UNITED STATES
ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS
REGION 1
~~XXXXXXXXXXXXXXX~~
~~XXXXXXXXXXXXXXXXXXXXXXXXX~~
631 Park Avenue
King of Prussia, Pennsylvania 19406

MAR 6 1974

H. D. Thornburg, Chief, Field Support & Enforcement Branch
Directorate of Regulatory Operations, HQ

RO INSPECTION REPORT 50-286/74-02
CONSOLIDATED EDISON COMPANY
LICENSE DPR-26

The subject Inspection report is forwarded for appropriate Headquarters action.

1. Refer to Page 4, paragraph B.1.f of the report. In the licensee's FSAR answer concerning the performance of this test, there was no requirement to conduct the test at ≥ 10% generator output. Regulatory Guide 1.68 is explicit on generator output required prior to the test. Since the licensee remains fast in his position, a resolution is required.

2. Refer to page 4, paragraph B.1.e and page 6, paragraph E of the report. The licensee intends to use a different criteria than that given in Regulatory Guide 1.68 for determining multiple drops of the fastest and slowest rods. The licensee's plan includes a choice from the application of statistics versus an assured ten drops for each of the fastest and slowest rods. Reference Attachment 2, a Con Ed internal memorandum dated November 1, 1973.

3. Refer to page 5, paragraph B.1.g of the report. The test demonstrates shutdown from outside the control room. The licensee does not intend to run an integrated shutdown test and does not meet the criteria given in Regulatory Guide 1.68.

We recommend that DL be advised of the matters discussed in this memorandum and that specific guidance be provided on the tests in question. We request that this guidance be provided by April 19, 1974.

E. J. Brunner
Chief, Reactor Operations Branch

Attachments
1. RO Inspection Report No. 50-280/74-02
2. Con Ed Memorandum, November 1, 1973

cc: A. N. Fasano
A. B. Davis

memorandum

November 1, 1973

Stephen H. Cantone
Unit No. 3 Operations Engineer
Indian Point Station

FROM: Min L. Lee
Reactor Fuel Engineer
By - David K. Hsu

SUBJECT: Control Rod Drop Tests on
Indian Point Unit No. 3

REFERENCE: Memorandum dated October 10, 1973 to Min L. Lee from
Stephen H. Cantone, same subject.

This is in response to your memorandum mentioned in the reference. In principle, we agree with your statistical approach regarding the criterion in testing the fastest and slowest control rods. But it appears arbitrary to choose four(4) standard deviations as the limit. We recommend the use of Chauvenet's criterion which relates to the number of events tested (see Attachment 1). Applying Chauvenet's criterion, a data point is to be suspected if the measured value has a deviation from the mean (average) such that the probability of such an occurrence(s) is $\leq \frac{1}{2N}$, where N is total number of data points in a series.

As an illustrative example we use N=53 for the 53 rod drop measurements of IP3. 1/2N is therefore equal to 0.0094 which corresponds to a 99.06% confidence level at 2.61 σ deviation (σ = Standard Deviation). In plain language, the odds are 1 against 106 that one measurement would be rejected if the rod drop time follows a binominal distribution. For a 4 σ deviation, the odds are 1 against 15772, which may preclude a rod that has a small defect.

attach.
DKS/ds

Copy to John J. Grob, Jr.
Arthur W. Flynn
Stephen G. Salay
NFM-17
NFM-47, 47A, 47B
NFM-38B

Example 3-1 What is the probability that a spread at least as great as that in Table 3-1 would be obtained if the experiment were run again?

Solution The quantity χ^2 is

$$\chi^2 = \frac{\sum_{i=1}^{30} (\bar{n} - n_i)^2}{\bar{n}} = \frac{815}{28.2} = 29$$

Since in this example χ^2 is approximately equal to N, the number of independent measurements, the probability is about 0.5. Thus these data show quite an acceptable dispersion.

The question of the rejection of outlying data is an important one that must be handled with caution [6]. Chauvenet's criterion [2] is frequently used for this purpose. The criterion states that any one in a series of N readings will be rejected when its deviation from the mean of the series is such that the probability of the occurrence of all deviations from the mean that are as large or larger is less than $\frac{1}{2}N$. Table 3-6 gives the magnitude of this deviation in terms of multiples k of σ for several values of N. On the basis of this criterion, some rather *small* deviations are discarded unreasonably if N is not very large. More conservatism is warranted [6]. A better criterion is to require that the fraction of the cases in which good but outlying data are rejected be a relatively small amount, for example, 0.05; that is, a confidence limit of 0.95 is employed as a precision index.

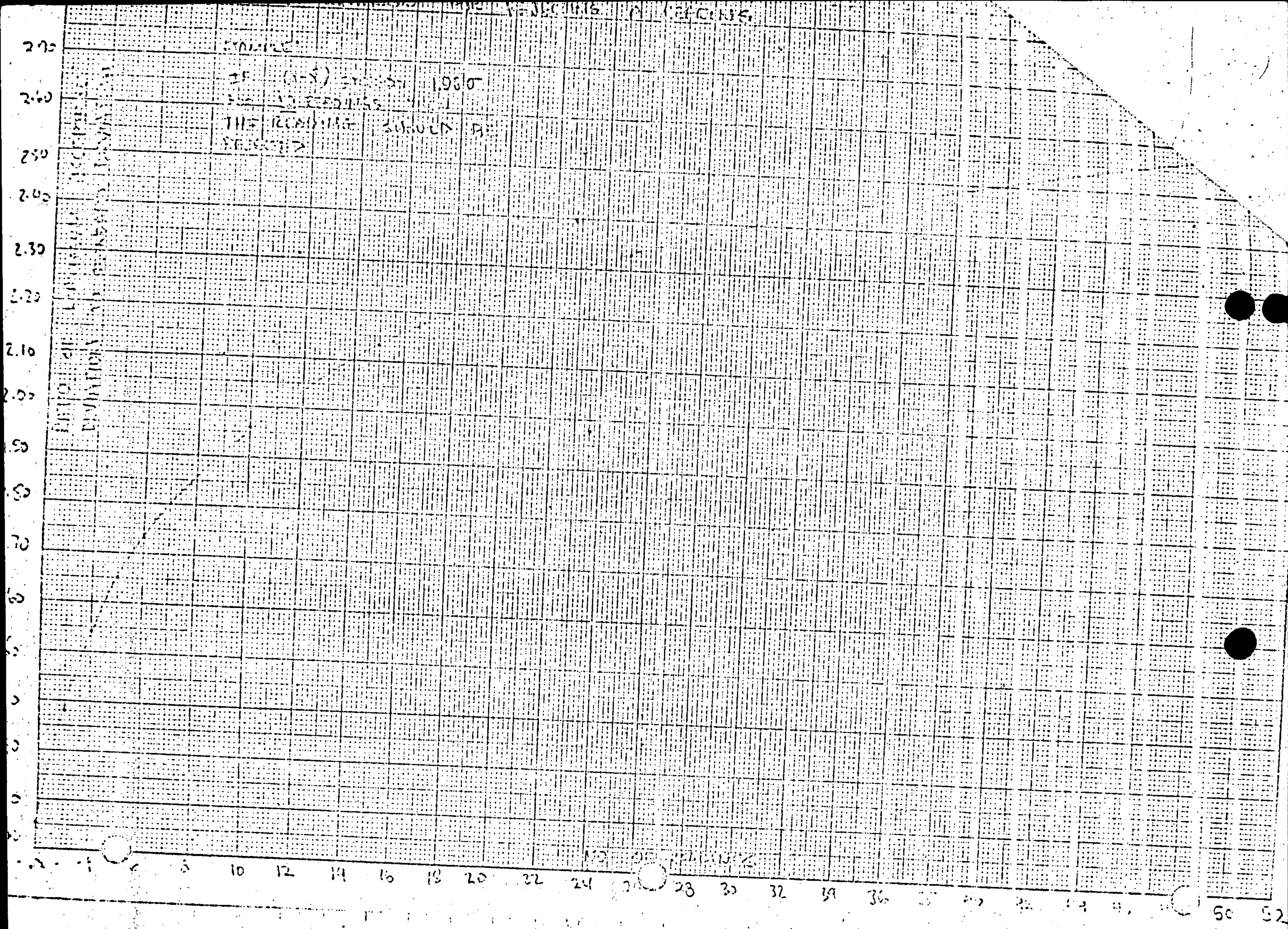
3-9 PULSE-HEIGHT RESOLUTION

The discussion above has drawn upon fluctuations in counting rates for applications of the statistical considerations. Another important area of application in nuclear-radiation detection is that of nuclear spectroscopy. Even though the nuclear radiation to be detected may be quite monoenergetic, the pulses produced by the radiation have a distribution in pulse heights.

One important consideration is the statistics of the transfer from the energy E of monoenergetic particles to ion pairs in the gas-type detectors, to the light photons in the scintillators, to the electron-hole pairs in the semiconductor detectors, etc. To a first approximation, one may consider that Poisson's distribution is followed and consequently the variance is equal to the mean m. Since the fractional deviation is proportional to $1/m^{1/2}$ for Poisson's distribution, it is clear that, the larger

TABLE 3-6 Maximum acceptable deviations in accordance with Chauvenet's criterion

No. of readings, N	2	3	4	5	7	10	15	25
k, ratio of deviation to standard deviation	1.15	1.38	1.54	1.65	1.80	1.96	2.13	2.33



THE READING SHOULD BE
2.30
2.60
2.50
2.30
2.10
10
12
14
16
18
20
22
24
28
30
32
34
36
50
52

8 Nov 1973

File

Douglas Whittier

Test Engineer (unit 3 Startup)

Control rod drop tests on unit No. 3

Discussed this subject via telecon with David Hsu, Reactor Fuel Engineer. He will support our position of not performing ten rod drops on the fastest and slowest rod unless the drop time is greater than 2.61 standard deviations from the mean drop time.

[signature]

cc: Steven H. Cantone