Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

March 1, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Inservice Inspection of Snubbers
NRC Docket Nos. 50-454, 50-455, 50-456, and 50-457

Reference (a): August 12, 1982 letter from T. R. Tramm to H. R. Denton.

(b): January 20, 1983 letter from T. R. Tramm to H. R. Denton.

Dear Mr. Denton:

This is to request relief from certain NRC requirements for inservice inspection of snubbers at Byron and Braidwood generating stations. Our general plan for snubber inspections was provided in reference (a). Enclosed with this letter are relief requests SR-1 and SR-2. Each request provides our justification for the requested relief and explains our alternate approach.

As indicated in references (a) and (b) the Inservice Inspection Program Plan for Snubbers is not being included in the Byron/Braidwood technical specifications because of its volume. It will be controlled in the same manner as our other ASME Section XI requirements. Specific NRC approval is therefore required only for the two attached relief requests. We will, of course, address any questions raised by the NRC regarding our inspection program. Please direct all such inquiries to this office.

One signed original and fifteen copies of this letter and the enclosures are provided for your review.

Very truly yours,

E. Douglas Swartz for

T. R. Tramm
Nuclear Licensing Administrator

lm

Enclosures

6076N

8303080425 830301
PDR ADOCK 05000454
Q PDR

B001

Relief Request SR-1

1. SYSTEM: All systems with safety related snubbers.

2. NUMBER OF ITEMS: Dependent upon total snubber population.

3. ASME CODE CLASS: 1, 2, and 3

4. ASME CODE SECTION XI REQUIREMENTS: Subarticle IWF-5400, paragraph (b), requires functional testing of a representative sample of 10% of the nonexempt snubbers, whose load rating is less than 50 kips, each inspection period.

5. BASIS FOR RELIEF: The presented snubber program identifies 1135 applicable snubbers on Class 1, 2, and 3 systems, as of the date on the table. Based upon present information, an 18 month re-fueling schedule, and a representative sample size of 55 snubbers, 9.7% of the snubbers identified would be functionally tested each inspection period. However, the total number of nonexempt snubbers subject to testing under IWF-5400, is expected to increase at Byron Unit 1. Additional nonexempt snubbers will be included into the Byron Unit 1 ISI Program Plan for Snubbers and functionally tested in accordance with the program plan requirements.

6. ALTERNATE TEST METHOD: Wald Sequential Sampling Plan and augmented Visual Examinations.

7. JUSTIFICATION: The statistical model, utilizing the Wald Sequential Sampling Plan, (see Attachment 1 for development), maintains approximately a 95% confidence level that 90% to 100% of the snubbers are operational. It is felt that the Wald Sequential Sampling Plan, along with the augmented Visual Examination Schedule, provides a more efficient and managable snubber testing program without significantly effecting the level of plant operational safety, while providing benefits through reduced man rems (ALARA concerns) for plant employees.

8. APPLICATION: Applies to scheduled functional testing.

9. IMPLEMENTATION: Functional testing is scheduled to concur with scheduled plant outages and will be performed, as a minimum, each 18 months ± 25%.

10. TIME PERIOD: This request for relief applies for the life of the plant.

ATTACHMENT I

The basis of functionally testing safety related snubbers is to provide a confidence level of approximately 95% that 90% to 100% of the snubbers in the plant are operable.

Byron Station proposes that the functional testing of the representative sample be in accordance with the Wald Sequential Sampling Plan. 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 upon 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.

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 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. With a β of .05, or 5% chance that an unacceptable snubber group will be accepted, it is 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 1.

On Figure 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 Byron 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 forumla:

$$r_n = \frac{\log \dfrac{1 - \beta}{\alpha} - n \cdot \log \dfrac{1 - p_o}{1 - p_1}}{\log \dfrac{p_1}{p_o} - \log \dfrac{1 - p_1}{1 - p_o}}$$

r_n = Rejection number
p_1 = 0.1
p = .05
p_o = .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.

Byron 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 commitment, 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; and the increased risk of accepting an unacceptable snubber group is extremely low.

ATTACHMENT 1

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:

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

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 λ = 8, the above formula yields 3.3546×10^{-4}.
With λ = 9, the above formula yields 1.2341×10^{-4}.
As λ increases, the result becomes increasingly small, e.g. at λ = 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 λ = 8 to λ = 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

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

Thus the total probability is the sum of the two calculations:

5.3069×10^{-4}
$\underline{6.23 \times 10^{-4}}$

11.5369×10^{-4} = .11537 percent

ATTACHMENT 1

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

It is felt that the Rejection line can be eliminated on the basis 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 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. Byron proposes to use the Wald Sequential Sampling Plan as provided in Figure 1.

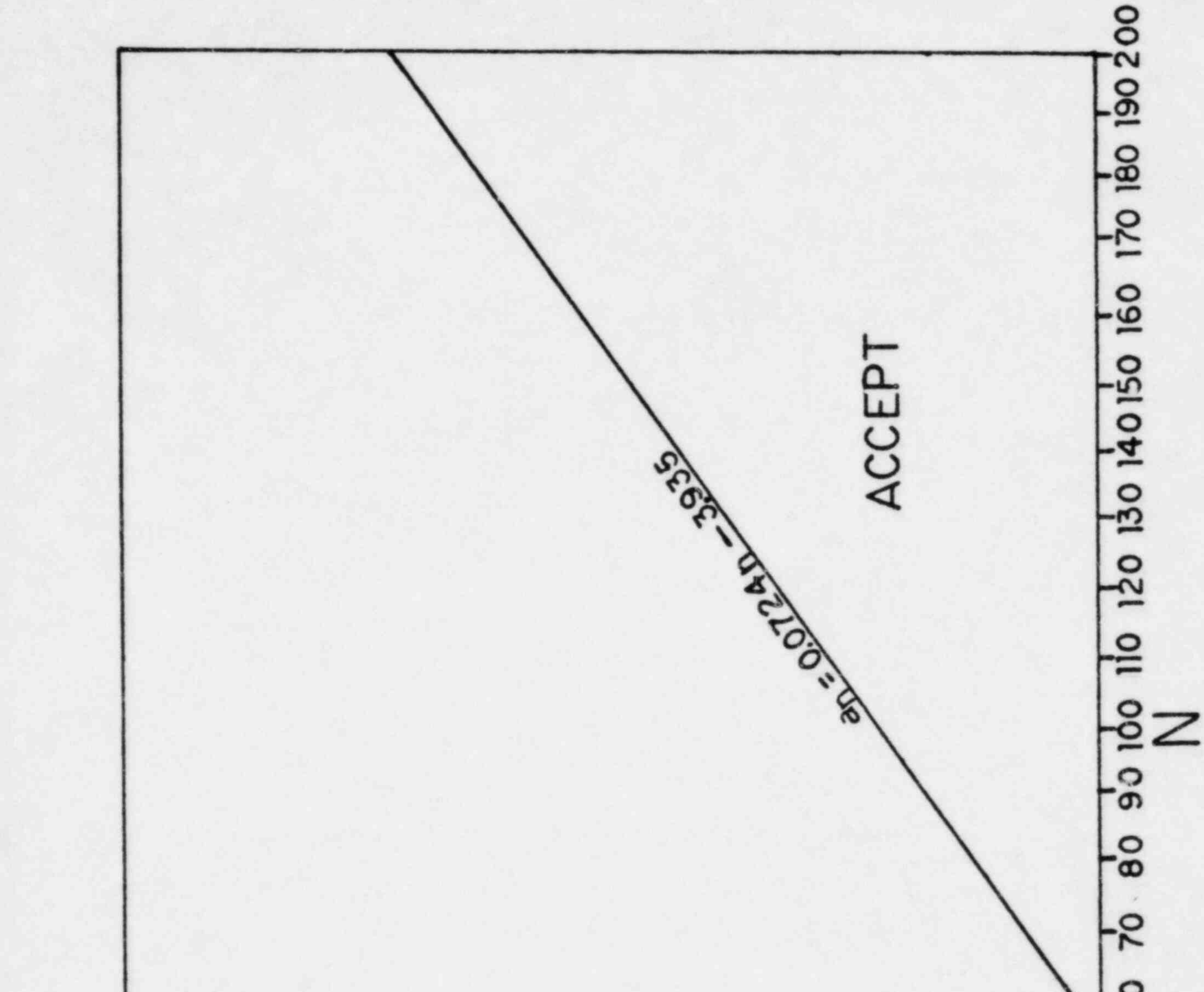

Figure 1

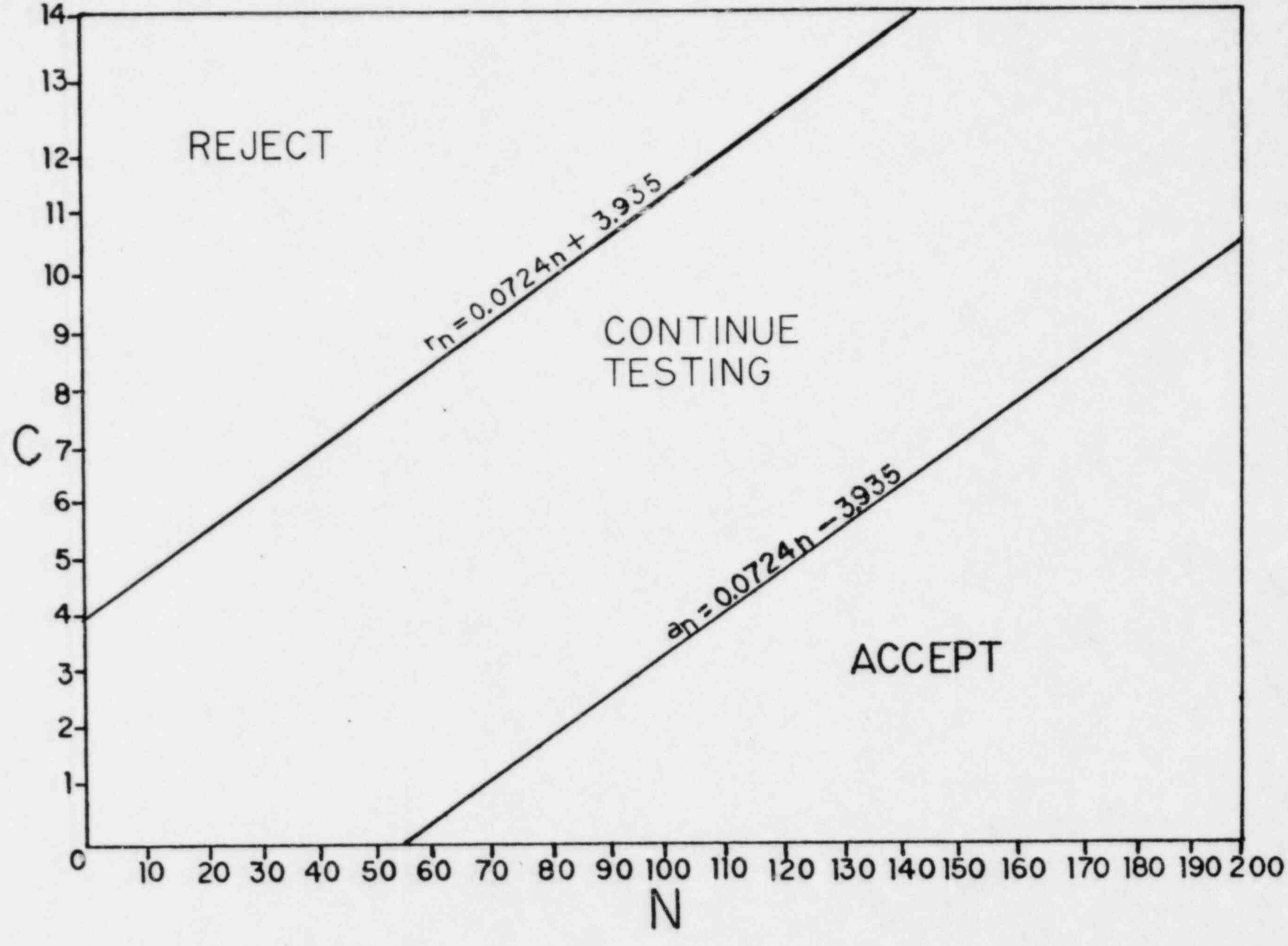
REJECT
CONTINUE TESTING
ACCEPT
$r_n = 0.0724n + 3.935$
$a_n = 0.0724n - 3.935$
C
N
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

Figure 2

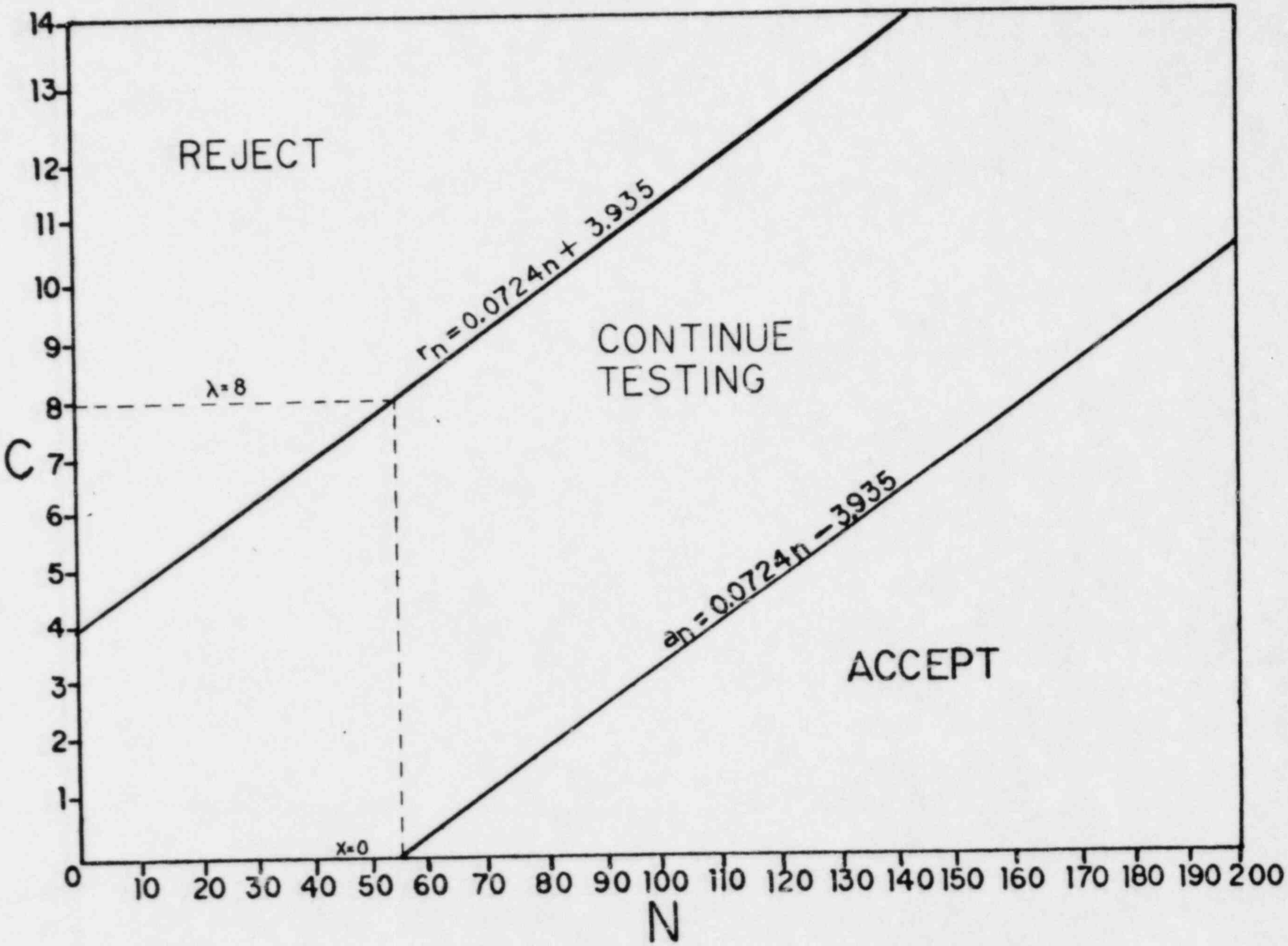
14
13
12
11
10
9
8
7
6
5
4
3
2
1
C
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
N
REJECT
CONTINUE
TESTING
ACCEPT
λ=8
x=0
$r_n = 0.0724n + 3.935$
$a_n = 0.0724n - 3.935$

Figure 3

Relief Request SR-2

1. SYSTEM: All systems with safety related snubbers

2. NUMBER OF ITEMS: Dependent upon the number of failures

3. ASME CODE CLASS: 1, 2, and 3

4. ASME CODE SECTION XI REQUIREMENTS: Subarticle IWF-5400, paragraph (c), requires an additional sample of 10% of the total number of nonexempt snubbers be functionally tested if any snubbers in the representative sample fail the inservice test of IWF-5400 paragraph (b), and that additional sample testing shall continue until all snubbers within the sample have met the requirements of IWF-5400 paragraph (b).

5. BASIS FOR RELIEF: Due to the large snubber population at Byron Station, functional testing of additional sample sizes of 10% of the total of nonexempt snubbers, cause undue hardship and increase ALARA concerns without significantly increasing the operational safety of the plant.

6. ALTERNATE TEST METHOD: Wald Sequential Sampling Plan

7. JUSTIFICATION: The statistical model, utilizing the Wald Sequential Sampling Plan, (see SR-1, Attachment 1), maintains approximately a 95% confidence level that 90% to 100% of the snubbers are operational. It is felt that the Wald Sequential Sampling Plan, along with the augment Visual Examination Schedule, provides a more efficient and managable snubber testing program without significantly effecting the level of plant operational safety, while providing benefits through reduced man rems (ALARA concerns) for plant employees.

8. APPLICATION: Applies to scheduled functional testing.

9. IMPLEMENTATION: Functional testing is scheduled to concur with scheduled plant outages and will be performed, as a minimum, each 18 months ± 25%.

10. TIME PERIOD: This request for relief applies for the life of the plant.