WM-40

circa 12/28/81

PDR

Return to D. Cramer 396-SS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION PROGRAMS-LAS VEGAS FACILITY
P.O. BOX 18416, LAS VEGAS, NEVADA 89114 ● 702/798-2100 (FTS 545-2100)

Gregory G. Eadie
Office of Nuclear Material
Safety and Safeguards (MS 483-SS)
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eadie:

I have reviewed the working paper titled "Recommended Procedures for Identifying Properties that Require Remedial Action, and for Verifying that Remedial Action Has Been Successful." My comments are both general and specific in nature, and opinions expressed are solely my own and may or may not reflect other ORP staff opinions.

General Comments

The draft is certainly all-inclusive and broad in scope. I believe it contains a procedure to handle any conceivable situation that may occur. The only general comments that I have concern organization of the draft and some outlining of cost effective critical pathways that could be followed. It is suggested that the procedures be condensed into a diagram. The diagram would cover all of the procedures and alternatives from the initial screening survey to confirmation of the work. I would envision most of the draft text to be an appendix to the procedural diagram. Each procedure would be referenced to the appendix and would access the user to all information regarding the particular procedural stage in which he is working.

Some critical paths can be outlined on the procedural diagram. For example: one critical path would be to immediately remove a small quantity of radioactive material (with the owner's permission) without going through a procedure to establish its origin. Another example would be to complete any removal of radioactive materials in such a fashion that further structure evaluations are not necessary.

Specific Comments

Indoor Working Level Assessment

There are likely to be many structures in which the annual average working level (AAWL) exceeds 0.015 from natural causes or occurrences. The variability of individual measurements to estimate the AAWL will require a statistical evaluation of the WL measurement data.

A statistical evaluation will indicate if the AAWL is clearly above or below 0.015 WL. There will also be a region where it cannot be determined if a

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Comments on "Recommended Procedures..."

structure is above or below the AAWL. Measurements of the AAWL should be avoided, where possible, because they are time consuming, costly, and may never provide yes or no answers. With this in mind, I suggest that:

1. No WL measurements be made in structures that obviously have no tailings use.
2. No WL measurements be made in structures that have had all tailings removed.
3. A WL assessment of a structure should only be conducted in cases where physical evidence casts some doubts concerning the complete removal of tailings or if the removal of tailings will require some work on the structure. It could very well be cost effective to do some limited work on the physical structure to remove tailings rather than undergo a WL evaluation.

In the likely event that some structures will need an AAWL evaluation, listed below are some comments and enclosed are some data that may be helpful.

Fortunately, some annual WL data does exist and some approaches to estimate the AAWL can be explored. Enclosure 1 is a plot of individual RPISU measurements made in a public building located in Butte, MT. The individual data points (dots) are quite variable. The 1, 2, and 3 month averages of the individual WL measurements indicate a seasonal trend. Enclosure 2 is a plot of the individual data points on log-probability paper. The distribution is log-normal with a geometric mean of 0.014 WL and a geometric standard deviation of 1.37. The geometric mean is about the best estimate of the true mean possible using RPISU's.

Ideally, we would like to estimate the AAWL as accurately as possible and in the shortest time period as possible. I see three possible approaches with the current technology. These are:

1. Collect one short-term WL sample

2. Collect short-term WL samples throughout a calendar year

3. Collect a continuous sample for a specified time period

The first approach is a screening mechanism. The short-term sample could be a grab or one-week RPISU.

With regard to grab WL samples, Mr. Gnugnoli at NRC conducted a statistical analysis of RPISU vs closed grab sampling data. His conclusion was that a single grab WL value in excess of 0.038 WL indicates that the geometric mean RPISU measurements (i.e., four to six samples of at least 100 hours sampling duration spaced over an entire year's cycle) would exceed the 0.015 WL value with a 95% confidence level.

A one-week RPISU sample may provide a similar screening measurement. With regard to Enclosure 2, if any single RPISU sample collected over a period of one week exceeds 0.028 WL, it is likely that the AAWL will exceed 0.015 WL at the 95% confidence level. Correspondingly, a single RPISU sample will be within +86% and -49% of the geometric mean at the 95% confidence level.

Using the second approach (short-term samples spaced over a period of one year) requires more time than grab sampling but produces better results. Enclosure 3 is a log-probability plot of 8 sets of the arithmetic average of 6 samples spaced approximately 2 months apart (i.e., Surgeon General's Criteria for Grand Junction, Colorado). They are within +21% and -16% of the geometric mean at the 95% confidence level. The line fit has a correlation coefficient of 0.97. If we extend the sampling interval to 3 months and plot 6 sets of the arithmetic average of 4 spaced samples, we obtain a log-normal plot (Enclosure 4). The data points are within +38% and -26% of the geometric mean at the 95% confidence level. This line fit has a correlation coefficient of 0.89.

Enclosure 5 is a presentation of how the geometric standard deviation changes using the third approach (i.e., assuming a continuous sampling period up to 90 days). The dashed line represents a plot of the geometric standard deviation as a percentage of the geometric mean with increasing sampling times. All possible combinations of consecutive 30, 60, and 90 day sampling periods were each plotted on log-probability paper and their geometric standard deviations were measured. You can improve the error by sampling for longer consecutive periods of time. Unfortunately the error at the 95% confidence level for a 90 day sampling period is +36% and -25% of the geometric mean. Seasonal variations undoubtedly contribute to this spread. The error may be reduced somewhat by selecting a particular sampling period during the year.

Although the interim standard of 0.015 WL is rational in terms of health effects, I believe that it is premature assuming that background WL's in structures are in the neighborhood of 0.004 WL. The Canadian survey indicates that about 10% of their structures exceed 0.02 WL. I feel that this is low because of bias in their measurements, (i.e., they sampled during normal working hours when inversions break and wind speeds increase, and they sampled during the summer season). Enclosure 6 is a log-normal plot of indoor WL measurements in 168 structures in the Butte, Montana area. As far as we know, the WL's are caused by natural occurrences. About 70% of the measurements exceed 0.015 WL and about 30% of the measurements exceed the upper level of the Surgeon General's Criteria for Grand Junction, Colorado (i.e., .05 WL).

In summary, I believe in most cases that it would be more cost effective to remove all tailings in or around a structure than engage in WL measurements that may not be definitive. There is a reasonable likelihood that AAWL in many structures can exceed 0.015 WL from natural occurrences.

<u>Sampling When Wind Speed $<$ 8 mph</u>

The concept of grab sampling under closed conditions and during periods when the wind speed is $<$ 8 mph appears to have good merit. As the wind speed increases the exchange of indoor air with outdoor air will increase, subsequently decreasing the indoor radon concentration. As the wind speed increases the outdoor radon concentration also decreases further decreasing the indoor radon concentrations. Enclosure 7 is a plot of outdoor radon concentrations vs wind speed measured at 10m. The dashed line is a frequency plot of the individual data points and has a sharp inflection at about 3m/sec ($\sim$ 7 mph). This corroborates Battelle's observations and conclusions concerning grab sampling when wind speeds are $>$ 8 mph. I also see some evidence of outdoor radon concentrations dependent upon wind direction as well as wind speed.

Radium-226 Concentrations in Soil

It has been my experience that land areas, for the most part, can be decontaminated below 5 pCi/g of radium-226. It is also my opinion, based on considerable experience, that the above concentration, in most cases, can be monitored readily with conventional survey instruments and that there is little need to resort to laboratory measurements. Laboratory measurements are deemed only necessary in the final appraisal of open lands. With regard to structures, it is strongly suggested that all tailings be removed around or in structures where possible. In most cases, this should require only minimal extra effort. If all tailings are removed (i.e., the residual levels are indistinguishable from background variations) this relieves you of the responsibility of performing additional measurements in a structure (i.e., gamma radiation exposure rates and WL's) under (b), Section 192.12 of 40 CFR, Part 192.

The standards concerning radium-226 concentrations do, however, have some shortcomings. The gamma exposure rates and WL values are proportional to the radium-226 concentration, geometry and total quantity of radium-226. The standards address the concentration and geometry but not the total quantity. For example: the gamma exposure rate and radon exhalation is certainly different for a disc with a radius of 1 foot vs a disc with a radius of 10 feet and with each disc having the same radium-226 concentration and thickness.

Please call me if you have any questions or need further information.

Sincerely yours,

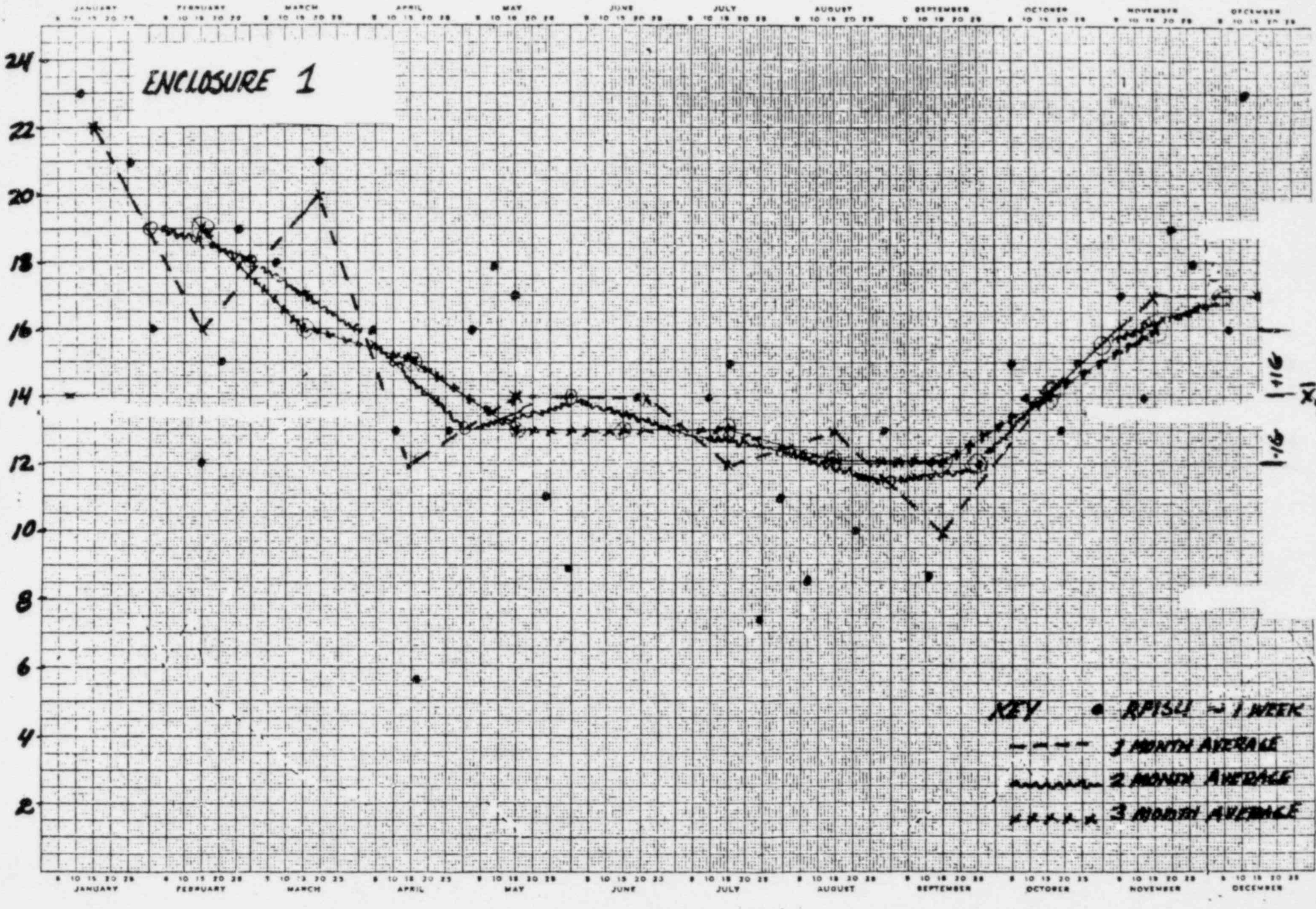
Joseph M. Hans, Jr.
Staff Officer
Field Studies Branch
Office of Radiation Programs-LVF

Encls (as stated)

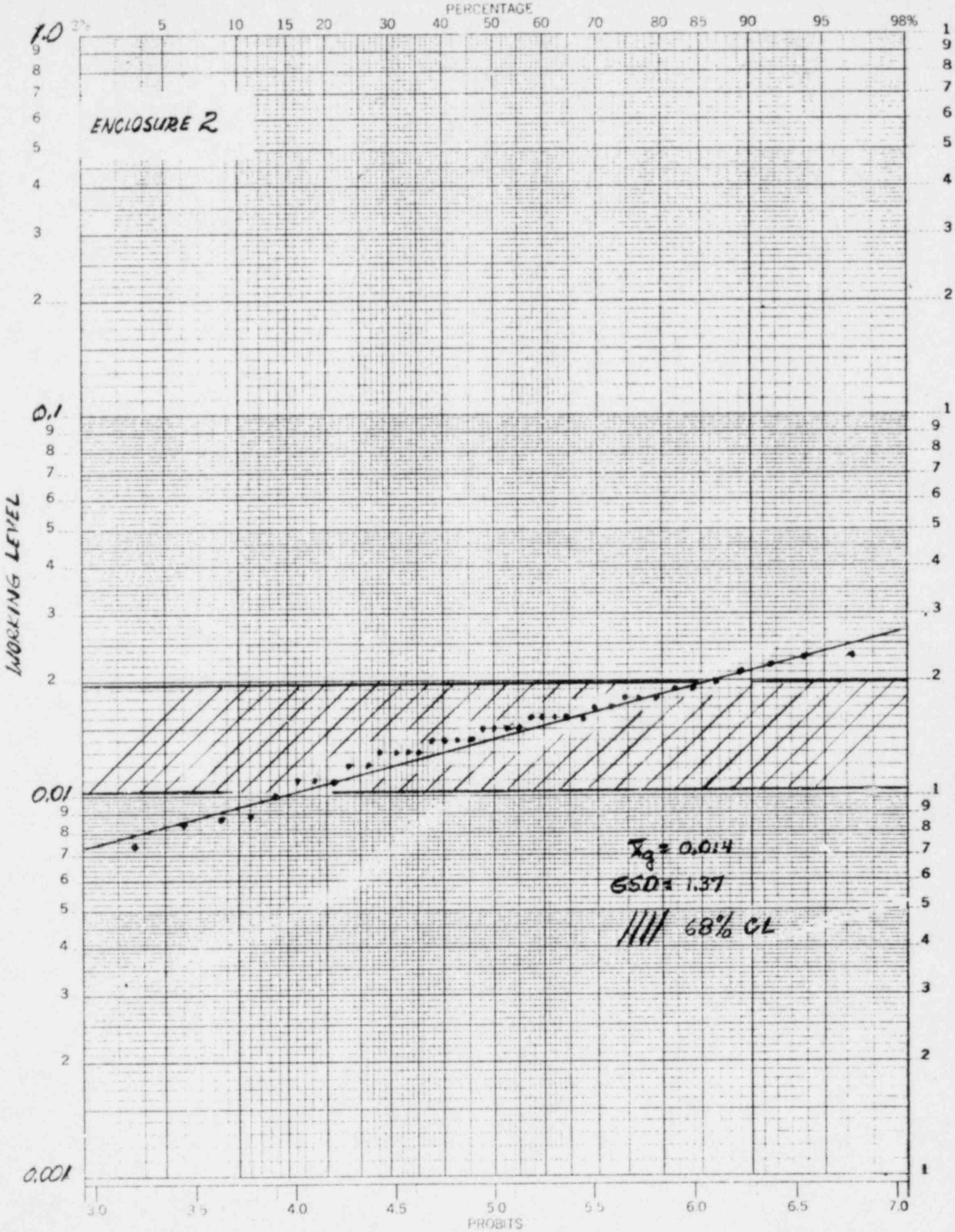
cc:
Larry Lloyd, (Helena, MT)
John Giedt, Region VIII

BM09B

ENCLOSURE 1



BM098

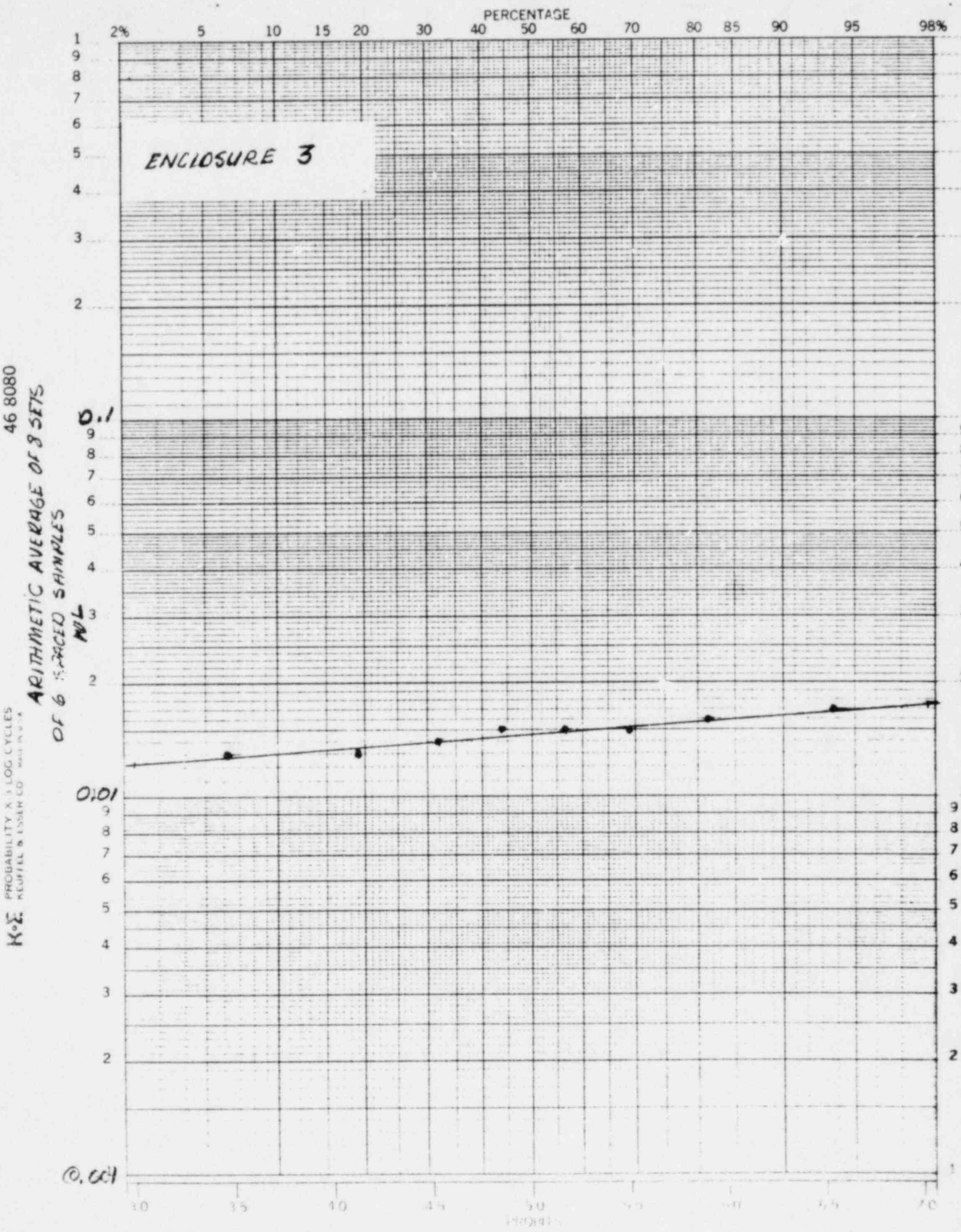


46 8080

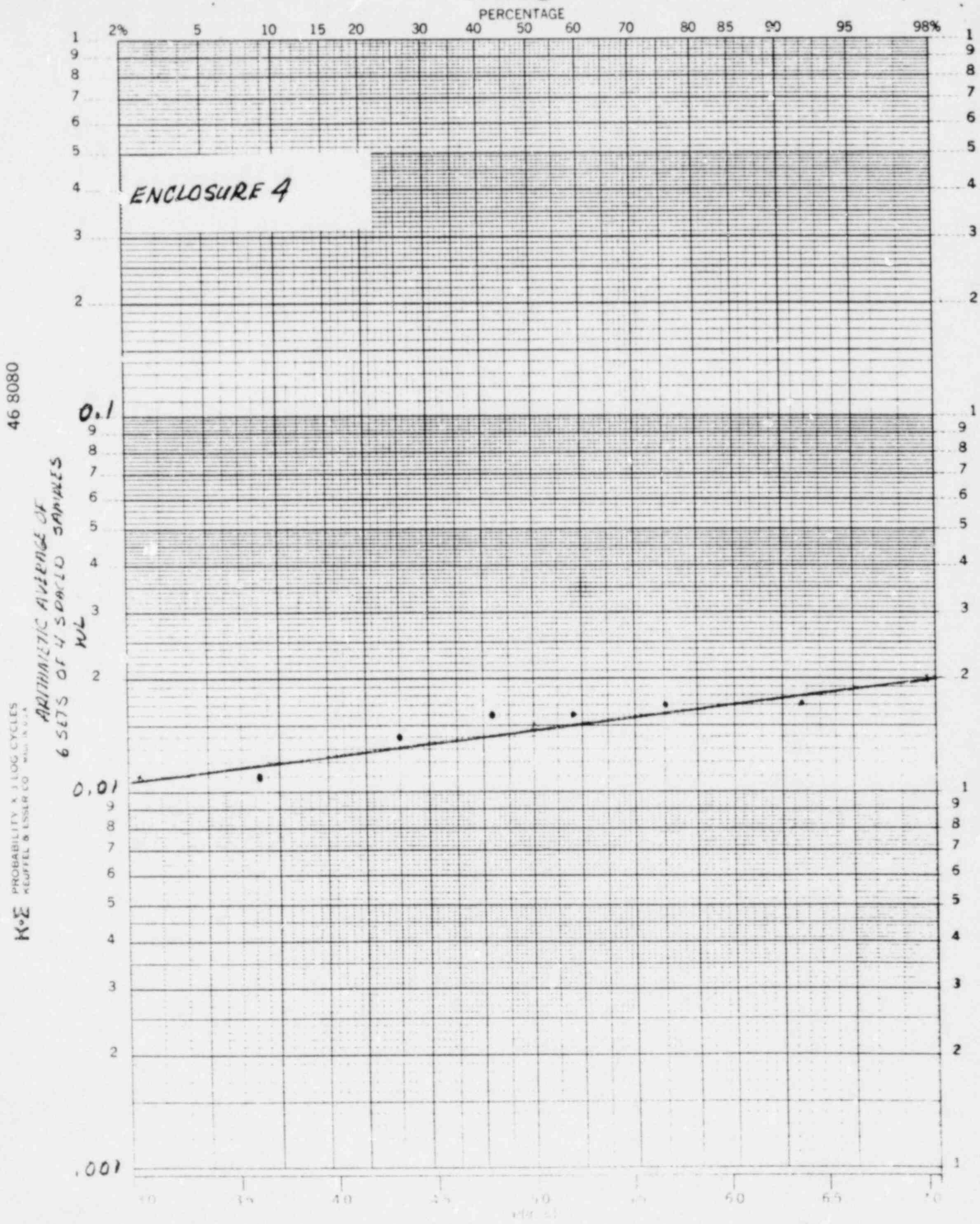
K&E PROBABILITY X 3 LOG CYCLES
KEUFFEL & ESSER CO.

BM098

ENCLOSURE 3



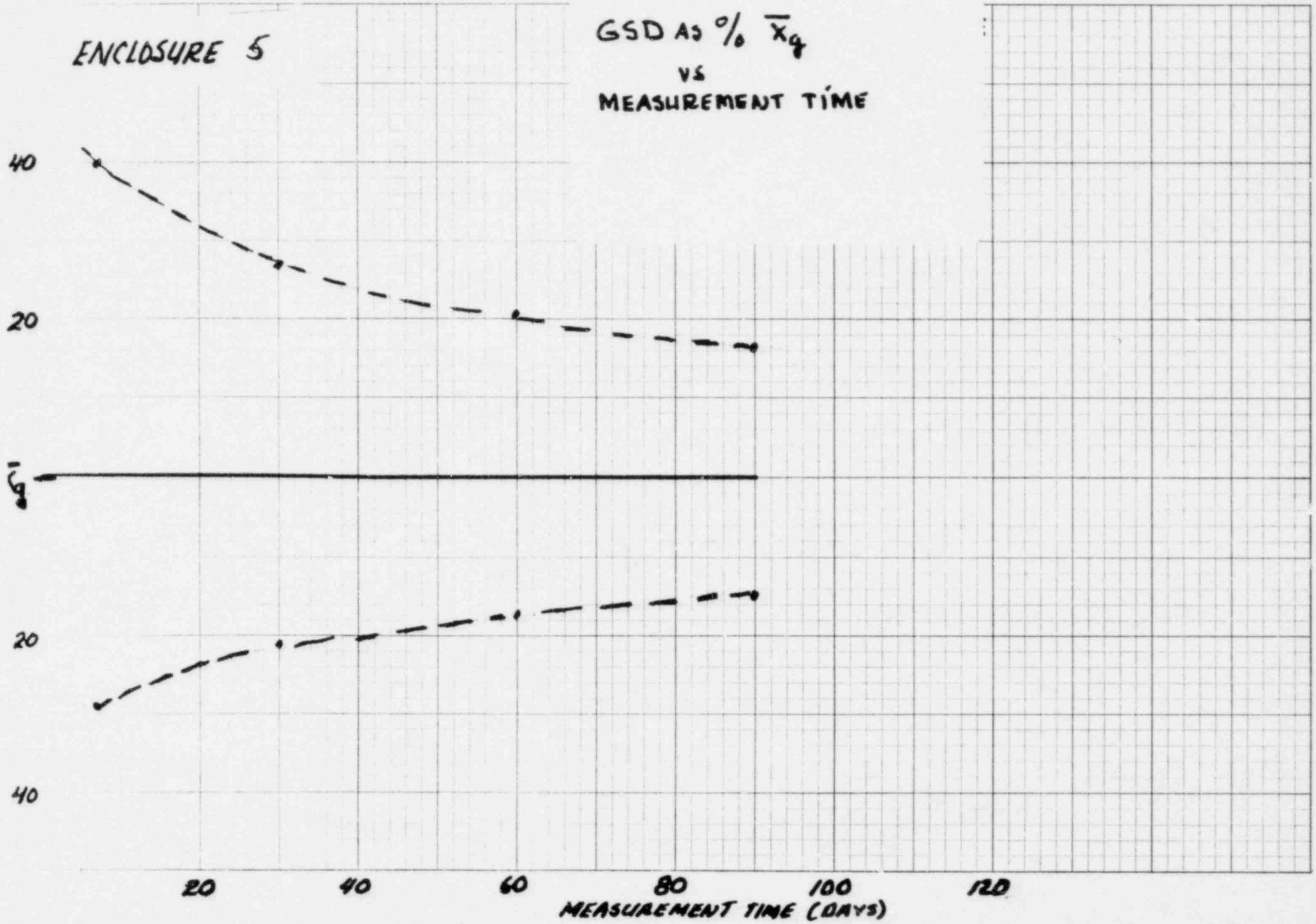
BM098

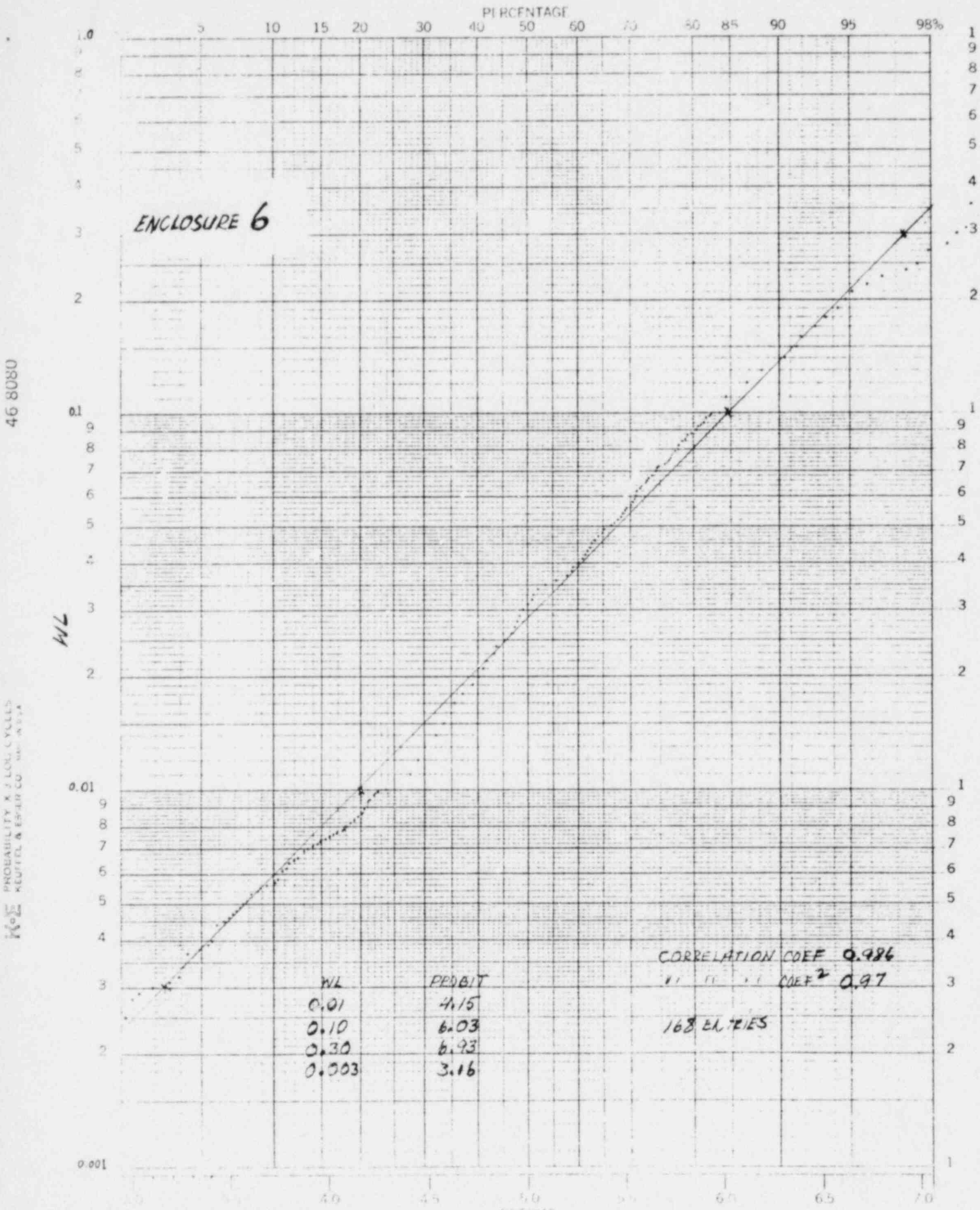


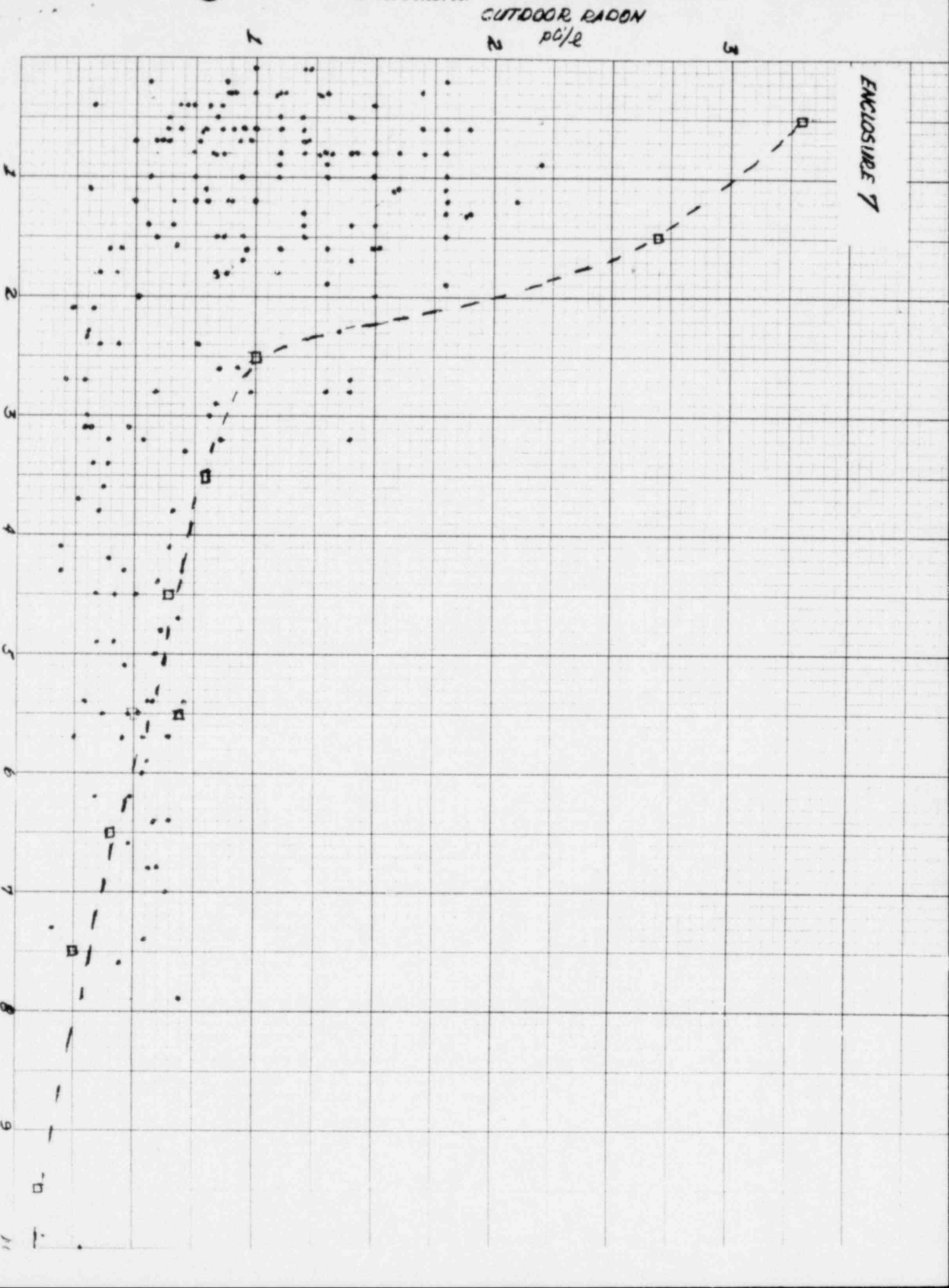
PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
ENCLOSURE 4
0.1
0.01
.001
ARITHMETIC AVERAGE OF
6 SETS OF 4 SPACED SAMPLES
WL
46 8080
K-E PROBABILITY X 3 LOG CYCLES
KEUFFEL & ESSER CO.
40
60
65

ENCLOSURE 5

BM 098




ENCLOSURE 6
PERCENTAGE
PROBITS
WL
WL PROBIT
0.01 4.15
0.10 6.03
0.30 6.93
0.003 3.16
CORRELATION COEF 0.986
" " " COEF² 0.97
168 ENTRIES
46 8080
K&E PROBABILITY X 3 LOG CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.


OUTDOOR RADON
pCi/l
1
2
3
ENCLOSURE 7
WIND SPEED (m/sec) @ 10m
1
2
3
4
5
6
7
8
9