Notice 84-36

This report deals with set screws that hold a locking nut in place in the Limatorque Model SMB-4 motor operator. Although required to be staked, the set screws had not been staked and were vibrating loose. After staking, no additional problems were noted. This issue is not related to thread gaging.

3) Information Notice 88-24

This information was supplied to you in a letter dated November 3, 1994. The root cause of failure was determined to be loose nuts in a circuit breaker as a result of insufficient preload. The problem was solved by increasing the preload and by applying locktite to minimize the tendency to loosen during service.

4) GAO Report

Discussion on the GAO report was submitted to you in a letter dated August 11, 1994. You cite the GAO report on the UH-60 accident as an example of where the use of a System 21 measurement resulted in an unsafe condition. Page 16 of the GAO report states "Although a group representing the fastener industry claimed that the spindle threads would not have passed the less rigorous method A inspection, the helicopter's manufacturer determined that the spindle was acceptable to the more rigorous method B inspection at the time of manufacture." Method A is the same as System 21 and Method B is the same as System 22.

5) Indian Point 2

This information was previously supplied to you in the letter dated November 3, 1994. The licensee found a loose part in the primary coolant system on the primary side of the 24 steam generator. The loose part was identified as a stud. This stud was sufficiently damaged that the tolerances of the threads could not be measured. It has been proposed that this stud may have come from a residual heat removal pump. It also could have been dropped into the reactor cavity during refueling.

6) Houston Lighting & Power

This information was previously supplied to you in the letter dated November 3, 1994. This event could not be located in the LER data base. However, it appears to refer to the stud failures on the emergency diesel generators. The studs were hollow and were designed to break in the event of a seizure of a fuel injector thus protecting the cam shaft from being damaged. The studs apparently were underdesigned and were prematurely breaking without seizure of the fuel injectors. The cam shafts were redesigned with the keys removed and with an interference fit to the fuel injectors. The fuel injectors would slip

on the cam shafts if a fuel injector would seize. The hollow studs were replaced with solid studs to prevent the premature failure of the studs. Bellville washers were used to avoid the loss of preload for the solid studs. This was a design issue and would not have been affected by the method used to measure the thread dimensions.

7) NE Utilities

This report is a discussion of the Millstone Employees Concern Program. Nothing related to threaded fastener failures was found in the report.

8) Southern Cal Edison

A more specific reference would be required to evaluate this incident.

9) Pacific Air Products/Texas Utilities Electric

Bolts on gravity dampers were designed with too low a strength. When proper strength bolts were used, the problem was resolved. This was not a thread gaging issue.

10) Calvert Cliffs Unit 1

Documents found with this date and Docket Number had nothing to do with fasteners. Unless you can provide us with more specific information regarding how this citation is related to threaded fastener failures, we cannot pursue this further.

11) Information Notice 90-68

This IN deals with A286 stainless steel bolts that hold on the turning vanes of the reactor coolant pumps. A286 stainless steel is not recommended for use in primary water due to its susceptibility to intergranular stress corrosion cracking. The information notice alerts licensees that A286 stainless steel bolts should be replaced with a more resistant material. This has nothing to do with thread gaging.

12) Cooper Industries

This was a letter concerning a non-cited violation for failure to implement adequate security compensatory measures at the Cooper Nuclear Station. It has nothing to do with thread gaging.

13) McGuire SER #93-30

No document was located in NUDOCS. A more specific reference would be required to evaluate this incident.

14) Millstone Docket SER #93-28

No document was located. A more specific reference would be required to evaluate this incident.

15) Dresden Units 2 & 3

This information was previously supplied to you in the letter dated November 3, 1994. Revised calculations indicate that permissible torque values for control rod drive mechanisms exceed the ASME code allowable stresses. One CRDM on Unit 2 and one CRDM on Unit 3 contain bolts that were overtorqued. This will be rectified during the next refueling outage for each unit. This is not a thread dimension issue.

16) Office of the Inspector General, OIG/93A-25

This report deals with the issue of programmatic versus reactive type of performance-based inspections of commercial dedication programs. Thread gaging is not addressed in the subject report.

17) NRC Inspection Reports 50-361, 50-362/94-22

These NRC Inspection Reports have been supplied to you in a letter dated May 22, 1995. These reports indicate that fasteners in the Southern California Edison San Onofre Nuclear Generating Station (SONGS) warehouse do not represent an unsafe condition.

18) INPO 3600 Failure reports

This information was previously supplied to you in the letter dated November 3, 1994. You commented that the Institute of Nuclear Power Operators (INPO) documented 3,600 threaded component failures in the time period between 1988 and 1994. We examined the INPO database to determine if there are failures consistent with out-of-tolerance threads. It is important to clarify several points. The NRC LER'S have a reporting threshold whereas the INPO event reports are voluntary with no reporting threshold. The NRC staff searched the INPO database between 1984 and the present using the key words: bolt, stud, and nut and retrieved 5540 records that involve a failure and the key words, bolt, stud, or nut appear in the failure report. The bolt, stud, or nut did not necessarily fail, rather just had to be mentioned in the report. You also state that these components passed the System 21 test. The requirements for these components were to pass a System 21, System 22, or System 23 test. Most of these components were purchased from certified suppliers who determined the acceptability of the threads. The licensee then received a certified material test report or certificate of compliance with the component and would not have been required to check the threads. We have reviewed the NRC licensee event reports (LER) for 1984 to 1989 and have found no records that are consistent with failure due to out-of-tolerance threads. We have reviewed selected LERs from 1989 to the present and have also found no records that are consistent with failure due to out-of-tolerance threads.

19) NUREG-1349 and Bulletin 87-02

These documents deal with counterfeit fasteners. There is nothing in them related to fastener failures that could be attributed to thread fastener gages.

20) Information Notice 93-90

This deals with a 2-inch valve that was leaking and was injected with leak sealant 30 times. Two of the four bolts holding the valve together were nicked when drilling took



place in preparation for leak sealant injection. The flange faces were peened in an attempt to stop the leak. The peening caused one of the bolts to fracture. This event had nothing to do with thread gaging.

21) SCE White Paper Assessment Report

These comments relate to your letter of October 6, 1994, on your comments on the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11. Many of these issues were previously addressed in NRC inspection report 50-361/94-22 and 50-362/94-22 which was provided to you by letter dated May 22, 1995.

Your Concern 1)

The White Paper does not address the worst case condition that exists in the warehouse.

NRC Response:

This is addressed in the NRC Inspection Report 50-361/94-22 and 50-362/94-22, paragraph 1.3.11.

Your Concern 2)

The White Paper does not address the relationship between thread dimensions and their effect on torque/preload requirements that exist in the ASME Nuclear Codes.

NRC Response:

The Electric Power Research Institute (EPRI) has addressed this issue in EPRI NP-5067 VI, "Good Bolting Practices," on pages 84-94, and pages 145-152. Since over 80 factors affect the torque/preload relationship, the relationship, at best has an accurate estimated by EPRI on page 146 to be "+/- 30% or so." If higher accuracy is required for a critical joint, EPRI recommends using datum rods or ultrasonics to measure the preload. With the amount of scatter within the torque/preload relationship, the types of out-of-tolerance conditions found during the SONGS inspection would have an insignificant affect on the torque/preload relationship.

Your Concern 3)

The fastener strength analysis did not use the worst case condition and is in error.

NRC Response:

This is addressed in the NRC Inspection Report 50-361/94-22 and 50-362/94-22, paragraph 1.3.11.

Your Concern 4)

Statements about material relaxation, vibration, metal fatigue, and leakage are incomplete and no data is provided to corroborate the results. The worst case was not considered.

NRC Response:

This is covered in the NRC Safety Evaluation of the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11 on pages 3 and 4.

Your Concern 5)

The White Paper considers only pitch diameter as it affects fastener performance. The effects of lead error, angle error, taper, out-of-round, helical path deviation, major diameter, and minor diameter are not considered.

NRC Response:

This is covered in the NRC Safety Evaluation of the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11 on page 3.

Your Concern 6)

Thread measurements are not made on fasteners that fail.

NRC Response:

This is addressed in the NRC Inspection Report 50-361/94-22 and 50-362/94-22, paragraph 1.3.36.

Your Concern 7)

The White Paper states that thread dimensions are not the basis for a safety concern at SONGS. There is no data to support this statement.

NRC Response:

NUREG-1445, "Regulatory Analysis for the Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," has the data to support this statement. NUREG-1445 is available in the NRC Public Document Room.

Your Concern 8)

The author of this White Paper (Revision One) still does not understand that product which is significantly out of tolerance can be accepted utilizing System 21 measurement.

NRC Response:

No comment.

Your Concern 9)

The effect of thread dimensions on performance at operating temperatures is not addressed.

NRC Response:

This is covered in the NRC Safety Evaluation of the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11 on page 4.

Your Concern 10)

The White Paper states that System 22 is a requirement for socket cap, shoulder, and set screws.

NRC Response:

As stated in previous correspondence to you, at the discretion of individual licensees, they may require that fastener thread acceptability be determined using Systems 21, 22, 23, or any newer equivalent system. Neither the American Society of Mechanical Engineering (ASME) Code nor the NRC regulations require the use of any given system for any nuclear application.

Your Concern 11)

Many references to the NRC Position paper have been taken out of context. The reference to Generic Letter 91-17, "Bolting Degradation or Failure in Nuclear Power Plants," is inaccurate since thread dimensions were not considered in the close out of Generic Issue-29 by the issuance of Generic Letter 91-17.

NRC Response:

Thread dimensions were not addressed in the close out of Generic Issue-29 because thread dimensions because the Metals Property Council (MPC), the Atomic Industrial Forum (AIF), and the Electric Power Research Institute (EPRI) did not rate thread dimensions as an area with high enough priority to be examined. The MPC, AIF, and EPRI agreed upon the 19 top priorities related to bolting that were examined in order to close out Generic Issue-29.

Your Concern 12)

The SONGS warehouse inspection conducted by the SONGS licensee was not scientifically run and was not randomly sampled.

NRC Response:

This is addressed in the NRC Inspection Report 50-361/94-22 and 50-362/94-22, paragraph 1.3.10.

Your Concern 13)

The formulas used in the White Paper are incorrect.

NRC Response:

This is covered in the NRC Safety Evaluation of the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11 on page 5.

Your Concern 14)

The White Paper formulas are only for thread shear strength and do not consider vibration loosening, preload relaxation, fatigue, or leakage.

NRC Response:

This is covered in the NRC Safety Evaluation of the Southern California Edison White Paper, "Fastener Strength Analysis," Nuclear Safety Concern 93-11 on page 6.

Your Concern 15)

Fastener failures are not reported if the core does not melt down.

NRC Response:

This is addressed in the NRC Inspection Report 50-361/94-22 and 50-362/94-22, paragraph 1.3.1.