Monsanto

MOUND FACILITY
Operated for the United States
Department of Energy

March 26, 1981

Dr. William E. Mott, Director
Environmental and Safety
Engineering Division
U. S. Department of Energy
Washington, D. C. 20545

Dear Bill:

Enclosed please find the short-term radon/radon progeny screening report conducted at the Seneca Army Depot in Romulus, New York per your request.

If you have any questions or comments, please feel free to contact me.

Sincerely,

William G. Yates
Radon Program Manager

WGY:mls
Enclosure

cc: R. Barber w/encl
J. Counts w/encl
G. Turi w/encl
A. Whitman w/encl

SHORT-TERM RADON/RADON PROGENY SCREENING AT SELECTED AREAS OF THE SENECA ARMY DEPOT, ROMULUS, NEW YORK

ABSTRACT

The results of the short-term radon/radon progeny screening at selected areas of the Seneca Army Depot, Romulus, New York are presented in this report. For brief interims of time during the early 1940's, eleven (11) munition bunkers on this site were previously used for storage of pitchblend ore (~2000 varrels). The screening was undertaken to assess representative current radon/radon progeny concentrations for the eleven bunkers. The screening results in selected bunker areas indicated radon/radon progeny concentrations do not impose significant health hazards or serious contamination problems. Contamination of residual radioactive materials in these bunkers can be significantly reduced with simple ventilation and cleanup procedures.

INTRODUCTION

At the request of the Department of Energy/Environmental and Safety Engineering Division (DOE/ESED), a short-term survey at selected bunker areas for representative radon/radon progeny concentrations was conducted by Mound at the Seneca Army Depot, Romulus, New York. About 2000 barrels of pitchblend ore were stored in eleven (11) munitions bunkers during brief periods of time in the early 1940's. The munition bunkers used for this storage effort are currently empty. Army personnel occupancy of these bunkers is extremely minimal, if not at all. Only Seneca health and safety personnel have authority to enter the area and their entry is minimal and in short durations. The areas of contamination have been isolated. Unauthorized ingress and egress into the bunker areas is strictly prohibited.

The present short-term screening was undertaken to assess current representative radon/radon progeny concentrations for all bunkers.

Based on an Oak Ridge National Laboratory (ORNL) radiological survey report (February, 1979), one of the bunkers with a high radon progeny concentration was chosen as a representative for the remaining eleven bunkers. The reasons for adopting this monitoring scheme were:

1-by choosing a bunker with one of the highest radon progeny concentrations (working level, WL) data, conclusions and inferences drawn from the data generated would be representative of all bunkers having the high WL values

2-secondly, by worst case, those bunkers having lower WL values would generally fall within conclusions drawn

3-by design, this was a limited study in time, manpower, instrumentation and equipment

A control bunker was chosen for reference data. This control bunker was at a considerable distance from the area of the eleven contaminated bunkers. An outdoor monitor was also established at each bunker location.

DISCUSSION OF RESULTS

The monitoring plan schematic was to place one radon monitor outside the control bunker C0912 and one radon monitor inside bunker C0912 (see Figure 1). The same procedure was used for the contaminated bunker, E0804. The outside radon monitors at each bunker were used to determine outdoor ambient radon concentrations and any contributing influence due to contamination in or outside the bunker. The radon monitors placed inside each bunker were moved at two-week intervals from the front, to the middle, and to the rear of each bunker. This was done for determining possible spatial effects in the radon concentration. A series of grab sample WL data was collected during the period of August 26 to August 29, 1980 at the control and contaminated bunker. A very limited number of weekly average WL data was collected at both bunkers.

The radon monitors used were Passive Environmental Radon Monitors (PERM's) of the type developed at the DOE/Environmental Measurements Laboratory (EML), New York, NY. This unit utilizes thermo luminescent dosimeter detectors (TLD) to give an integrated weekly average radon concentration. Two types of working level (radon progeny) monitors were utilized, the "MOD" and RDA-200. The "MOD" (Measurement of Daughters) works on the same TLD principle as the PERM to give an integrated weekly average WL concentration. This instrument was also developed at the DOE/Environmental Measurements Laboratory. The RDA-200 developed at EDA was used to collect grab sample radon and radon progeny measurements. This instrument utilizes scintillation cells and filter samples to determine radon and radon progeny values respectively.

OUTDOOR RADON DATA

The outdoor radon monitors placed outside the control bunker (C0912) and the contaminated bunker (E0804) indicated no significant differences by comparison (see Table I). The control bunker's outside monitor ranged from 0.09-0.71 pCi/ℓ with an average concentration of 0.34 pCi/ℓ. Bunker E0804 outdoor radon values ranged from 0.10-0.58 pCi/ℓ with an average concentration of 0.25 pCi/ℓ. Outdoor radon values at both bunkers are well below the DOE guideline of 3.0 pCi/ℓ.

It can be concluded that virtually no difference exists in outdoor radon values at both bunkers, especially since the control bunker monitor had a marginally higher value. The data also suggest no contributing influence from concentration inside E0804 bunker or from possible radium contamination in contiguous soil around the bunker.

INDOOR BUNKER RADON DATA

A radon monitor was placed inside the control bunker (C0912) and contaminated bunker E0804. The monitors were positioned at the front of each bunker and moved to the center and rear of each bunker at two-week intervals. The doors to both bunkers were kept closed during the measurements with the exception of sample

collection and instrument maintenance. This procedure was used for spatial considerations in determining radon concentrations indoors. The monitoring scheme covered the period of July 31, 1980 to October 21, 1980. Only three measurements were made for radon progeny (working level) with MOD units. This unit normally operates on AC electrical power. No AC electrical power was available in the bunkers. A great deal of technical difficulty was encountered converting this unit to DC battery power (auto battery). Thus, only a few integrated WL measurements were made toward the end of the screening period. However, grab sampling for radon and radon progeny (WL) was performed and reported infra in this report.

Radon values in control bunker C0912 ranged from 0.45-5.5 pCi/ℓ with an average of 3.1 pCi/ℓ. One radon progeny (working level) value of 0.032 WL was recorded from 10/2/80 to 10/9/80. Radon values in contaminated bunker E0804 ranged from 2.6 to 13. pCi/ℓ with an average of 7.5 pCi/ℓ. Two radon progeny (WL) values of 0.061 and 0.10 WL were recorded from the period of 10/9/80 to 10/21/80 (see Table II).

Radon values recorded in contaminated bunker E0804 were slightly more than twice the values in control bunker C0912. Likewise radon progeny (WL) data was two to three times higher in the contaminated bunker versus the control bunker. It is evident that residual radioactive material in bunker E0804 is the probable factor.

However, it is important to indicate here that both radon and radon progeny values in the control bunker are above the DOE standard for radon (3.0 pCi/ℓ) and the interim EPA standard for radon progeny (0.015 WL). It is a well known and accepted fact that minute amounts of natural occurring radium exist in concrete. Radon and radon progeny concentrations in the control bunker may be naturally above the applicable standards because of material of construction and non-ventilated or closed systems associated with the bunkers.

GRAB SAMPLE RADON/RADON PROGENY MEASUREMENTS

A series of grab samples for real time radon/radon progeny concentrations were taken at bunkers C0912, E0804, and E0808 during the period of August 26, 1980 to August 29, 1980. These samples were taken to augment MOD and PERM weekly averaged radon/radon progeny data; secondly to introduce a new variable, specifically, measurements taken with bunker doors open. Thus a comparison of closed versus opened door data could be made to determine what effect simple ventilation would have on radon/radon progeny concentrations.

A series of radon/radon progeny measurements were taken in front and rear of control bunker C0912 with the bunker door closed. Radon concentration ranged from 6.2 to 6.8 pCi/ℓ and radon progeny concentrations ranged from 0.037 to 0.052 working level (WL) respectively (see Table III, Figure 2 and Figure 2A).

A series of radon/radon progeny measurements were taken at the front, middle, and

rear of control bunker C0912 with the bunker door opened. Radon concentrations initially ranged from 8.3 to 1.7 pCi/ℓ and radon progeny concentrations initially ranged from 0.064 to 0.012 working levels (WL) respectively (see Table III, Figure 3 and Figure 3A).

It should be noted that initially, both radon and radon progeny concentrations in control bunker C0912 were above the DOE guideline for radon (3.0 pCi/ℓ) and the EPA interim standard (0.015 WL) for unrestricted areas even though this was not a contaminated area. This fact is attributed to small amounts naturally occurring radium in concrete, the tremendous mass of concrete used in the construction of the bunker and virtually no ventilation when the bunker is a closed structure.

Comparison of the radon/radon progeny data with the door closed versus the door open indicate a dramatic reduction in both concentrations. The reduction in radon/radon progeny concentrations inside the bunker is substantial enough to bring it into compliance with current DOE and EPA guidelines.

The same trend in contaminated bunker E0804 was noted. Radon and radon progeny concentrations ranged from 12.0 to 14.2 pCi/ℓ and 0.116 to 0.124 WL, respectively, with the bunker door closed. With the door open, radon/radon progeny values ranged from an initial high of 14.4 to 1.4 pCi/ℓ radon and 0.122 to 0.009 WL respectively (see Table III, Figures 4, 4A, 5 and 5A).

The same opened door experiment was performed at another contaminated bunker (E0808) for WL only. Initial radon progeny concentration ranged from a high of 0.052 to 0.011 WL (see Table III and Figure 6).

It is concluded that simple ventilation (opened doors) results in substantial reduction of radon/radon progeny concentrations for the bunkers measured (C0912 control, E0804, and E0808). The reduction is significant enough in all bunkers tested to meet applicable DOE and EPA standards. It can be assumed from the data generated that the remaining nine (9) contaminated bunkers would follow the same trend.

It is suggested that adequate ventilation and a simple scrub down of the contaminated bunkers will resolve the contaminated bunker problems at the Seneca Army Depot.

RECOMMENDATIONS

As evidenced by the data, radon and radon progeny concentrations were substantially lowered by simply opening the doors to both bunkers and increasing the ventilation. The data indicate that this action brings both bunkers into compliance with applicable DOE (3.0 pCi/ℓ) and EPA (0.015 WL) standards. It is recommended before entry into any bunker that the doors be opened for at least 1-2 hours to reduce radon/radon progeny concentrations.

It is also recommended that a simple scrub down of the contaminated bunkers will remove the majority of any residual radioactive material due to the storage of pitchblend ore.

SUMMARY

The short-term radon/radon progeny screening at the Seneca Army Depot indicates:

1-data taken at the selected bunker is assumed to approximate conditions in all eleven bunkers

2-no eminent health hazard to Seneca Army personnel due to radon/radon progeny concentrations exist

3-simple ventilation of the contaminated bunker (open bunker doors for 1-2 hours) will bring the bunker into compliance with applicable DOE and EPA standards

4-scrub down of the eleven bunkers is suggested to remove the majority of residual radioactive material

REFERENCES

Radiological Survey of the Seneca Army Depot, Romulus, New York
DOE/EV-0005/11, Feb. 1979.

ACKNOWLEDGEMENT

The authors wish to acknowledge the effort of Stephen Sarris for sample analysis relative to this report.

Table I

OUTDOOR RADON DATA AT SENECA ARMY DEPOT

DATE	Control Bunker C0912 pCi/ℓ*	Contaminated Bunker E0804 pCi/ℓ*
7/31/80-8/7/80	0.53	--
8/7/80-8/21/80	0.19	0.15
8/21/80-9/4/80	0.09	0.11
9/4/80-9/11/80	0.21	0.10
9/11/80-9/18/80	0.71	--
9/18/80-9/25/80	0.20	0.17
9/25/80-10/2/80	0.33	0.58
10/2/80-10/9/80	0.38	0.33
10/9/80-10/16/80	0.14	0.40
10/16/80-10/21/80	0.16	0.16
Range	0.09-0.71	0.10-0.58
Average	0.34	0.25
Standard Error	0.07	0.06

*picocuries/liter

Table II

DATE	Control Bunker C0912 pCi/ℓ*	WL**	Contaminated Bunker E0804 pCi/ℓ*	WL**
7/31/80-8/7/80	3.4		7.1	
8/7/80-8/21/80	3.5		7.1	
8/21/80-9/4/80	3.6		6.0	
9/4/80-9/11/80	2.3		-	
9/11/80-9/18/80	0.45		2.6	
9/18/80-9/25/80	1.6		4.3	
9/25/80-10/2/80	3.0		13.	
10/2/80-10/9/80	3.5	0.032	12.	
10/9/80-10/16/80	4.1		7.9	0.061
10/16/80-10/21/80	5.5		7.9	0.10
Range	0.45-5.5	--	2.6-13.	0.061-0.10
Average	3.1	0.032	7.5	0.083
Standard Error	0.4	--	1.1	0.022

*picocuries/liter

**A working level (WL) is defined as any combination of short lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of alpha particle energy.

Table III

Seneca Army Depot

Grab Sample Data

DOOR CLOSED

Control Bunker C0912			Contaminated Bunker E0804		
DATE/TIME	pCi/ℓ*	WL**	DATE/TIME	pCi/ℓ*	WL**
8/27/80-0925 AM	6.76	0.052	8/27/80-1005 AM	14.17	0.118
0942	6.24	0.037	1025	15.43	0.124
				11.96	0.116

DOOR OPEN

8/26/80-1020 AM	8.32	0.064	8/29/80-0950 AM	14.43	0.122
1031	3.12	0.035	1005	7.54	0.082
1042	1.69	0.012	1022	2.99	0.038
			1042	2.21	0.020
			1104	1.39	0.009

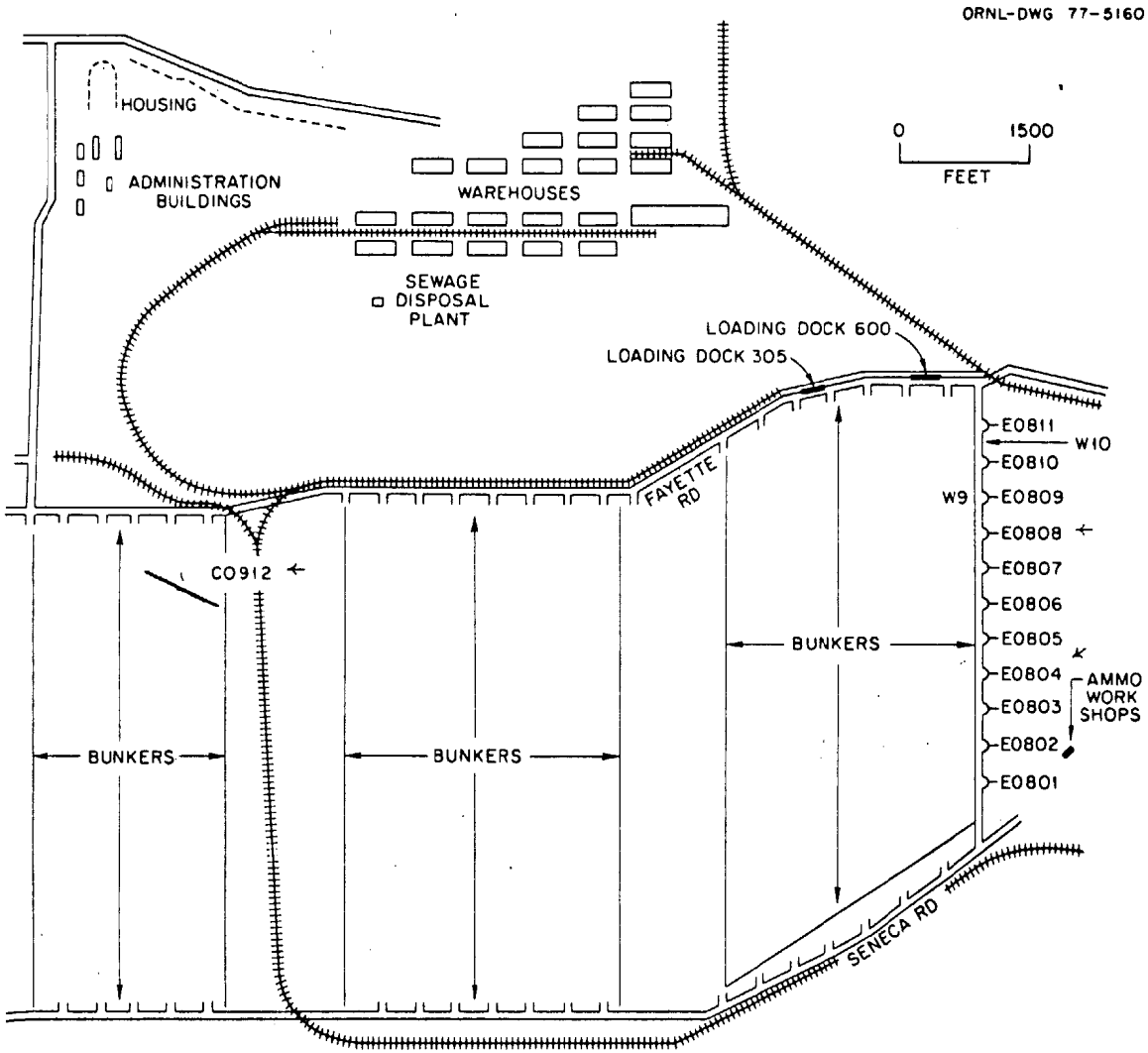
CONTAMINATED BUNKER E0808
WL Data Only

	WL
08/28/80-0900 AM	0.052
0917	0.039
0930	0.036
1000	0.033
1015	0.019
1030	0.023
1051	0.019
1106	0.011

*picocuries/liter

**A working level (WL) is defined as any combination of short lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of alpha particle energy.

FIGURE 1



← indicates bunkers monitored

Map of portion of Seneca Army Depot.

(Permission granted by Oak Ridge National Laboratory)

August 27, 1980

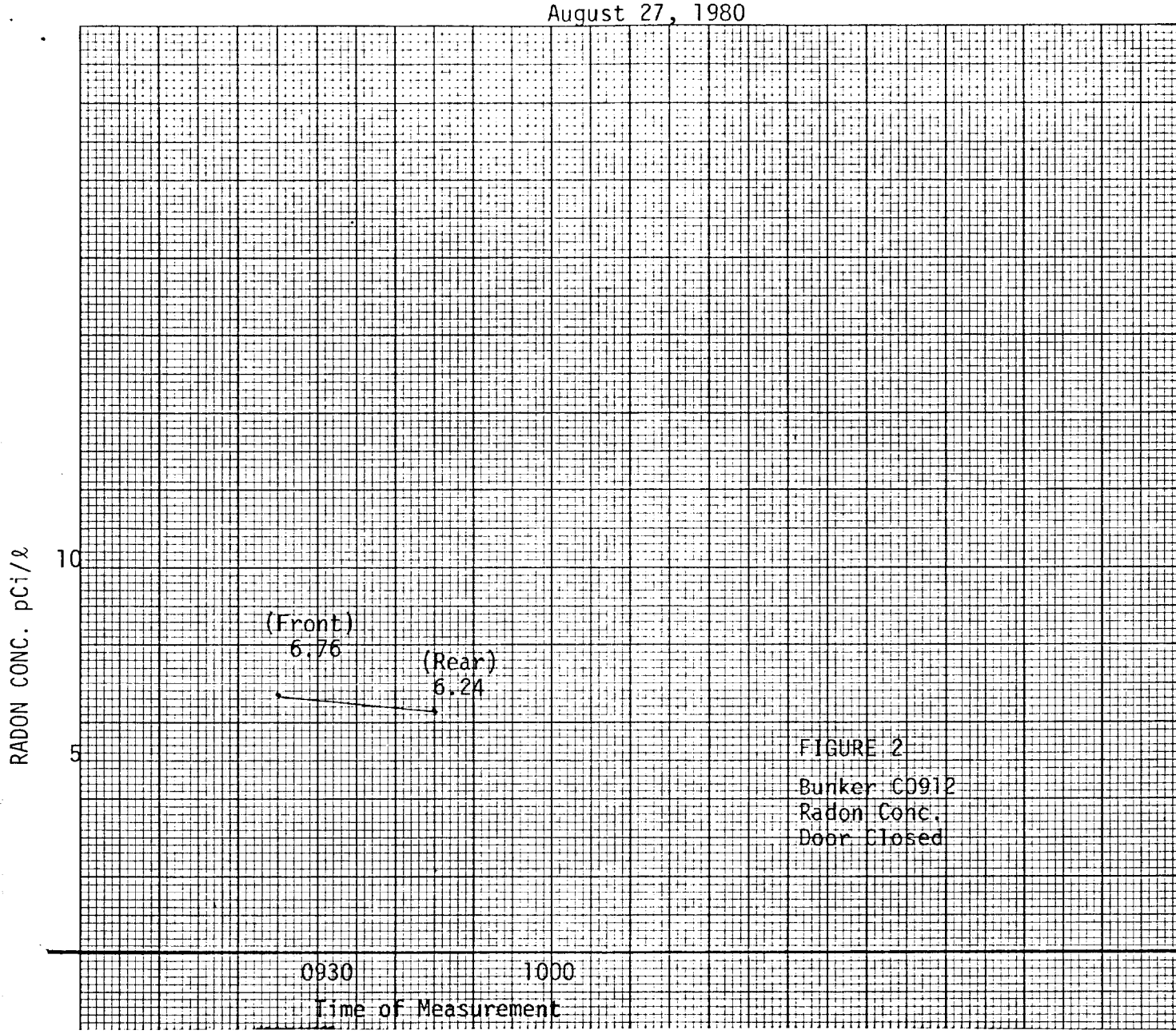


FIGURE 2

Bunker C0912
Radon Conc.
Door Closed

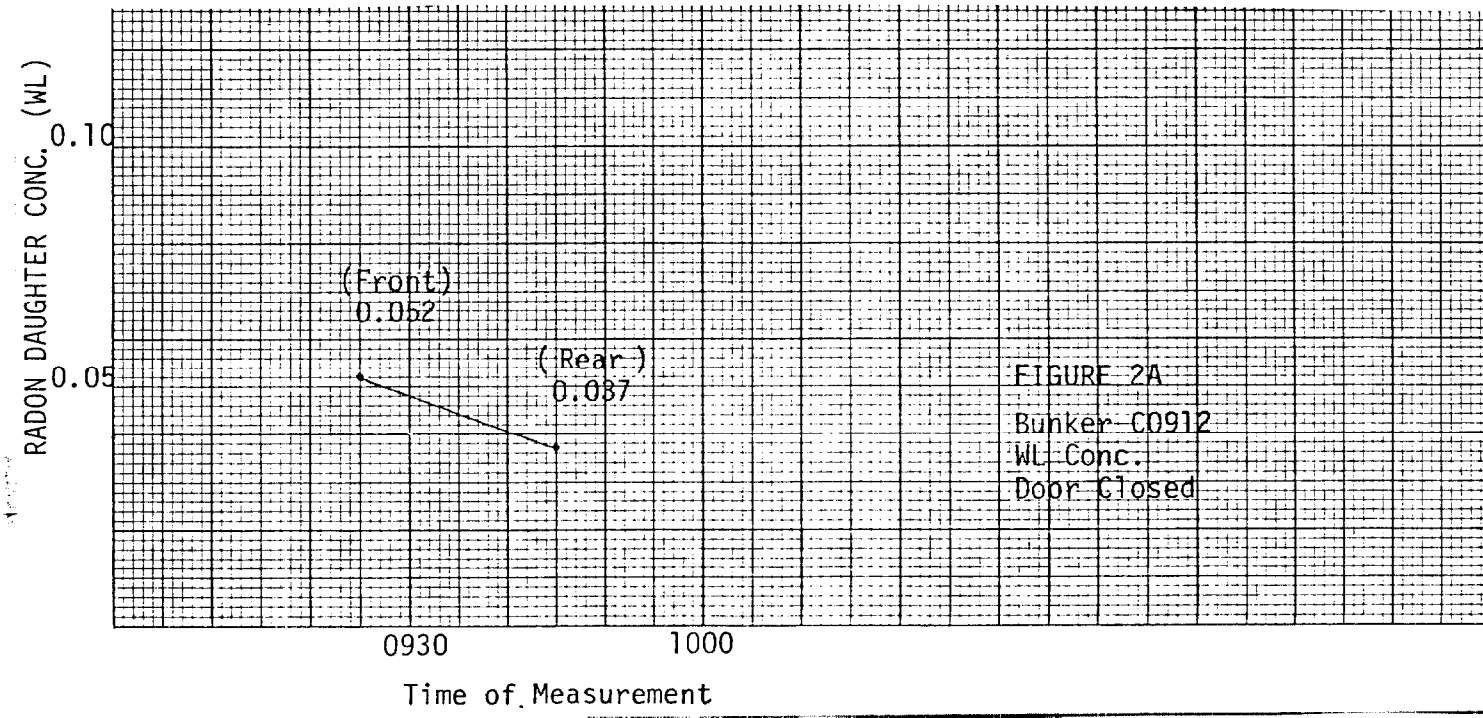


FIGURE 2A

Bunker C0912
WL Conc.
Door Closed

August 26, 1980

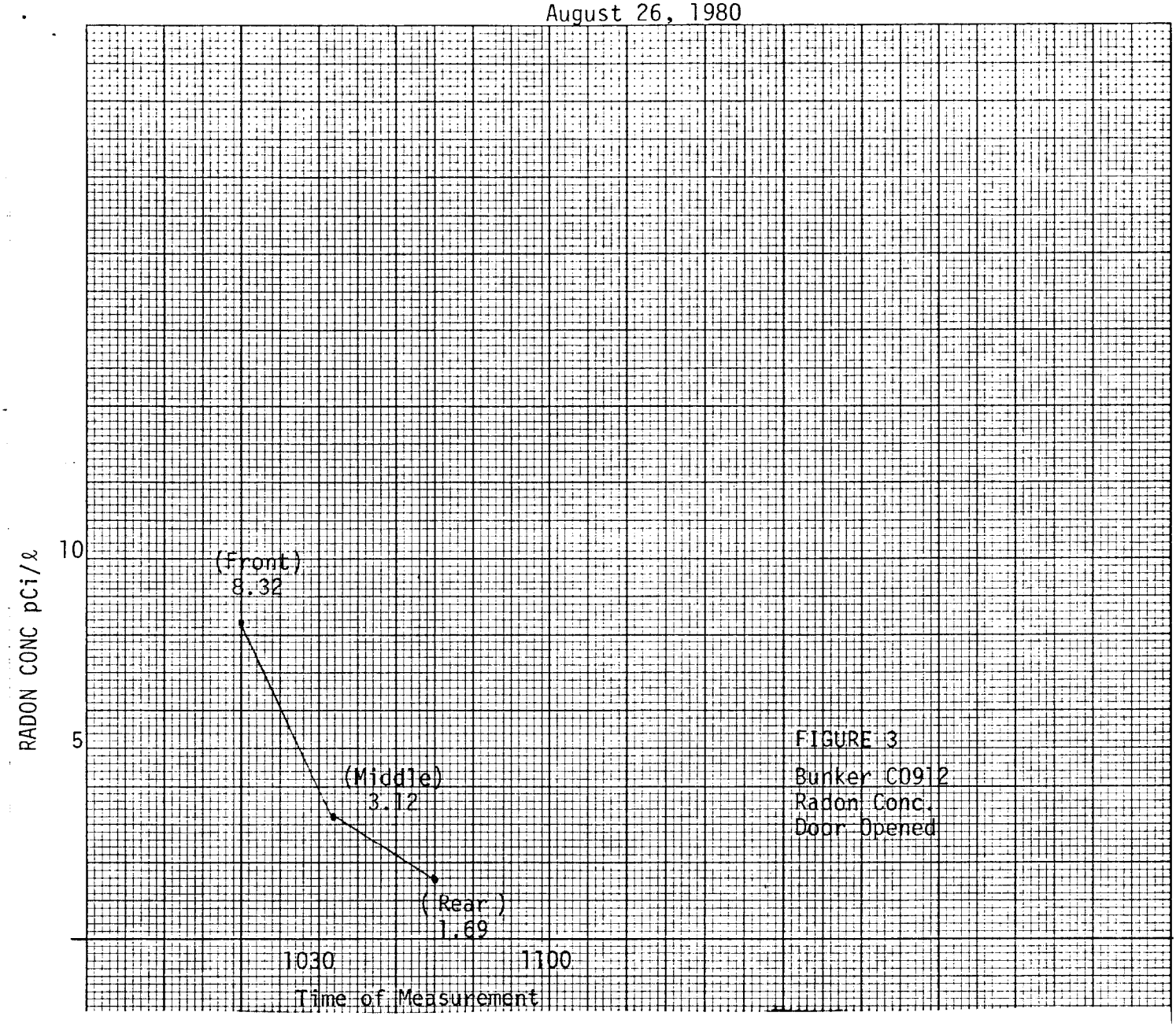


FIGURE 3
Bunker C0912
Radon Conc.
Door Opened

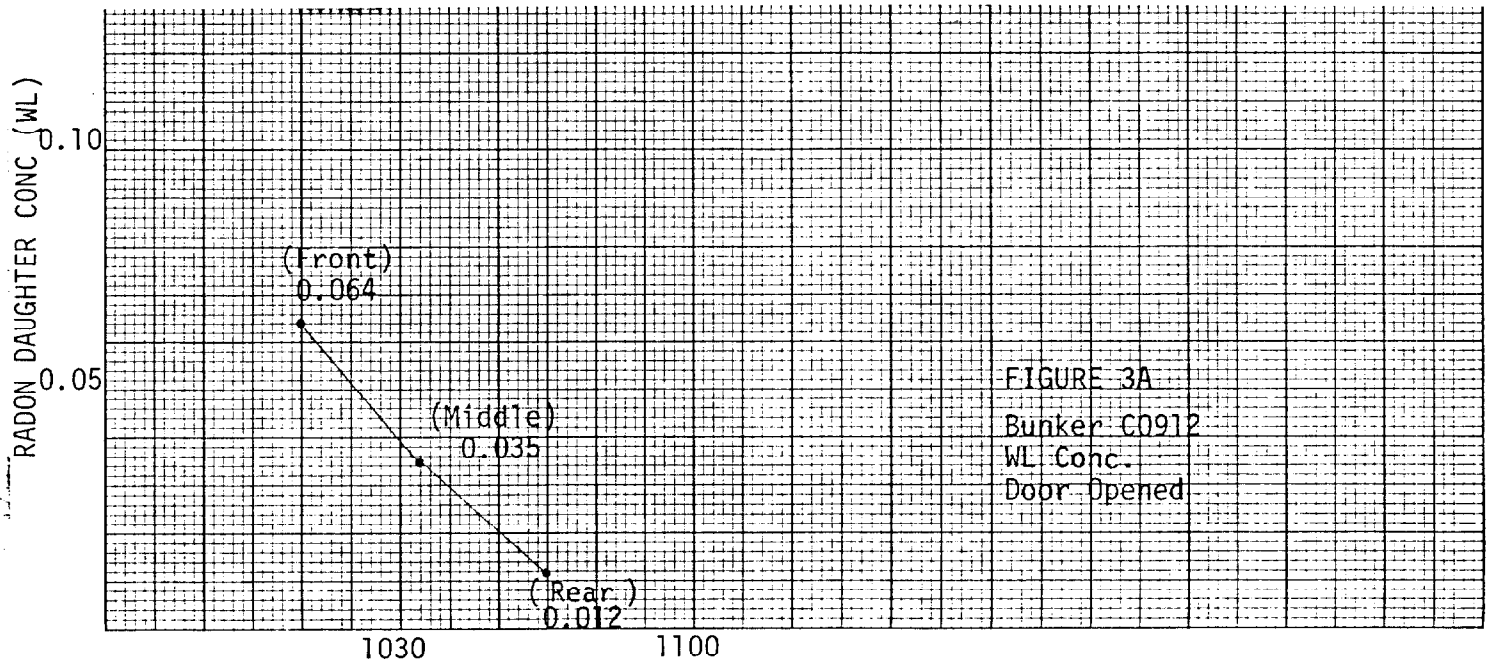


FIGURE 3A
Bunker C0912
WL Conc.
Door Opened

August 27, 1980

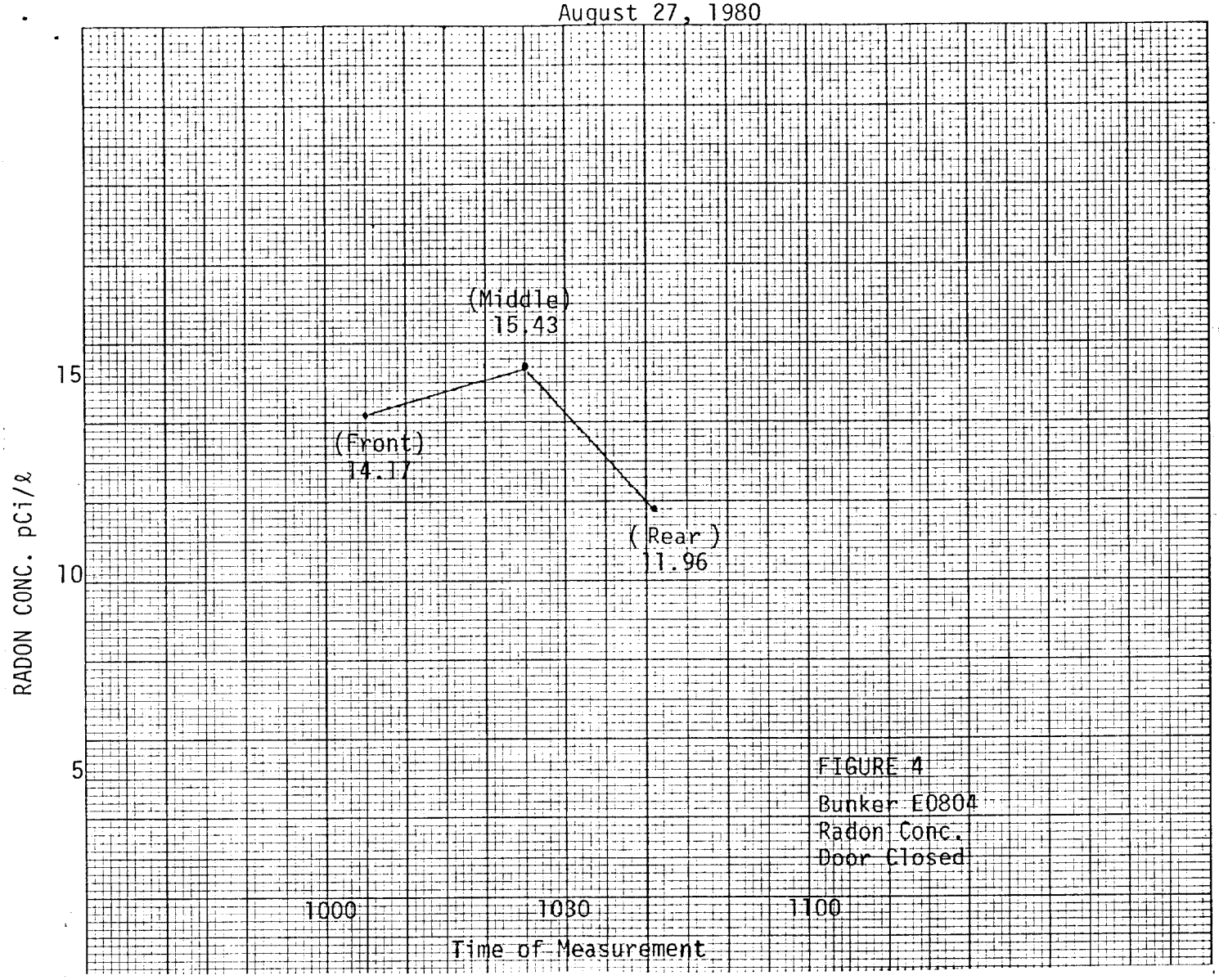


FIGURE 4
Bunker E0804
Radon Conc.
Door Closed

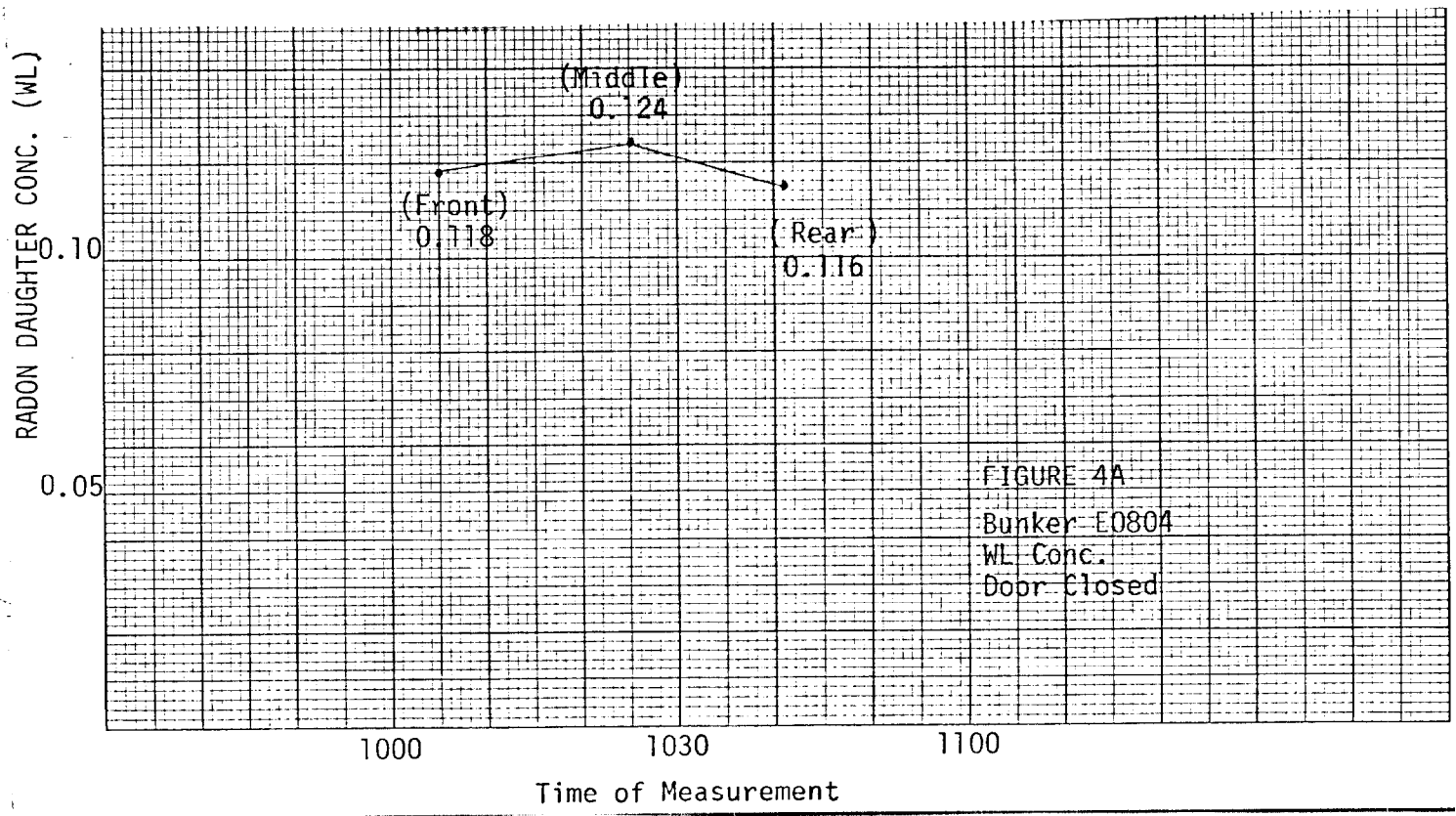


FIGURE 4A
Bunker E0804
WL Conc.
Door Closed

August 29, 1980

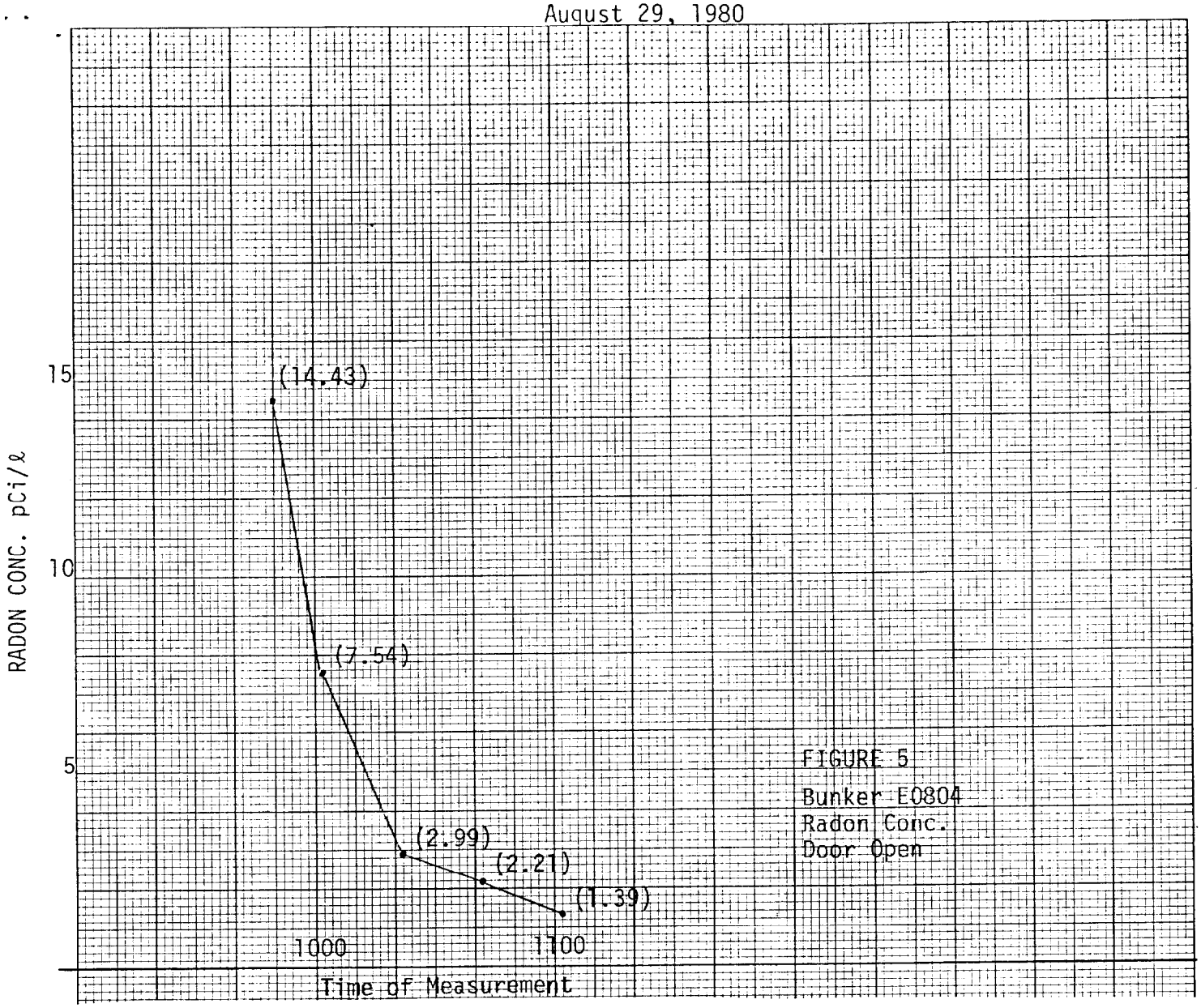


FIGURE 5
Bunker E0804
Radon Conc.
Door Open

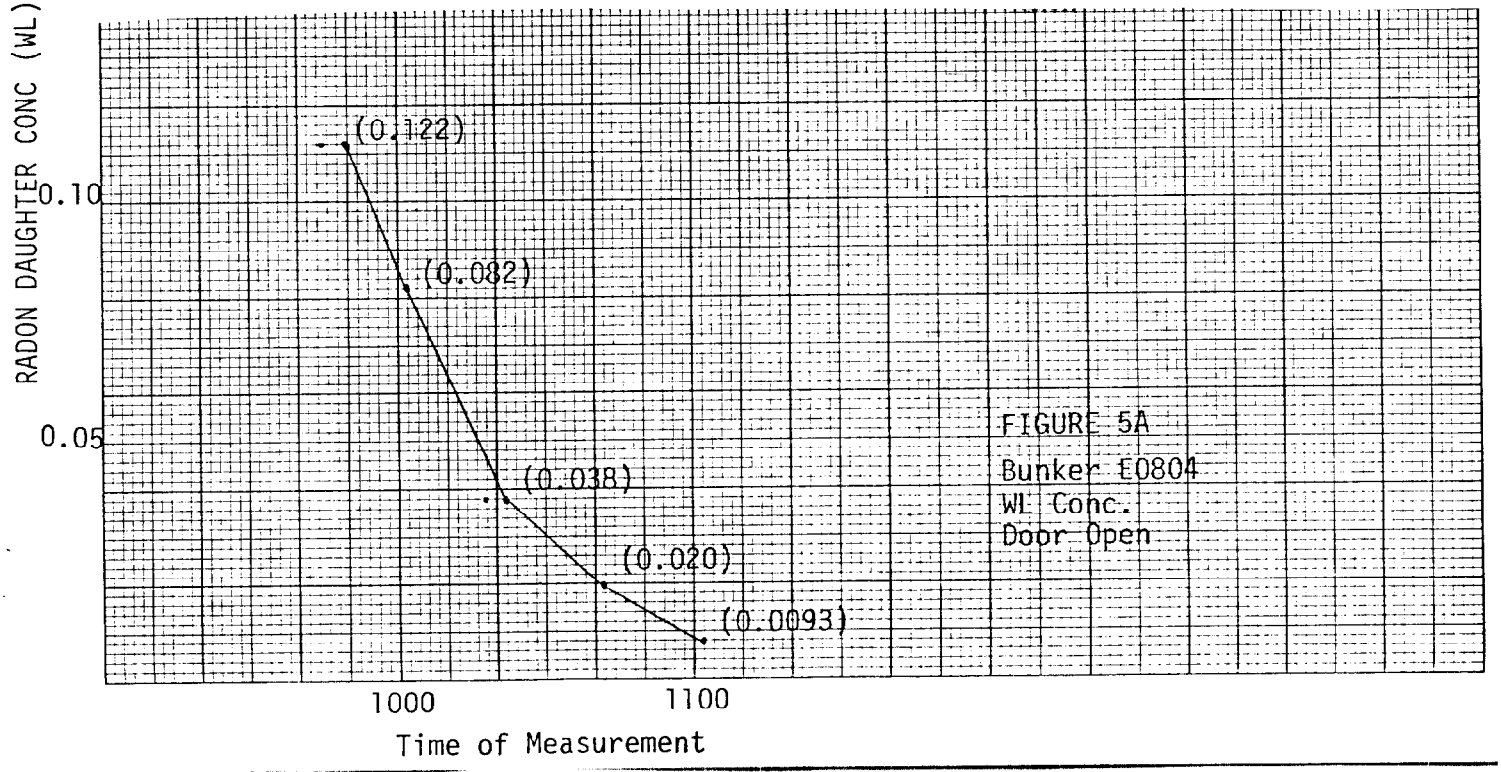


FIGURE 5A
Bunker E0804
WL Conc.
Door Open

August 28, 1980

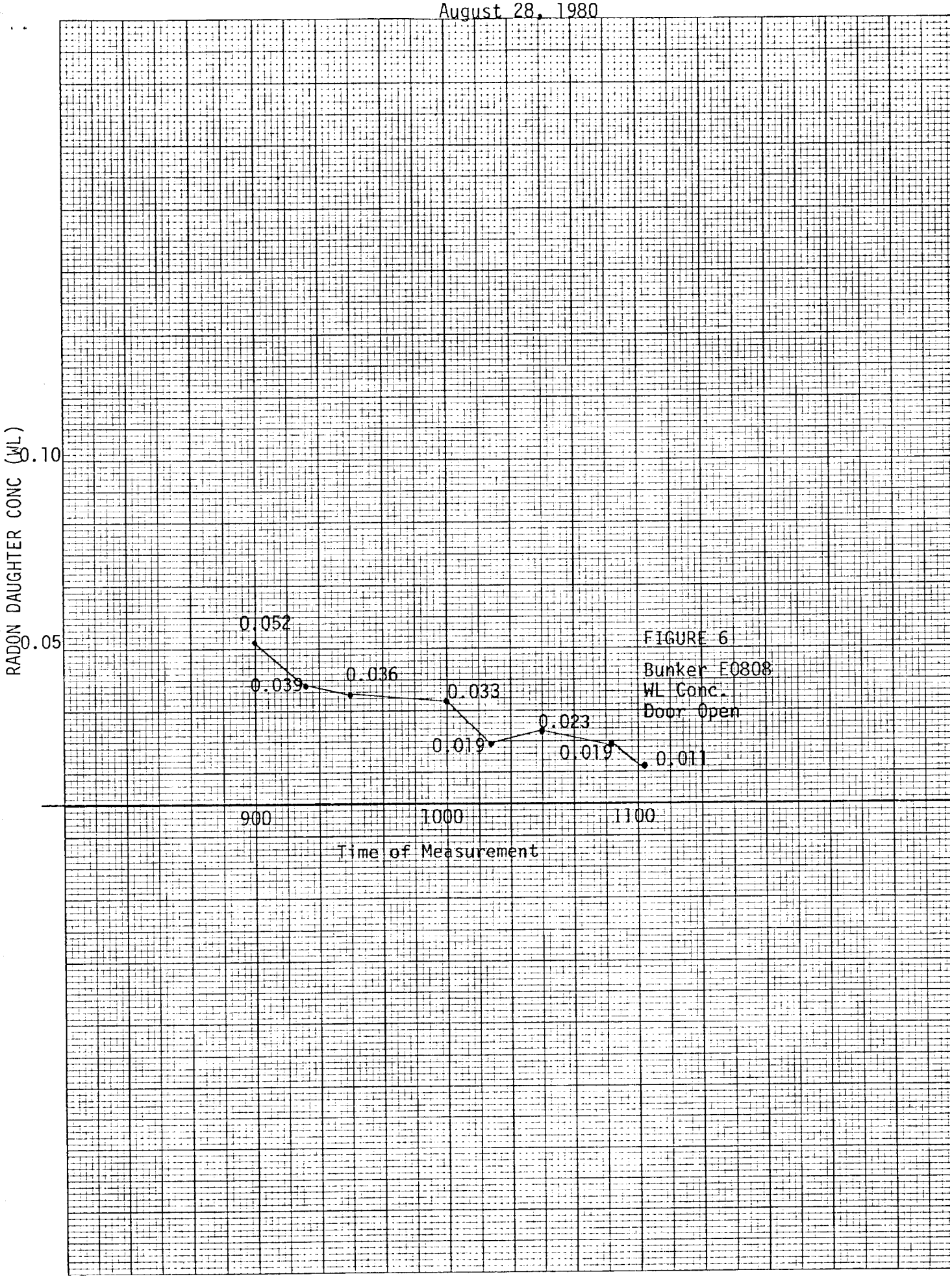


FIGURE 6

Bunker E0808
WL Conc.
Door Open