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Docket Nos.: 50-373
and 50-374

MEMORANDUM FOR: John A. Olshinski, Chief
Operating Reactors Assessment Branch
Division of Licensing

Ashok Thadani, Chief
Reliability and Risk Assessment Branch
Division of Safety Technology

FROM: Anthony Bournia, Project Manager
Licensing Branch No. 2
Division of Licensing

SUBJECT: Review of a Draft on Snubber's Technical Specification Visual Inspection for La Salle

Enclosure 1 is a draft copy of some work that Commonwealth Edison has performed with respect to a sampling plan for visual inspection of snubbers. Enclosure 2 indicates the surveillance required by the Standard BWR Technical Specification. The applicant has indicated that the above plan does not impose too much of a penalty to the plants presently in operation since at most these plants contain only a few hundred snubbers. However, for La Salle County Station Units 1 and 2, each has approximately 1500 total snubbers, approximately 450 of these are located inside containment. If the present inspection criteria are used which require 100 percent visual inspection the applicant alleges that this will cause additional hardship on La Salle. Hence, the applicant is submitting this sampling plan as an alternative. As indicated by Commonwealth Edison, they would like to discuss their comments with us after we have completed our review. Therefore, we are requesting that this review be performed in an expeditious manner such that we can get back to the applicant. In addition, as was indicated by the August 4, 1981 memorandum from the Licensing Guidance Branch transmitting a draft of the La Salle Technical Specifications for comments from the reviewers by August 31, 1981, we would like to incorporate any changes to the snubbers section of the Technical Specifications in this time frame. You may wish to review the licensing action taken by NRC on Zion, which also had a large number of snubbers.

/S/

Anthony Bournia, Project Manager
Licensing Branch No. 2
Division of Licensing

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DATE	8/11/81	8/12/81					

ENCLOSURE 1

August 5, 1981

To: Tony Bournia
Horace Shaw

From: Don Zebranskas

At the LaSalle Technical Specification Meeting of July 16, 1981 information pertaining to the snubber section of the Tech Specs was requested. The items listed as Attachment 1, Figure 4.7.1, Figure 2, and Figure 3 of this telecopy provide our derivation of the Wald Sequential Sampling Plan, and our justification for the elimination of the rejection line. Also included are comments pertaining to the table of visual inspections in 4.7.9.a of the Tech Specs, which includes our derivation of an alternate inspection table.

After reviewing the results of our July 16, 1981 Meeting and discussions with Pacific Scientific, we have revised some of our comments on snubbers. The comments pertaining to the snubber section given to you on July 16, plus the enclosed comments in this telecopy contain our comments to date.

After you have reviewed our comments, we would like to discuss them with you by telephone. If you have any questions, please call.

Don Zebranskas

ommonwealth Edison, LaSalle County Station 815-357-6761, ext.

ATTACHMENT I

Reference (1) Probability and Statistics for Engineers, Irwin Miller and John E. Freund.

The Tech Specs for LaSalle state that the bases of functionally testing mechanical snubbers is to provide a confidence level of approximately 95% that 90% to 100% of the snubbers in the plant are operable.

This is provided by functionally testing a representative sample. The Tech Spec provides the formula 35 $(1 + \frac{c}{2})$ which will provide the desired objectives. LaSalle County Station proposes that the functional testing of the representative sample be in accordance with the Wald Sequential Sampling Plan, as described in Reference (1). A description of the Plan and the justification that it will attain a 95% confidence level that 90% to 100% of the snubbers are operable is provided below.

The Wald Sequential Plan requires the determination of an acceptance line, based on calculations. The variables for the equation for the acceptance line are as follows:

Lot Tolerance Percent Defective = p_1. The maximum allowable number of defective items, this would be 10% or 0.1, because we want to assure that at least 90% of the snubbers are operable, 100% - 90% = 10% = 0.1. We can tolerate 10% defective.

Risk that an unacceptable snubber group will be accepted = β. For a 95% confidence level, this would be a 5% chance (100% - 95%) = 5% or .05.

Acceptable Quality Level = p_o This is not specifically stated in the Tech Spec. This was selected to be .05 which corresponds to a 95% quality level which is reasonable based on a 95% confidence level and a 90 - 100% operability requirement.

Risk that an acceptable snubber group will be rejected = α. This is not specifically stated in the Tech Spec. With a β of .05, or 5% chance that an unacceptable snubber group will be accepted, it would appear reasonable to have a 5% or .05 value for the risk that an acceptable snubber group will be rejected.

Calculation of the acceptance line is provided by the following formula:

$$a_n = \frac{\log \frac{\beta}{1-\alpha} + n \cdot \log \frac{1-p_o}{1-p_1}}{\log \frac{p_1}{p_o} - \log \frac{1-p_1}{1-p_o}}$$

a_n = acceptance number
p_1 = 0.1
β = .05
p_o = .05
α = .05

Solving the above equation yields:

$a_n = 0.0724n - 3.935$

n = the number of snubbers being tested.

$a_n = 0$ at $n = 55$, thus at least 55 snubbers must be tested before testing can cease. The specific number of snubbers, n, which would have to be tested before testing could cease can be calculated by assuming a_n is the number of failures and solving the equation ($a_n = .0724n - 3.935$) for n. This can be shown on a graph, as shown in Figure 4.7.1.

On Figure 4.7.1, "C" is the total number of snubbers not meeting the acceptance criteria. The cumulative number tested is denoted by "N". As the testing continues, the values of "C" and "N" may be plotted. Whenever a point plotted falls in the "ACCEPT" region, testing is terminated. When the point plotted lies in the "Continue Testing" region, additional snubbers are tested with the objective of getting into the "Accept" region. It can be seen that the equation $a_n = .0724n - 3.935$ determines the end of the continue test and the start of the acceptance range.

The Wald Sequential Sampling Plan also mentions an upper limit or rejection curve. Crossing the curve signifies rejection or testing of all items involved in the program. This line is not included in the LaSalle Proposal, before presenting the reasoning behind not including it, the nature and calculation of the curve will first be discussed.

The rejection line is calculated by the formula:

$$r_n = \frac{\log \frac{1-\beta}{\alpha} + n \cdot \log \frac{1-p_0}{1-p_1}}{\log \frac{p_1}{p_0} - \log \frac{1-p_1}{1-p_0}}$$

r_n = Rejection number
p_1 = 0.1
β = .05
p_0 = .05
α = .05

Solving the above equation yields:

$r_n = 0.0724n + 3.935$

n = the number of snubbers being tested.

Figure 2 illustrates both the acceptance and rejection lines.

LaSalle County Station is committed to testing (and repairing) all snubbers in a group if the functional testing does not demonstrate an acceptable fraction of defectives. In light of this committment, the use of a rejection line provides no benefit. On the other hand, erroneously testing an entire snubber group with an acceptable fraction of defectives has significant consequences in plant availability and personnel radiation exposure. These consequences can be eliminated by eliminating the rejection line. The risk of erroneously testing an acceptable snubber group is thus reduced to zero; for the LaSalle method the increased risk of accepting an unacceptable snubber group is extremely low.

The only risk is that an unacceptable snubber population is later accepted because of a random variance which suddenly falls in the acceptance range. It can be shown thru probability calculations that the probability of this occurrence, and hence the increased risk, is extremely low. The following demonstrates the calculation of this probability:

The random possibility of a group in the reject area crossing into the accept region after continued testing can be described by the Poisson distribution. The formula obtained thru Reference (1) is:

$$F(X;\lambda) = \sum_{x=0}^{\lambda} e^{-\lambda} \frac{\lambda^{X}}{X!}$$

λ = the theoretical number of failures on or above the rejection line.
X = the number of failures on the acceptance line.

The Poisson distribution can be figured by taking any point on the rejection line along with the corresponding value on the acceptance line. The point selected was where the number of failures is "0" on the acceptance line, which corresponds to "8" on the rejection line, see Figure 3. At this particular point on the graph (Figure 3), it requires 8 or more failures to be in the "Reject" area. Thus λ values for 8 and above must be used in the above formula for the Poisson Distribution. The point on the acceptance line is always "0", thus X = 0 in the above formula. With these values of X and λ, the Poisson Distribution formula becomes:

$$F(0;\lambda) = \sum_{\lambda=8}^{\infty} e^{-\lambda}$$

With $\lambda = 8$, the above formula yields 3.3546×10^{-4}.
With $\lambda = 9$, the above formula yields 1.2341×10^{-4}.
As λ increases, the result becomes increasingly small, e.g. at $\lambda = 25$ the above formula yields 1.3888×10^{-11}. Due to the fact that the results become insignificant with higher values of λ, the results of $\lambda = 8$ to $\lambda = 25$ were added together to obtain the total probability. The result can be expressed as:

$$\sum_{\lambda=8}^{25} F(0;\lambda) = 5.3069 \times 10^{-4}.$$

The risk must also be included for points 6 and 7. This becomes the sum of $(1 - [F(8,6)]e^{-6}$, $(1 - [F(8,7)]e^{-7}$. Values of 5 or less do not have to be considered because they represent acceptable (< 10%) groups. The following results were found by the use of Table 11 of Reference 1.

$1 - [F(8,6)]\ e^{-6} = 1 - .847 = .153\ (e^{-6}) = .153\ (.0025) = .000379$
$1 - [F(8,7)]\ e^{-7} = 1 - .729 = .271\ (e^{-7}) = .271\ (.0009) = \underline{.000244}$
6.23×10^{-4}

Thus the total probability is the sum of the two calculations:
5.3069×10^{-4}
$\underline{6.23 \times 10^{-4}}$
$11.5369 \times 10^{-4} = 1.1537 \times 10^{-3}$
$1.1537 \times 10^{-3} = .11537$ percent.

These calculations demonstrate that eliminating the rejection line increases the risk of erroneously accepting a snubber group with > 10% defectives by 0.

It is felt that the Rejection line can be eliminated on the bases that an unacceptable snubber population would be detected thru the requirement to cross the acceptance line, and that the probability of a random variance from the reject to the acceptance region is extremely low. The Tech Specs state that the desired confidence level is approximately 95%. It is felt that a 0.11537 percent decrease in the confidence level does not jeopardize the health and safety of the public. LaSalle proposes to use the Wald Sequential Sampling Plan as provided in Figure 4.7.1.

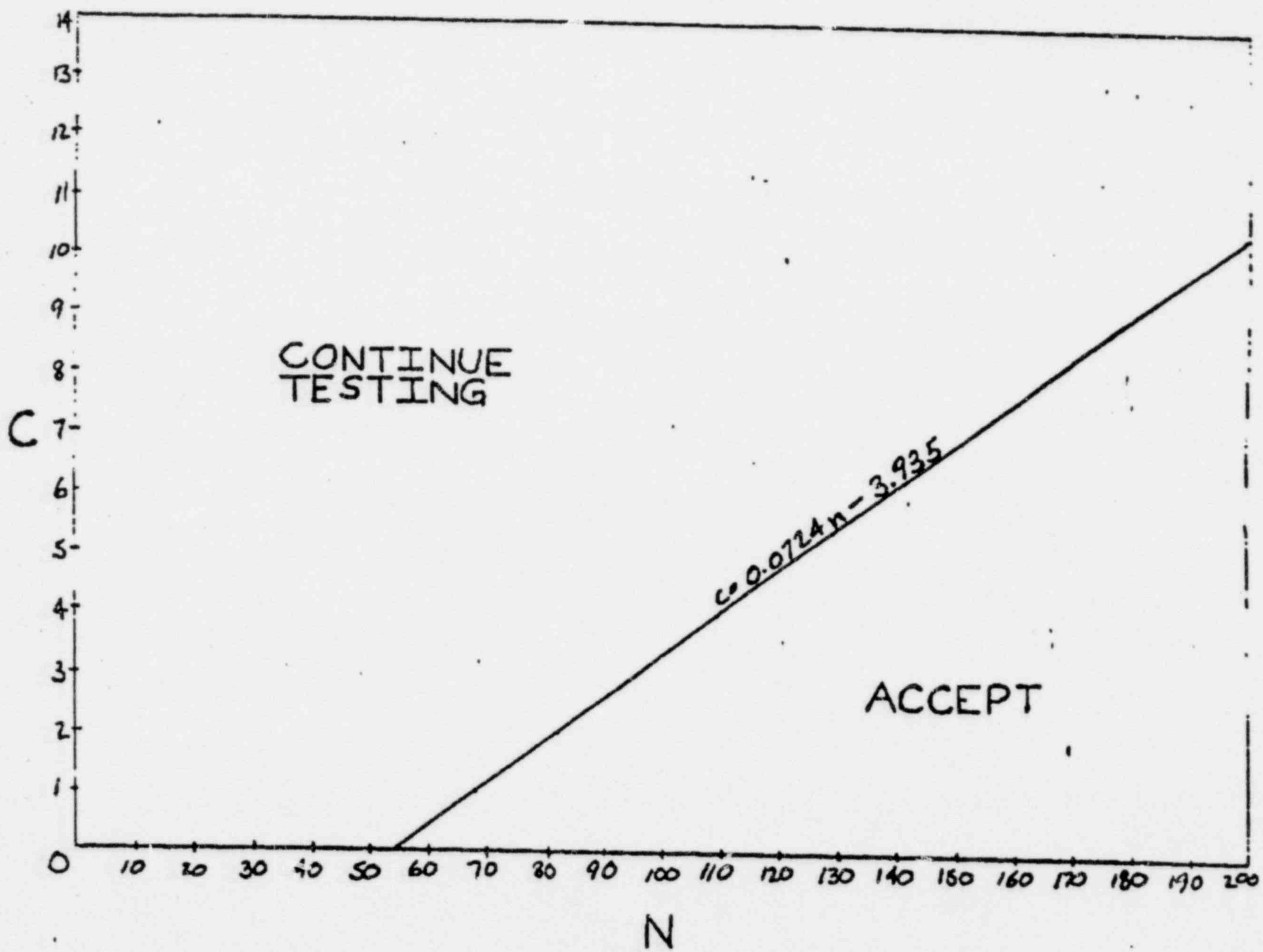
14
13
12
11
10
9
8
C 7
6
5
4
3
2
1
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
N
CONTINUE
TESTING
ACCEPT
c = 0.0724n - 3.935

Figure 4.71

August 4, 1981

SUBJECT: LaSalle County Station Technical Specifications, Snubbers, Paragraph 4.7.9.a. Visual Inspections

REFERENCE: (1) Joseph Sapir to Daniel J. Ziemann letter of March 1, 1975.

LaSalle County Station offers the following comments in regards to the subject Technical Specifications and Reference (1).

The bases for the table for visual inspections provided in the NRC Draft Tech Specs appears to be from the letter identified as Reference (1). This letter appears to apply to hydraulic snubbers only. All the problems identified in the letter are applicable to hydraulic snubbers only, e.g. seal material. In fact, the fourth paragraph does specifically state safety related hydraulic snubbers. There are no references to mechanical snubbers. Even the date of the letter, March 1, 1975, indicates that the intent of the letter was for hydraulic snubbers only.

LaSalle realized the problems with hydraulic snubbers identified in Reference (1), and therefore there are no hydraulic snubbers at LaSalle. All snubbers from LaSalle are mechanical, supplied by Pacific Scientific. It is felt that Pacific Scientific mechanical snubbers have demonstrated superior performance to hydraulic snubbers, and to our knowledge all other makes of mechanical snubbers.

Reference (1) also notes that plants with a large number of snubbers would be at a disadvantage, but states that one plant has as many as 500. LaSalle has more than twice that amount. It is evident that some type of adjustment is needed for LaSalle. Reference (1) also makes an assumption that the operability of each snubber is required to protect the pipe. This is not necessarily true.

Due to the above, it is felt that the table of visual inspections should be revised to more closely represent conditions at LaSalle County Station. A table was calculated, based on a Poisson Distribution for the number of snubbers at LaSalle. The calculation depends on a confidence level. It is felt that the confidence level should be no more stringent than that provided for functional testing, for which the Tech Spec states that a 95% confidence that 90% to 100% are operable is the desired objective.

It was decided that a 95% confidence level that 98% are operable is even more conservative. This confidence level was applied and was based on a population of 600 snubbers which is an estimate of the number of snubbers in each of the two groups, accessible and inaccessible. The calculations generated the following table:

NO. INOPERABLE SNUBBERS PER INSPECTION PERIOD	SUBSEQUENT VISUAL INSPECTION PERIOD
0, 1, 2, 3, 4, 5, 6, 7	18 months ± 25%
8, 9, 10, 11	12 months ± 25%
12 thru 23	6 months ± 25%
24 thru 34	124 days ± 25%
35 thru 69	62 days ± 25%
70 or more	31 days ± 25%

The above table is what is proposed for the LaSalle Tech Spec. It is felt that more than adequate protection is provided by the above table.

The following is how the visual inspection table was calculated:

The calculation is based on the Poisson Probability Distribution. LaSalle estimates about 600 snubbers in each group, accessible and inaccessible. The calculation is based on a 95% confidence level that 98% of the snubbers are operable. The formula for the Poisson Distribution is:

$$F(X,\beta) = \sum_{K=0}^{X} e^{-\beta} \frac{\beta^K}{K!}$$

with $\beta = \lambda t$ and $f(X,\lambda t) = \frac{e^{-\lambda t}(\lambda t)^X}{X!}$

β = failure rate
λ = no. of defects
t = time

The requirement is that 98% of the 600 snubbers will be operable, or 2% may fail. 2% = .02. (600) (.02) = 12. Thus 12 snubbers failing would mean 98% are operable.
x = 12 with a 95% confidence level, .95.
We thus have $F(12, \beta) = .95$

From Table 11 of the book Probability and Statistics for Engineers, by Irwin Miller and John E. Freund, $F(12, \beta) = .95$ provides a value of 7.69 for β $F(12, 7.69) = .95$

$\beta = \lambda t$, $\lambda = \frac{\beta}{t}$

Assume an 18 month inspection cycle is t = 1.
For 18 months t = 18/18 = 1
At 18 months $\lambda = \frac{7.69}{1} = 7.69$ thus 0 - 7 failures allowed.
At 12 months $t = 12/18 = .67$ $\lambda = \frac{7.69}{.67} = 11.48$, thus 8 - 11 failures.
At 6 months $t = \frac{6}{18} = .33$ $\lambda = \frac{7.69}{.33} = 23.30$ thus 12 - 23 failures.
At 4 months $t = \frac{4}{18} = .22$ $\lambda = \frac{7.69}{.22} = 34.95$ thus 24 - 34 failures.
At 2 months $t = \frac{2}{18} = .11$ $\lambda = \frac{7.69}{.11} = 69.9$ thus 35 - 69 failures.
At 1 month $t = \frac{1}{18} = .05$ $\lambda = \frac{7.69}{.055} = 139.8$ thus 70 or more failures.

4.7.9.e Revise the circled portion as follows:

1. The force that initiates free movement of the snubber rod in either tension or compression is less than the specified maximum breakaway friction force.

2. Activation (restraining action) is achieved within the specific range of velocity or acceleration in both tension and compression.

Bases

All of LaSalle's snubbers are mechanical snubbers supplied by Pacific Scientific. Conversations have been held with Pacific Scientific Application Engineers, who have stated that as long as the force that initiates snubber movement is less than the specified maximum breakaway friction force, the snubber is operating properly. Breakaway friction is also the only inservice test recommended in the Pacific Scientific Installation and Maintenance Manuals. Furthermore, the tests which Pacific Scientific performs as a final inspection before shipment does not include a drag force measurement, but does include breakaway friction force. Based on the above, it is felt that breakaway friction is the parameter which should be used to verify snubber operability. Drag force increases of 50% or more do not necessarily indicate a defective snubber, however exceeding the breakaway friction is an adequate indication that there may be a problem. Activation, within the specified range of velocity or acceleration, though not specifically recommended by Pacific Scientific as an inservice test, might be a meaningful parameter. La Salle cannot at this date specify exactly how activation will be measured, a large part of that determination depends upon the field test machines which become available in the future. Pacific Scientific has stated that for their types of snubbers used at La Salle, the activation measurement described above and snubber release rate are the same thing. The snubber release rate is provided by performing the activation test. For these reasons, snubber realease rate should be deleted from the Tech Specs. Also, the Pacific Scientific snubbers used at LaSalle are not required to not displace under continuous load. Thus all of paragraph 4.7.9.e.3 is non applicable to LaSalle, and should be deleted.

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SURVEILLANCE REQUIREMENTS (Continued)

Functional Tests (Continued)

both the failed snubber, if it is repaired and installed in another position, and the spare snubber shall be retested. Test results of these snubbers may not be included for the re-sampling.

If any snubber selected for functional testing either fails to lockup or fails to move, i.e., frozen in place, the cause will be evaluated and if caused by manufacturer or design deficiency all snubbers of the same design subject to the same defect shall be functionally tested. This testing requirement shall be independent of the requirements stated above for snubbers not meeting the functional test acceptance criteria.

For any snubber(s) found inoperable, an engineering evaluation shall be performed on the components which are supported by the snubber(s). The purpose of this engineering evaluation shall be to determine if the components supported by the snubber(s) were adversely affected by the inoperability of snubber(s) in order to ensure that the supported component remains [illegible] [illegible].

c. Hydraulic Snubbers Functional Test Acceptance Criteria ††

The hydraulic snubber functional test shall verify that:

1. Activation (restraining action) is achieved within the specified range of velocity or acceleration in both tension and compression.

2. Snubber bleed, or release rate, where required, is within the specified range in compression or tension. For snubbers specifically required to not displace under continuous load, the ability of the snubber to withstand load without displacement shall be verified.

d. Mechanical Snubbers Functional Test Acceptance Criteria

The mechanical snubber functional test shall verify that:

1. The force that initiates free movement of the snubber rod in either tension or compression is less than the specified maximum drag force. Drag force shall not have increased more than 50% since the last functional test.

2. Activation (restraining action) is achieved within the specified range of velocity or acceleration in both tension and compression.

3. Snubber release rate, where required, is within the specified range in compression or tension. For snubbers specifically required not to displace under continuous load, the ability of the snubber to withstand load without displacement shall be verified.

†† La Salle has no hydraulic snubbers

4.7.9.f. Paragraph 1 Revise the circled portion as follows:

A record of the service life of each snubber shall be maintained in accordance with existing company maintenance history tracking programs.

Bases:

The station already has adequate maintenance history tracking programs for other equipment. Having snubbers within the same program as other equipment provides a more reliable tracking method.

4.7.9.f. Paragraph 2 Delete the circled portion

Bases:

LaSalle County Station only has mechanical snubbers from Pacific Scientific. The subject of service life was discussed with Pacific Scientific. They have stated that their snubbers are designed with the intent to last the life of the plant. Therefore, this paragraph in the Tech Spec is non applicable, because the service life on all LaSalle snubbers is 40 years or more. It is not known at this time as to how the service life would change. Therefor, if at a later date a particular type o snubber used at LaSalle is demonstrated to have a service life less than the life of the plant, it could be addressed at that time.

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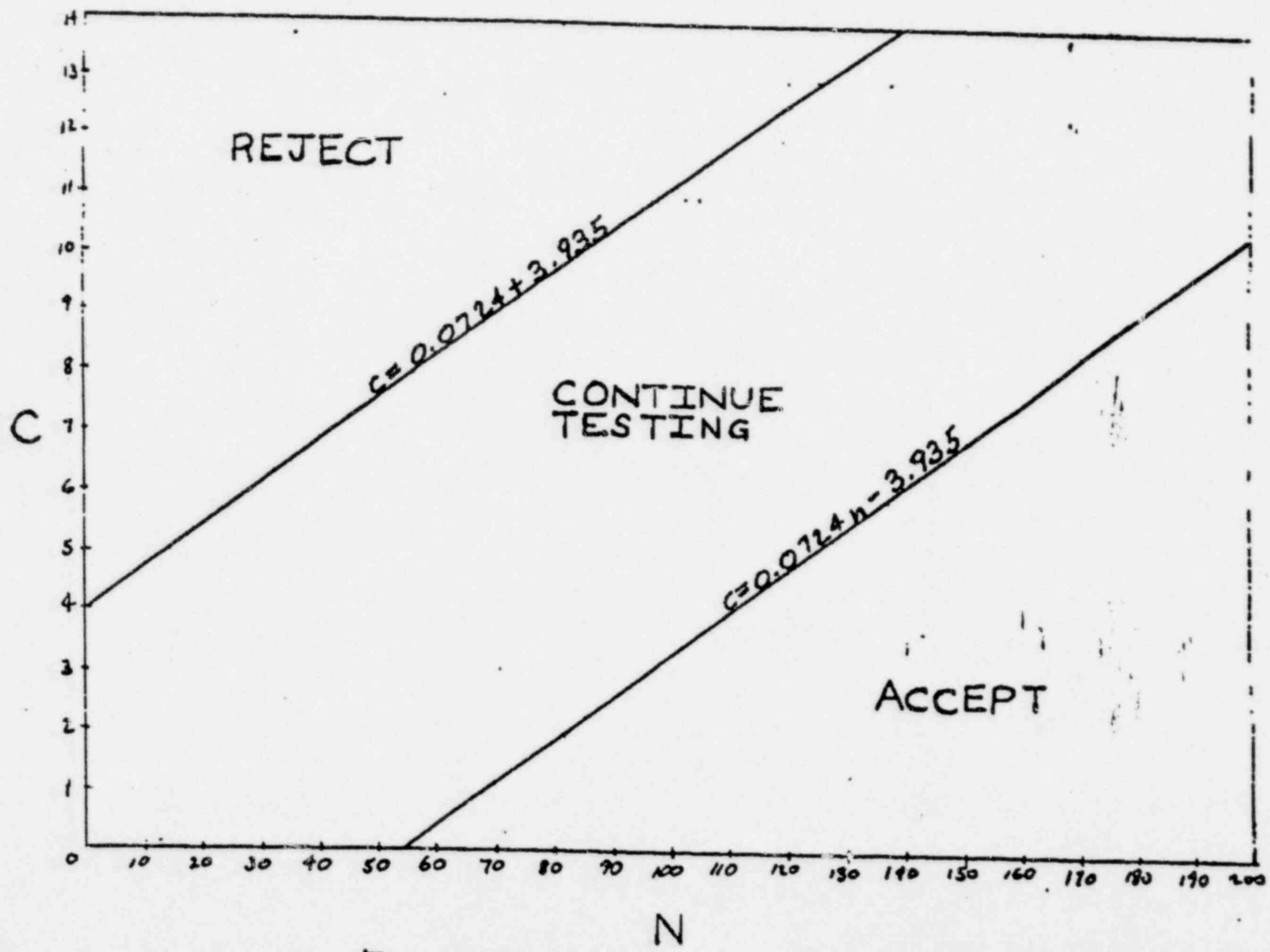
PLANT SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

f. Snubber Service Life Monitoring

A record of the service life of each snubber, the date at which the designated service life commences and the installation and maintenance records on which the designated service life is based shall be maintained as required by Specification 6.5.3.16.

Concurrent with the first inservice visual inspection and at least once per 18 months thereafter, the installation and maintenance records for each snubber listed in Tables 3.7.9-1 and 3.7.9-2 shall be reviewed to verify that the indicated service life has not been exceeded or will not be exceeded prior to the next scheduled snubber service life review. If the indicated service life will be exceeded prior to the next scheduled snubber service life review, the snubber service life shall be reevaluated or the snubber shall be replaced or reconditioned so as to extend its service life beyond the date of the next scheduled service life review. This reevaluation, replacement or reconditioning shall be indicated in the records.



REJECT
c=0.0724+3.935
CONTINUE TESTING
c=0.0724n-3.935
ACCEPT
C
N
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
10
20
30
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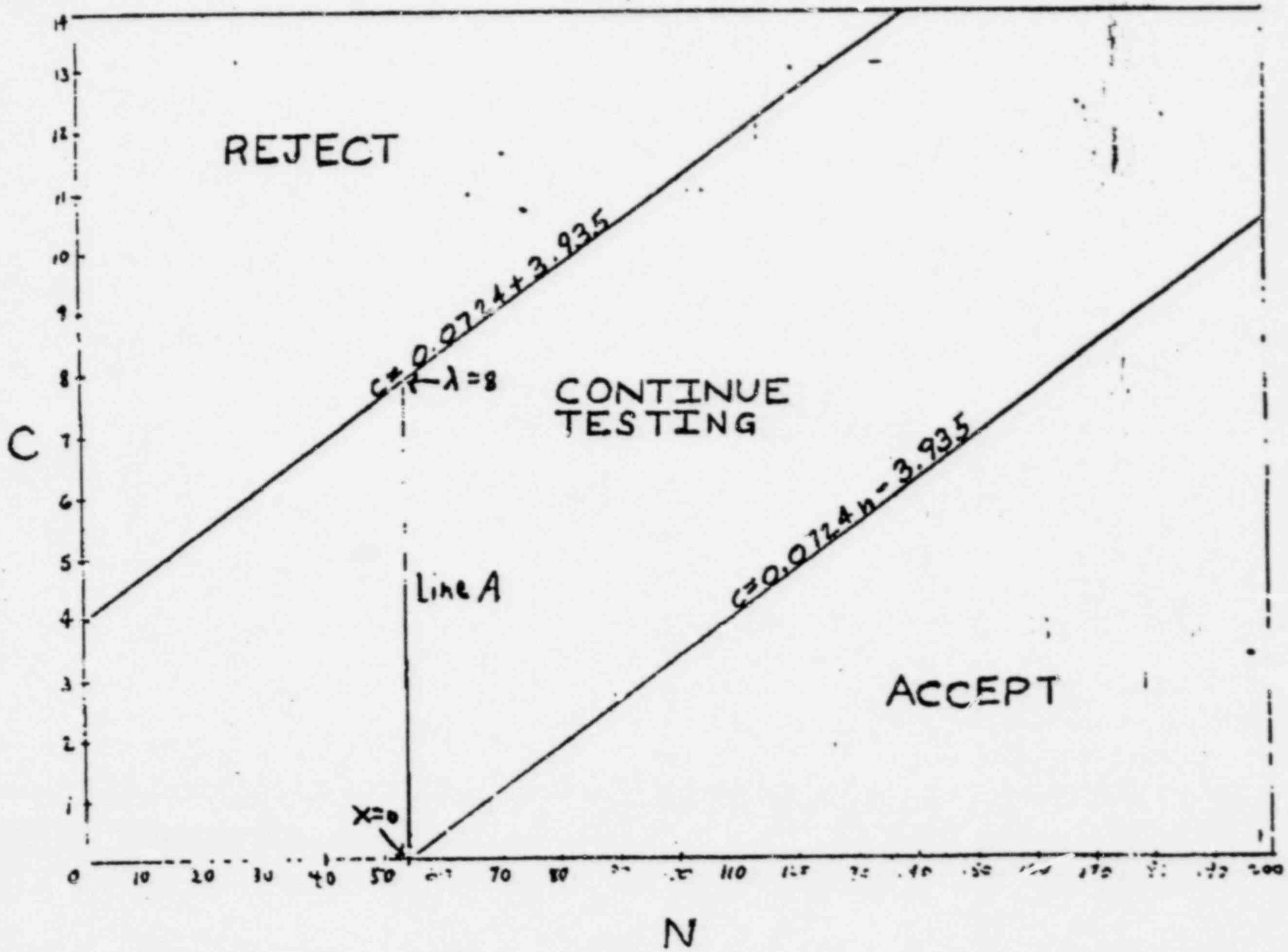
200

Figure 2



REJECT
c=0.0724+3.935
λ=8
CONTINUE TESTING
Line A
X=0
c=0.0724n-3.935
ACCEPT
C
N

Figure 3

Bases 3/4.7.9 Revise the circled portion as follows - Page B 3/4 7-4.

The sample size will be determined in accordance with Figure 4.7.1, which has been developed using the Wald Sequential Sampling Plan.

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BASES

SNUBBERS (Continued)

The service life of a snubber is evaluated via manufacturer input and information through consideration of the snubber service conditions and associated installation and maintenance records (newly installed snubber, seal replaced, spring replaced, in high radiation area, in high temperature area, etc.). The requirement to monitor the snubber service life is included to ensure that the snubbers periodically undergo a performance evaluation in view of their age and operating conditions. These records will provide statistical bases for future consideration of snubber service life. The requirements for the maintenance of records and the snubber service life review are not intended to affect plant operation.

Bases 3/4.7.9
Page B 3/4 7-5

Delete the circled portion.

3/4.7.9 SNUBBERS

All snubbers are required OPERABLE to ensure that the structural integrity of the reactor coolant system and all other safety related systems is maintained during and following a seismic or other event initiating dynamic loads. Snubbers excluded from this inspection program are those installed on nonsafety related systems and then only if their failure or failure of the system on which they are installed, would have no adverse effect on any safety related system.

The visual inspection frequency is based upon maintaining a constant level of snubber protection to systems. Therefore, the required inspection interval varies inversely with the observed snubber failures and is determined by the number of inoperable snubbers found during an inspection. Inspections performed before that interval has elapsed may be used as a new reference point to determin the next inspection. However, the results of such early inspections performed before the original required time interval has elapsed, nominal time less 25%, ma not be used to lengthen the required inspection interval. Any inspection whose results require a shorter inspection interval will override the previous schedule

When the cause of the rejection of a snubber is clearly established and remedied for that snubber and for any other snubbers that may be generically susceptible, and, verified by inservice functional testing, that snubber may be exempted from being counted as inoperable. Generically susceptible snubbers are those snubbers which are of a specific make or model and have the same design features directly related to rejection of the snubber by visual inspection, or are similarly located or exposed to the same environmental conditions such as temperature, radiation, and vibration.

if necessary

When a snubber is found inoperable, an engineering evaluation is performed, in addition to the determination of the snubber mode of failure, in order to determine if any safety-related component or system has been adversly affected by the inoperability of the snubber. The engineering evaluation shall determine whether or not the snubber mode of failure has imparted a significant effect or degradation on the supported component or system.

To provide assurance of snubber functional reliability, a representative sample of the installed snubbers shall be functionally tested during plant shutdowns at 18 month intervals. Selection of a representative sample according to the expression $35 (1 + \frac{c}{2})$ provides a confidence level of approximately 95% that 90% to 100% of the snubbers in the plant will be OPERABLE within acceptance limit Observed failures of these sample snubbers will require functional testing of additional units.

Hydraulic snubbers and mechanical snubbers may each be treated as a different entity for the above surveillance programs.

ENCLOSURE 2