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JULY 1997

REPORT NO. 94-28-1

ENVIRONMENTAL MONITORING
OF STORED AMMUNITION
IN SOUTH KOREA
(1995-1997)

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Redstone Technical Test Center
ATTN: STERT-TE-M-CL
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IN SOUTH KOREA (1995-1997)

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by Redstone Technical Test Center (RTTC) to monitor environmental conditions of stored ammunition in South Korea. This report contains test results of data obtained from August 1995 - May 1997.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of the instrumentation was to obtain temperature and humidity data for stored ammunition located in South Korea. The data will be used for the purpose of ensuring long-term reliability of ammunition in the field.

D. CONCLUSION. As expected, igloos showed the least temperature fluctuation of the warehousing facilities instrumented. The maximum temperature recorded inside an igloo was 83 degrees Fahrenheit. Above-ground magazines followed the daily temperature pattern, occasionally exceeding the maximum daily ambient temperature. The maximum temperature recorded inside an above-ground magazine was 113 degrees Fahrenheit. One Quonset hut was instrumented during cold weather months only, and it regularly exceeded maximum daily ambient temperatures. It appeared to have the potential to provide the most hostile warehousing environment of the structure types instrumented. Humidity levels in both above-ground magazines and igloos showed less deviation than ambient humidity level with neither warehousing structure type having a clear advantage.

PART 2

AUGUST 1995 - MAY 1997

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PART 3

TEST SETUP

Instrumentation of stored ammunition occurred at two sites within South Korea. Five locations were instrumented at the 17th Ordnance Company, located near Uijongbu from November 1995 - May 1996. Fourteen locations were monitored at Army Depot No. 2 (AD-2), located near Yongchon from February 1996 - May 1997. Ammunition stored in above-ground magazines, igloos, and Quonset huts was monitored. Table 1 (page 3-2) displays the contents of each magazine monitored. Temperature and humidity readings were obtained by ACR data loggers, which were placed with ammunition items. The data loggers recorded readings every 30 minutes. In some instances, external probes were fastened to the inner pack of ammunition items to obtain an item temperature. Approximately every 6 months, the installed data loggers were replaced and shipped back to the U. S. Army Defense Ammunition Center (DAC) for computer downloading and analysis.

TABLE 1

TEST SETUP

LOCATION	STORAGE TYPE	DODIC
17th Ordnance Company	Above-Ground Magazine	A974
17th Ordnance Company	Quonset Hut	N402
17th Ordnance Company	Igloo	D684
17th Ordnance Company	Above-Ground Magazine	N464
17th Ordnance Company	Above-Ground Magazine	D684
Army Depot No. 2	Above-Ground Magazine B-105	A165
Army Depot No. 2	Above-Ground Magazine B-133	B546
Army Depot No. 2	Above-Ground Magazine B-135	B630
Army Depot No. 2	Above-Ground Magazine B-163	N463
Army Depot No. 2	Above-Ground Magazine B-177	B632
Army Depot No. 2	Above-Ground Magazine B-182	C508
Army Depot No. 2	Above-Ground Magazine B-313	C445
Army Depot No. 2	Above-Ground Magazine B-215	N340
Army Depot No. 2	Above-Ground Magazine B-315	N340
Army Depot No. 2	Above-Ground Magazine B-335	B646
Army Depot No. 2	Above-Ground Magazine B-303	N285
Army Depot No. 2	Above-Ground Magazine B-437	D563
Army Depot No. 2	Above-Ground Magazine B-239	D541
Army Depot No. 2	Igloo B-184	C543
Army Depot No. 2	Igloo B-555	C380

Additionally, a weather station was set up at AD-2 to monitor ambient conditions. This weather station was equipped to monitor 13 channels, including ambient temperature and ambient humidity. The weather station was in operation from August 1995 - May 1997. At 6-month intervals, the storage module was replaced and returned to DAC for computer downloading and analysis.

PART 4

TEST RESULTS

Monitoring of stored ammunition at the 17th Ordnance Company occurred from November 1995 - May 1996. Five storage locations were monitored. No weather station was located at this site. Data collected by a weatherstation located at AD-2, approximately 200 miles south-southeast of the 17th Ordnance Company, were used for an ambient baseline. Table 2 below contains monthly peak temperature values for each storage location. Table 3 (page 4-2) contains monthly humidity peaks for each storage location.

TABLE 2

PEAK TEMPERATURES
17TH ORDNANCE COMPANY

	Nov 95	Dec 95	Jan 96	Feb 96	Mar 96	Apr 96
Ambient	68.6	50.4	50.4	42.8	No Data	No Data
Above-Ground Mag (A974)	57.0	40.3	39.5	47.8	58.2	61.4
Quonset Hut (N402)	72.2	59.5	62.7	65.2	85.2	83.2
Igloo (D684)	50.5	42.4	33.7	32.2	35.9	38.8
Above-Ground Mag (N464)	58.2	45.8	43.1	51.1	58.9	62.7
Above-Ground Mag (D684)	52.4	42.4	42.4	No Data	No Data	No Data

All values in degrees Fahrenheit

TABLE 3

PEAK HUMIDITY READINGS
17TH ORDNANCE COMPANY

	Nov 95	Dec 95	Jan 96	Feb 96	Mar 96	Apr 96
Ambient	100	100	100	90	No Data	No Data
Above-Ground Mag (A974)	68	67	71	71	70	60
Quonset Hut (N402)	71	72	74	73	71	67
Igloo (D684)	62	78	60	69	67	64
Above-Ground Mag (N464)	64	65	65	64	63	60
Above-Ground Mag (D684)	72	67	71	No Data	No Data	No Data

All values in percent relative humidity

Due to the limited number of storage locations and the abbreviated time span for cold weather months for monitoring at the 17th Ordnance Company, limited conclusions can be made. The Quonset hut appears to create daily peak temperatures in excess of ambient temperature and considerably greater than above-ground magazines and igloos. For the months monitored, the above-ground magazines regularly showed daily peaks that were less than the daily ambient temperatures, but greater than igloo peak temperatures. The igloo provides a more stable temperature environment, with the maximum and minimum ammunition temperature within a month for the months monitored not varying more than 10 degrees. No type of storage facility appears to have a significant advantage in regard to humidity levels.

Environmental monitoring at AD-2 was performed from February 1996 - May 1997. Fourteen warehousing locations were monitored. DODIC N340 was moved from above-ground magazine B-315 to above-ground magazine B-215 on 14 January 1997. Table 4 (page 4-3) contains the monthly temperature peaks for each storage location.

TABLE 4

PEAK TEMPERATURES

AD-2

	Feb 1996	Mar 1996	Apr 1996	May 1996	Jun 1996	Jul 1996	Aug 1996	Sep 1996	Oct 1996	Nov 1996	Dec 1996	Jan 1997	Feb 1997	Mar 1997	Apr 1997	May 1997
Ambient	43	N/A	N/A	87	91	97	100	85	N/A	59	59	55	65	69	84	88
Igloo B-555	40	46	76	73	68	80	83	74	70	59	42	42	43	48	60	63
External Probe	40	47	N/A	N/A	69	79	82	74	70	59	42	40	42	47	59	62
Igloo B-184	42	47	75	N/A	N/A	N/A	N/A	N/A	N/A	56	43	41	42	48	58	N/A
External Probe	67	69	66	N/A	N/A	N/A	N/A	N/A	N/A	53	41	40	40	46	56	N/A
Mag B-105	52	57	77	80	85	94	94	83	74	61	47	42	52	58	72	83
Mag B-133	61	63	85	91	96	105	105	91	83	67	52	47	60	68	82	98
Mag B-135	54	59	83	79	84	93	93	81	73	64	46	42	53	61	75	97
Mag B-163	46	53	71	77	83	91	91	79	73	61	44	41	50	54	72	96
Mag B-177	56	56	82	81	86	95	94	81	72	68	45	40	51	57	72	95
Mag B-182	49	55	77	79	84	93	93	81	75	62	N/A	N/A	N/A	N/A	N/A	N/A
Mag B-215	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	42	46	51	67	83
Mag B-315	50	54	80	93	99	108	108	94	85	69	46	42	N/A	N/A	N/A	N/A
Mag B-313	54	56	83	77	84	83	93	81	75	65	N/A	N/A	N/A	N/A	N/A	N/A
Mag B-335	46	53	76	77	84	82	113	105	73	66	52	44	58	65	80	86
Mag B-239	42	49	76	74	76	84	84	72	67	56	39	35	44	49	63	101
Mag B-303	51	54	77	78	85	93	93	81	73	61	N/A	N/A	N/A	N/A	N/A	N/A
External Probe	42	49	89	89	75	84	84	72	67	57	39	35	43	48	62	98
Mag B-437	47	52	77	N/A	N/A	N/A	N/A	N/A	N/A	52	42	38	48	54	69	84
External Probe	44	50	89	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All value in degrees Fahrenheit

Peak igloo temperatures were generally lower than both ambient and above-ground magazine peak temperatures. Igloos appear to be particularly effective during the summer months. Above-ground magazines had peak temperatures nearer to ambient.

Table 5 (page 4-4) contains monthly percentages of the readings in excess of 70 degrees, 80 degrees, and 90 degrees, respectively.

TABLE 5

TEMPERATURE DISTRIBUTION

AD-2

DATES	AMBIENT			ABOVE-GROUND MAGS			IGLOOS		
	70	80	90	70	80	90	70	80	90
Feb 96	0	0	0	0	0	0	0	0	0
Mar 96	N/A	N/A	N/A	0	0	0	0	0	0
Apr 96	N/A	N/A	N/A	2.2	0.2	0	0	0	0
May 96	23.2	4.6	0	15.2	1.3	0.1	0	0	0
Jun 96	37.0	9.6	0.3	46.4	5.6	0.7	8.4	0	0
Jul 96	62.8	30.8	8.9	69.8	37.2	6.0	53.0	5.4	0
Aug 96	76.2	31.0	9.8	95.5	51.4	6.6	97.9	8.2	0
Sep 96	31.9	7.3	0	49.6	4.9	0.3	34.8	0	0
Oct 96	N/A	N/A	N/A	45.4	4.8	0.2	49.4	0.1	0
Nov 96	0	0	0	1.0	0	0	0	0	0
Dec 96	0	0	0	0	0	0	0	0	0
Jan 97	0	0	0	0	0	0	0	0	0
Feb 97	1.4	0	0	0	0	0	0	0	0
Mar 97	5.2	0	0	1.0	0	0	0	0	0
Apr 97	29.6	6.9	0.4	20.6	2.9	0.1	1.0	0	0

All values in percent of readings

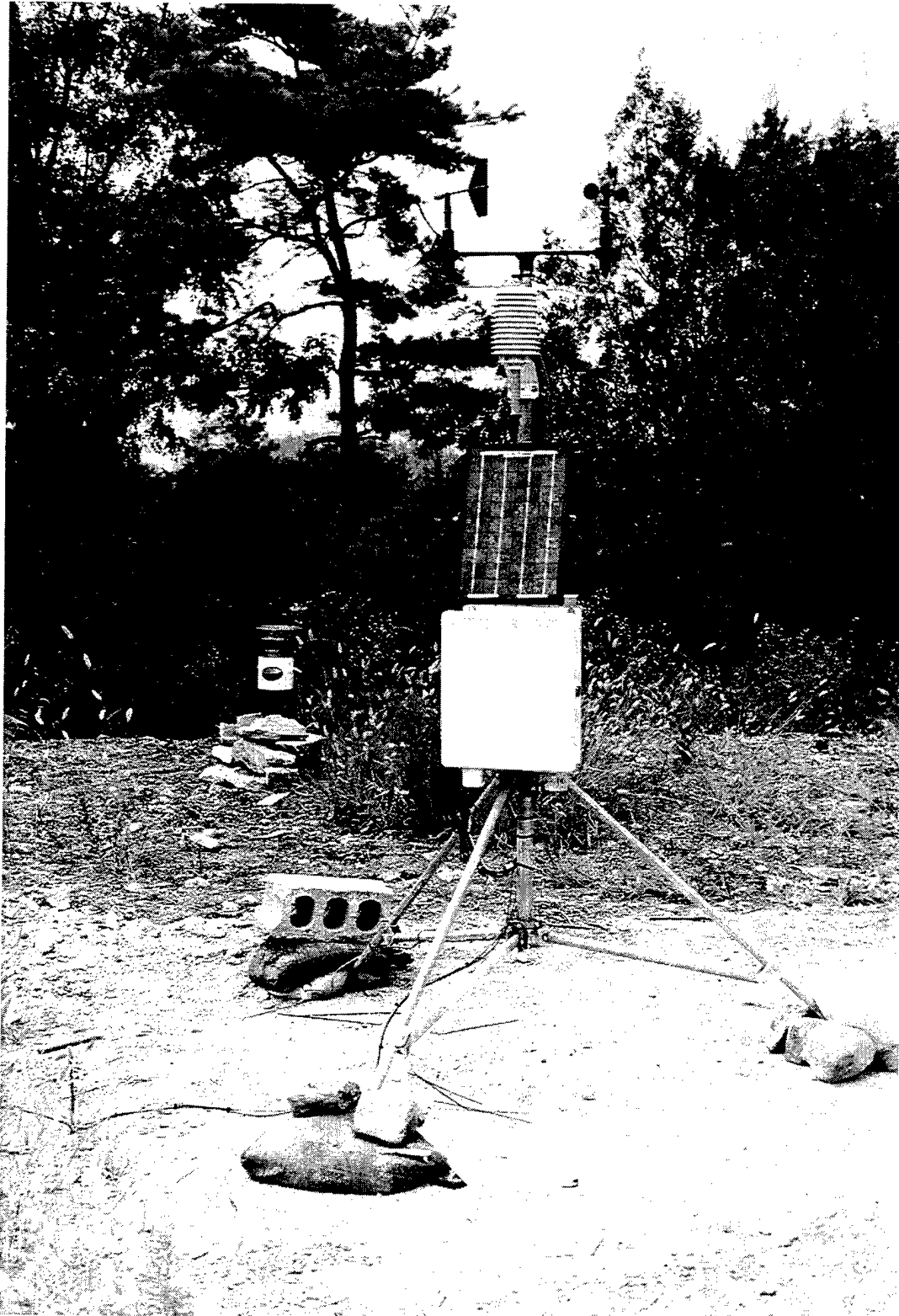
Above-ground magazines consistently show higher percentages of temperature readings in excess of 80 and 90 degrees than temperature readings in igloos. Above-ground magazines follow ambient temperatures more closely with larger daily differences in temperature extremes. Igloos show less deviation in temperature, as igloo temperatures never exceeded 90 degrees during the test period.

Monthly histograms of humidity distribution can be found in part 7 of this report. Humidity levels inside above-ground magazines were generally between 40 and 90 percent. The ambient humidity generally ranged from 20 to 100 percent. Humidity levels in igloos generally ranged from 50 to 80 percent prior to November 1996. Occurrences of 100 percent humidity existed in both above-ground magazines and igloos, but with far less frequency than occurred as ambient.

After November 1996, humidity levels in igloos generally ranged from 10 to 30 percent. The lower humidity readings coincide with a data logger swap out at each igloo. Above-ground magazine B-335 experienced similar drop in its humidity levels. The humidity sensors of the data loggers producing these lower temperatures may not have been operating properly.

PART 5

PHOTOGRAPHS



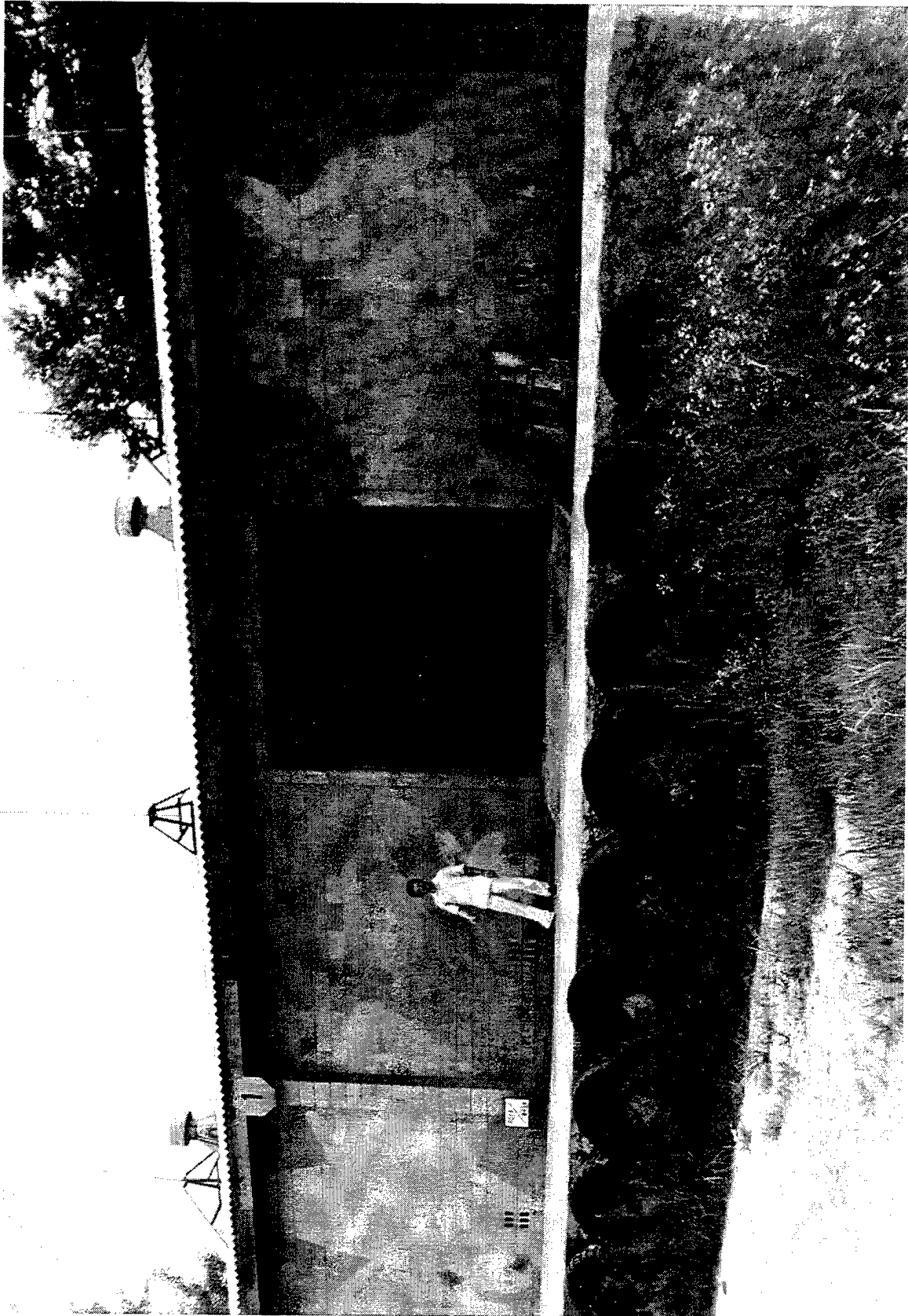
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PHOTO NO. AO317-SCN-95-31-2676. This photo shows the weather station setup located at AD-2.		
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PHOTO NO. AO317-SCN-95-31-2693. This photo shows a typical igloo.



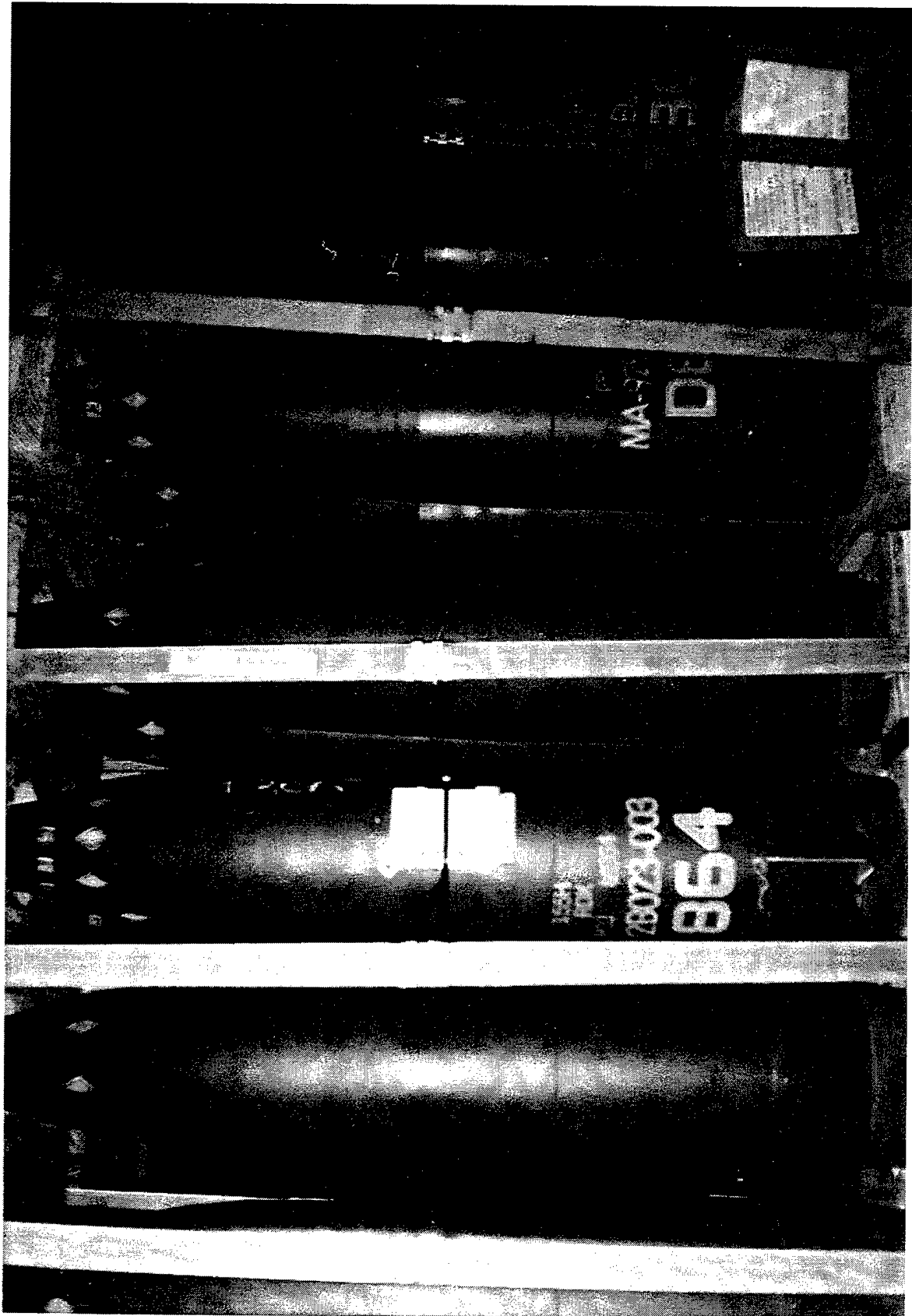
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PHOTO NO. AO317-SCN-95-31-2630. This photo shows a typical above-ground magazine located at AD-2.



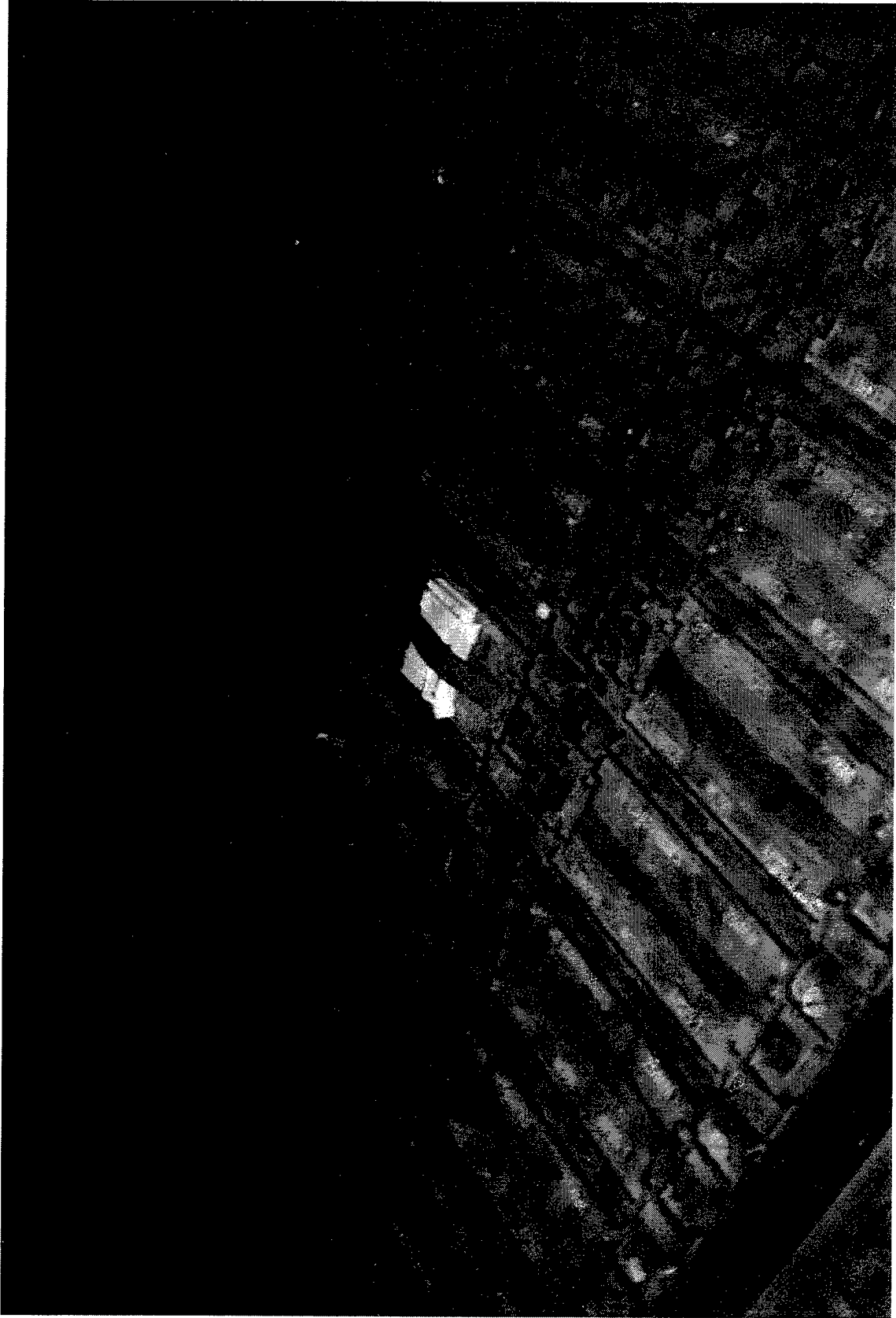
U.S. ARMY DEFENSE AMMUNITION CENTER

PHOTO NO. AO317-SCN-95-31-2711. This photo shows a typical Quonset hut.



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PHOTO NO. AO317-SCN-95-31-2639. This photo shows an installed ACR data logger on DODIC D864.

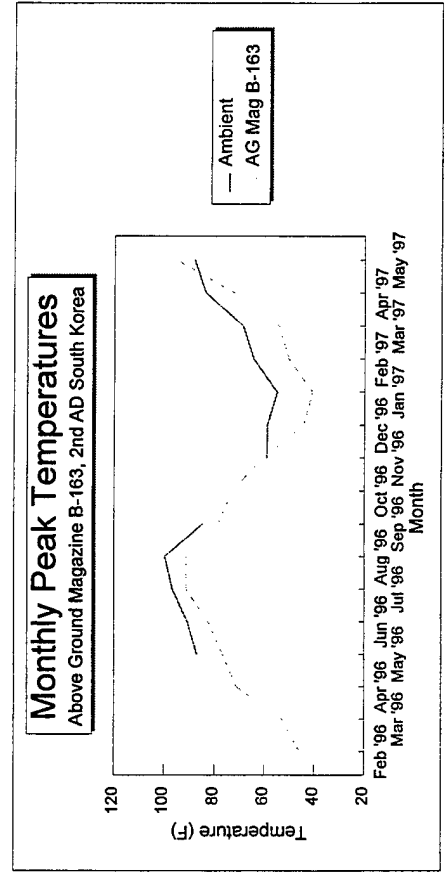
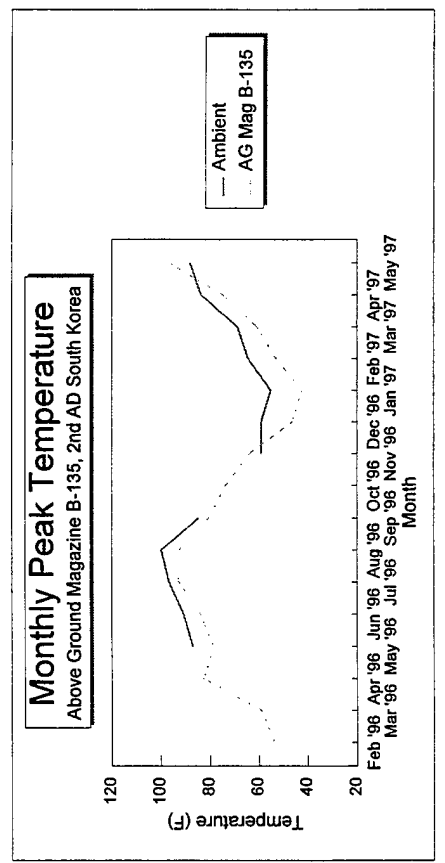
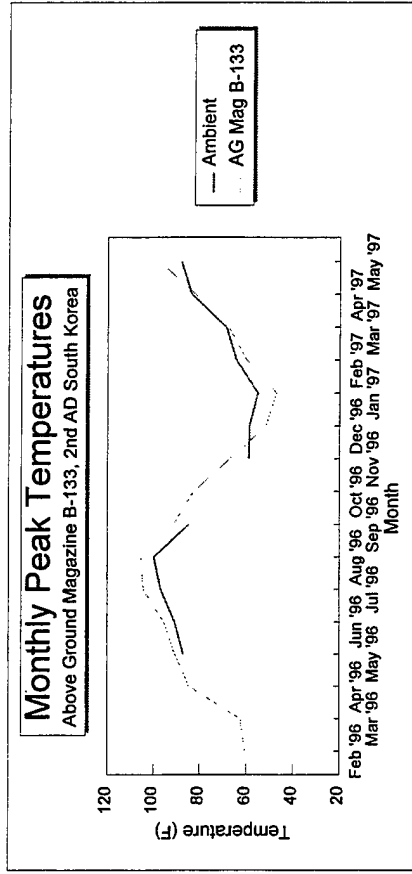
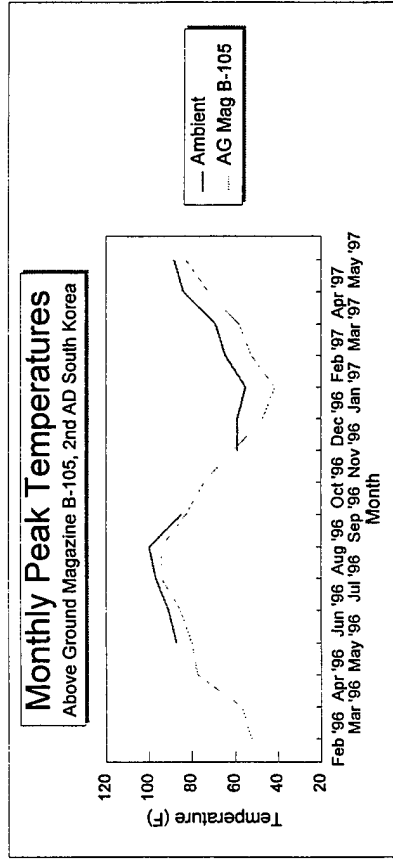
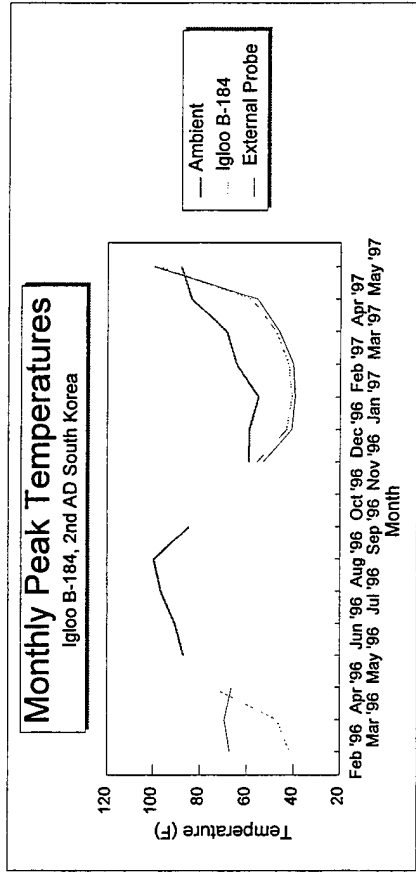
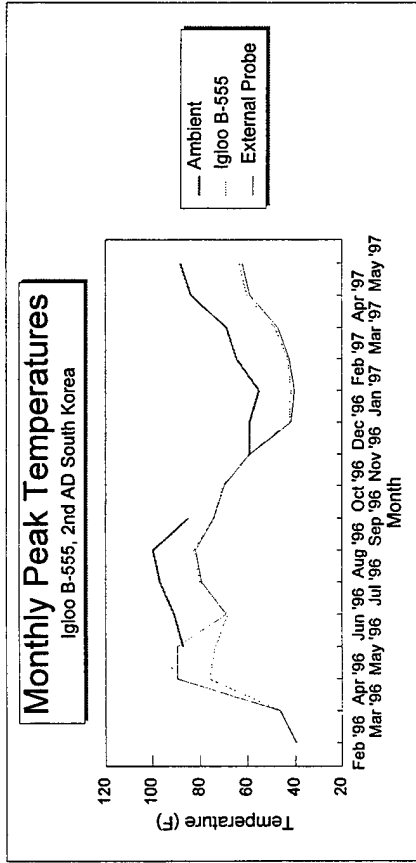


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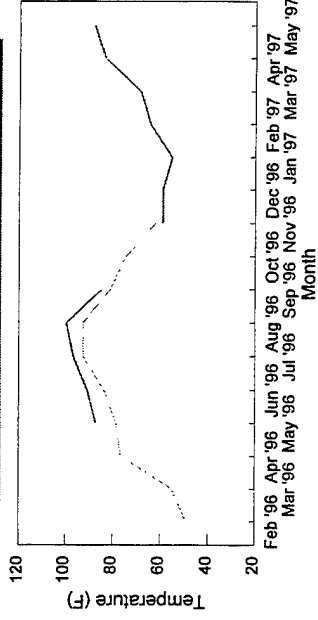
PHOTO NO. AO317-SCN-95-31-2632. This photo shows an ACR data logger installed on top of a pallet of DODIC A974. The pallet is stored in an above-ground magazine.

PART 6

GRAPHS

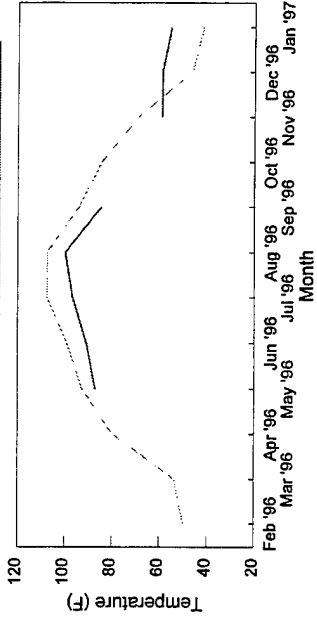


Monthly Peak Temperatures
Above Ground Magazine B-182, 2nd AD South Korea



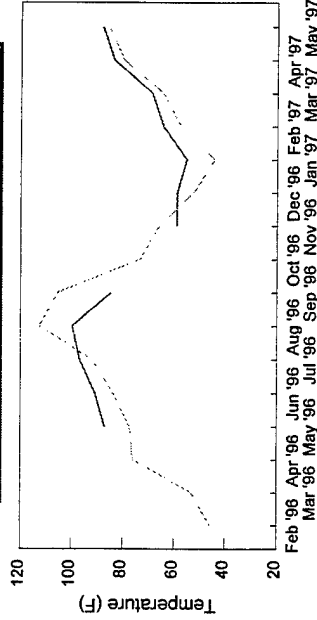
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Monthly Peak Temperatures
Above Ground Magazine B-315, 2nd AD South Korea



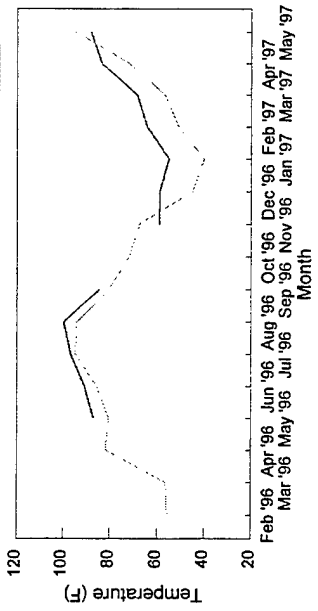
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- - - AG Mag B-315

Monthly Peak Temperatures
Above Ground Magazine B-335, 2nd AD South Korea



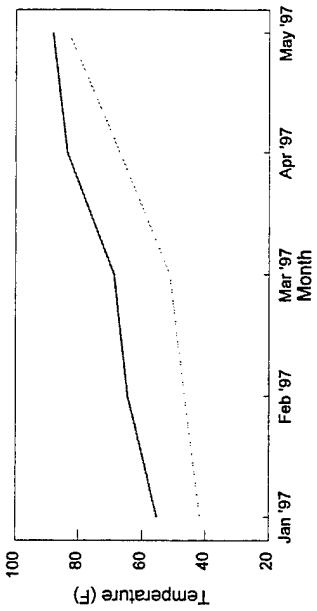
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Monthly Peak Temperatures
Above Ground Magazine B-177, 2nd AD South Korea



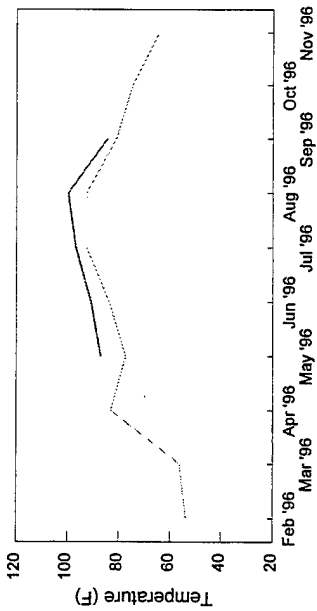
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Monthly Peak Temperatures
Above Ground Magazine B-215, 2nd AD South Korea



— Ambient
- - - AG Mag B-215

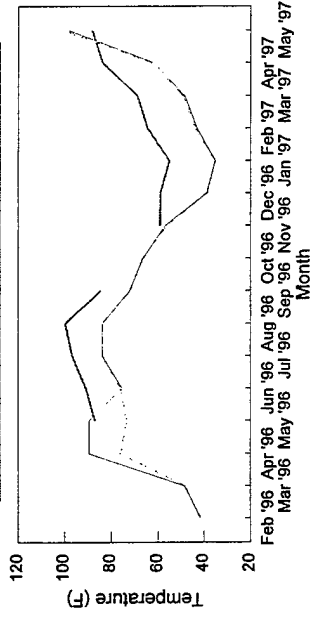
Monthly Peak Temperatures
Above Ground Magazine B-313, 2nd AD South Korea



— Ambient
- - - AG Mag B-313

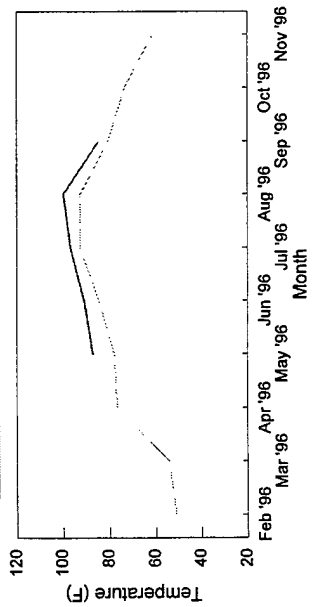
Monthly Peak Temperatures

Above Ground Magazine B-239, 2nd AD South Korea



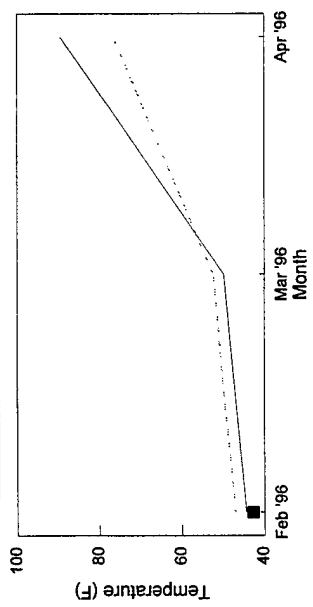
Monthly Peak Temperatures

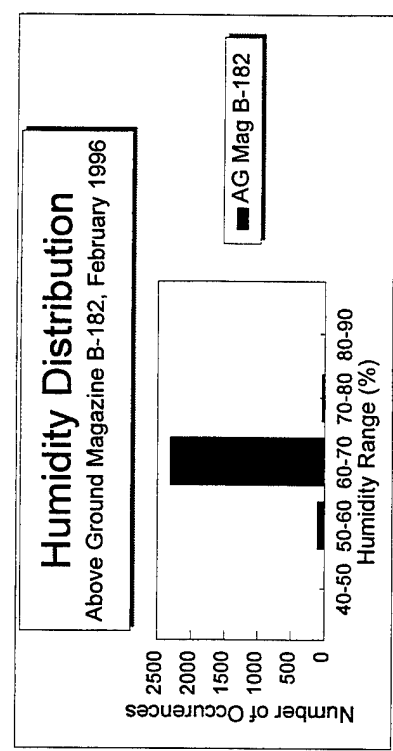
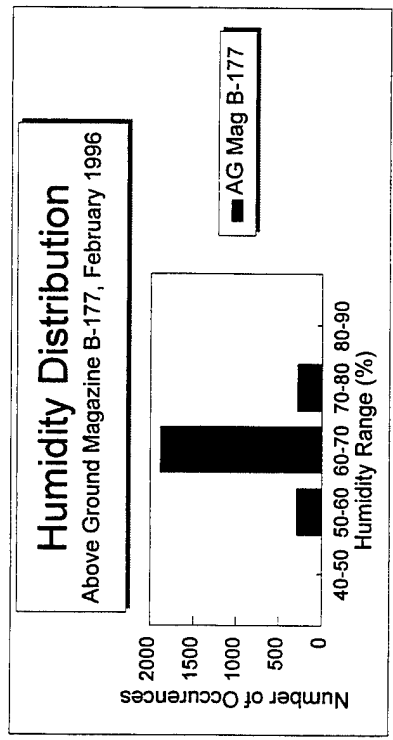
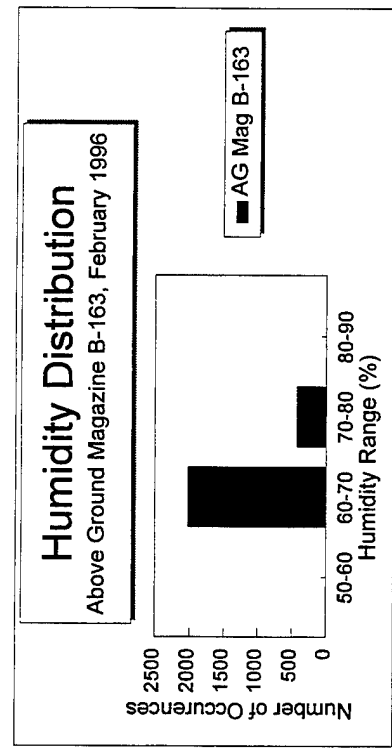
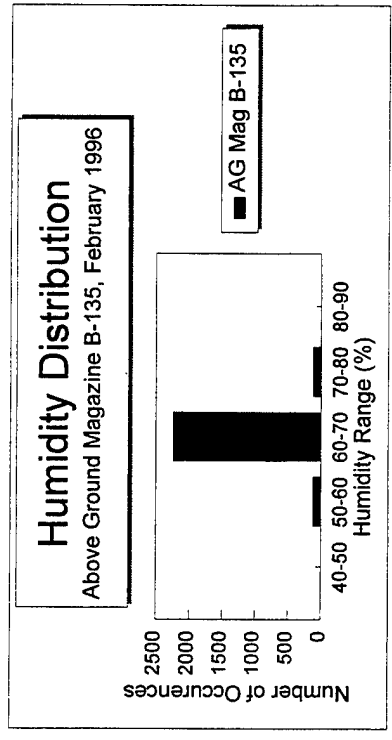
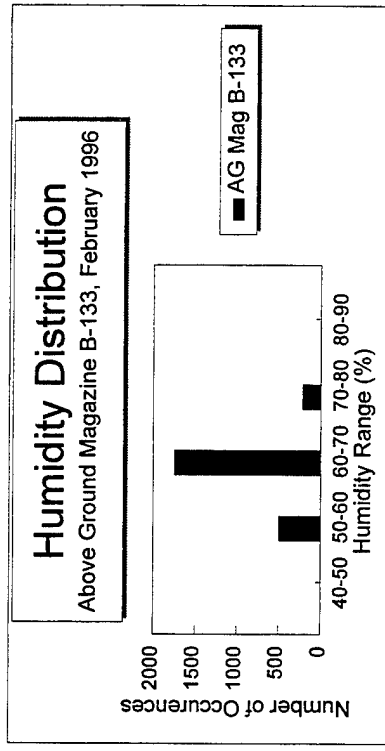
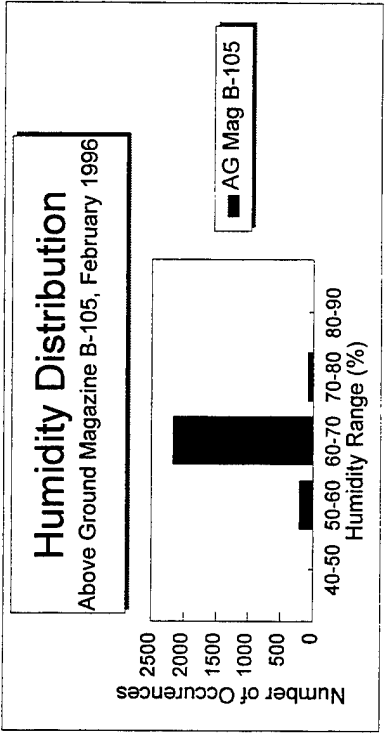
Above Ground Magazine B-303, 2nd AD South Korea



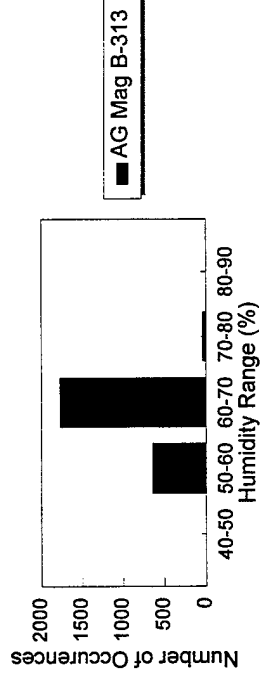
Monthly Peak Temperatures

Above Ground Magazine B-437, 2nd AD South Korea

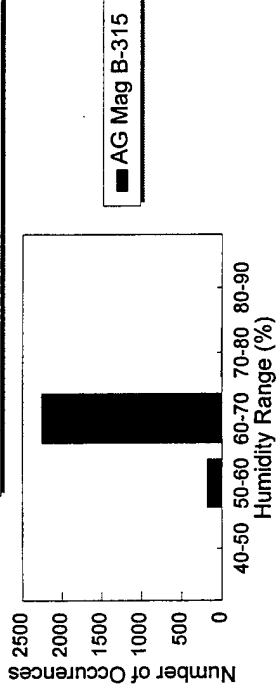




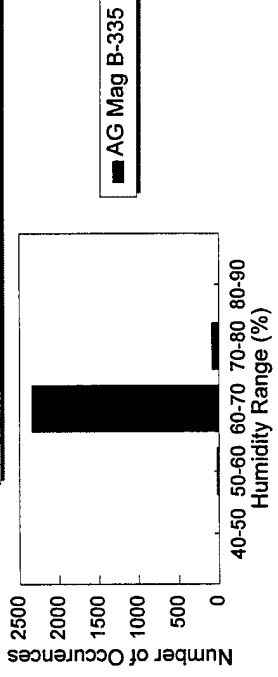
Humidity Distribution
Above Ground Magazine B-313, February 1996



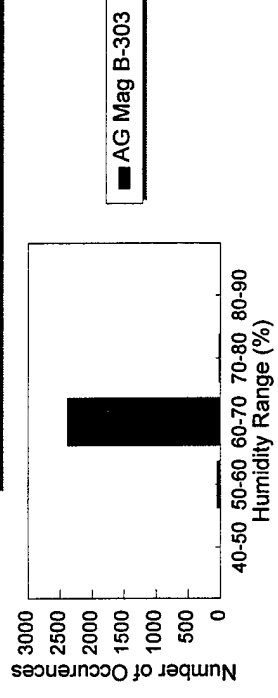
Humidity Distribution
Above Ground Magazine B-315, February 1996



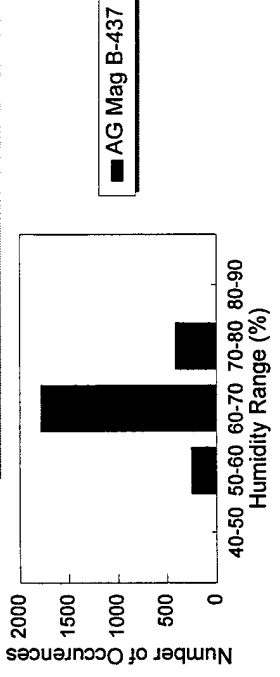
Humidity Distribution
Above Ground Magazine B-335, February 1996



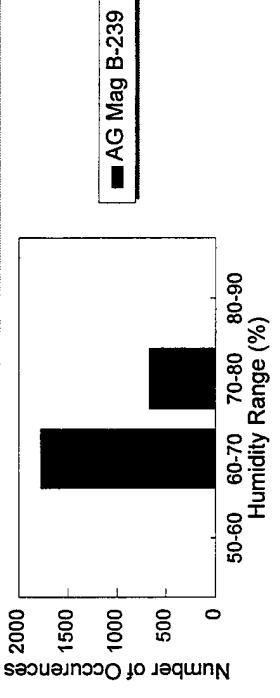
Humidity Distribution
Above Ground Magazine B-303, February 1996



Humidity Distribution
Above Ground Magazine B-437, February 1996

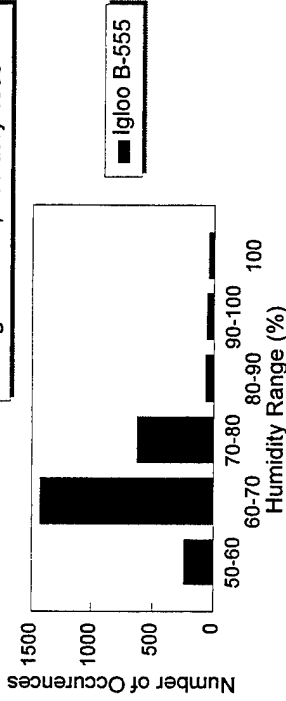


Humidity Distribution
Above Ground Magazine B-239, February 1996



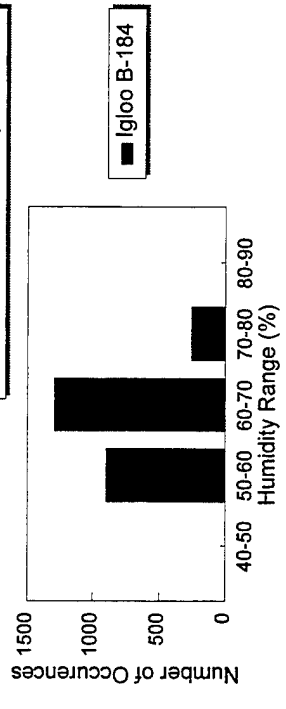
Humidity Distribution

Igloo B-555, February 1996



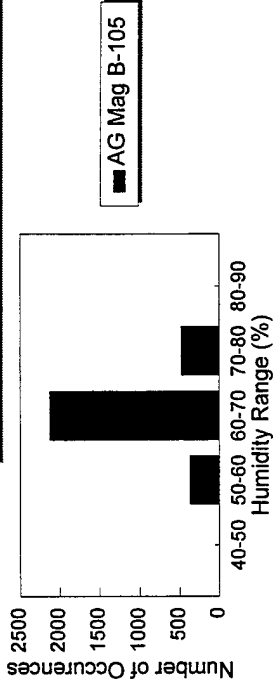
Humidity Distribution

Igloo B-184, February 1996



Humidity Distribution

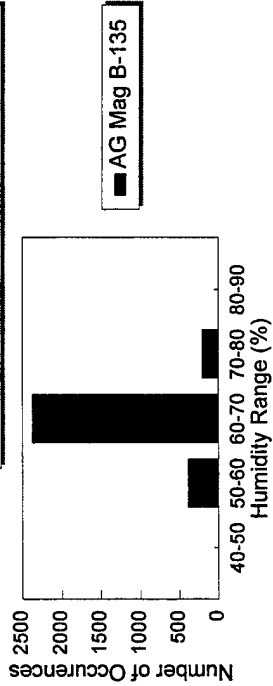
Above Ground Magazine B-105, March 1996



AG Mag B-105

Humidity Distribution

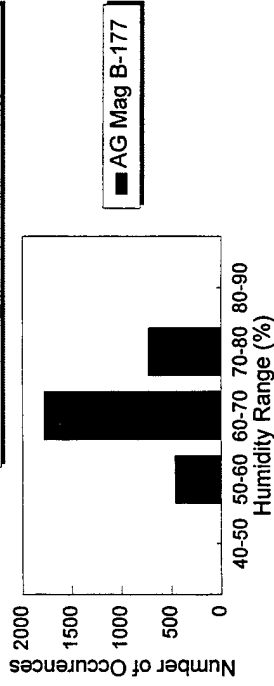
Above Ground Magazine B-135, March 1996



AG Mag B-135

Humidity Distribution

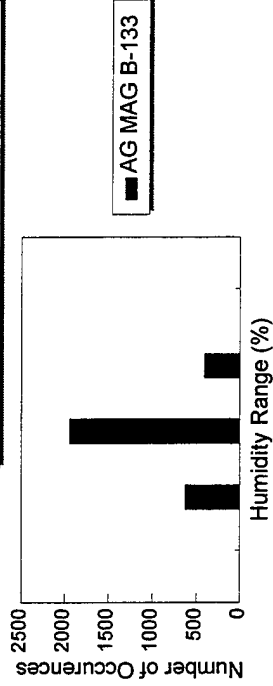
Above Ground Magazine B-177, March 1996



AG Mag B-177

Humidity Distribution

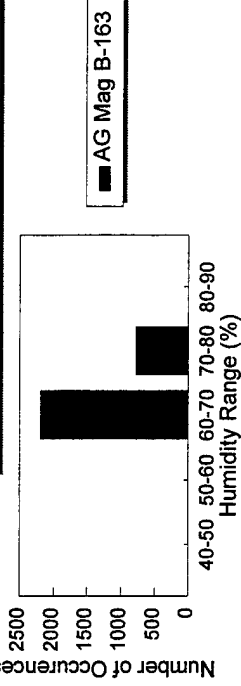
Above Ground Magazine B-133, March 1996



AG MAG B-133

Humidity Distribution

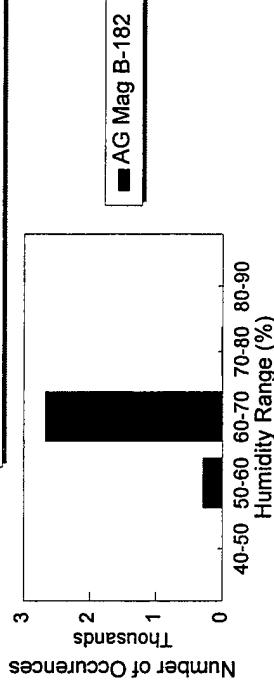
Above Ground Magazine B-1637, March 1996



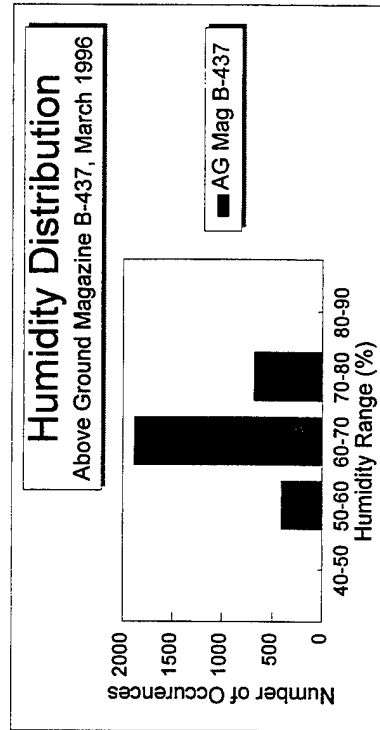
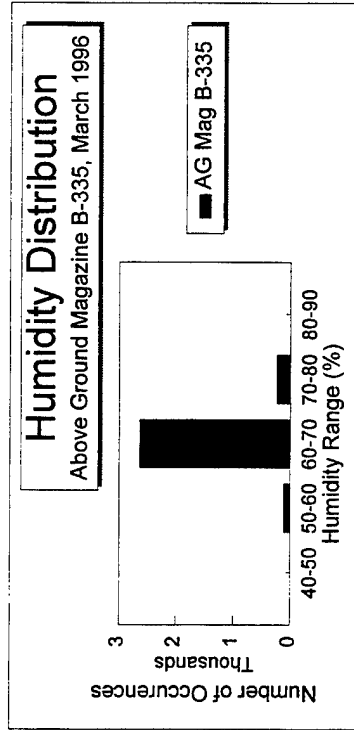
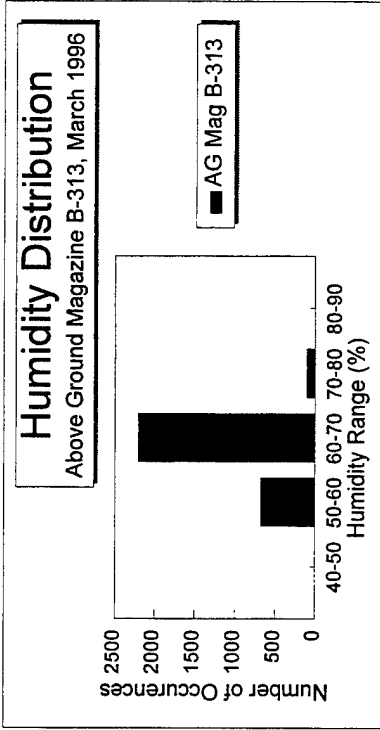
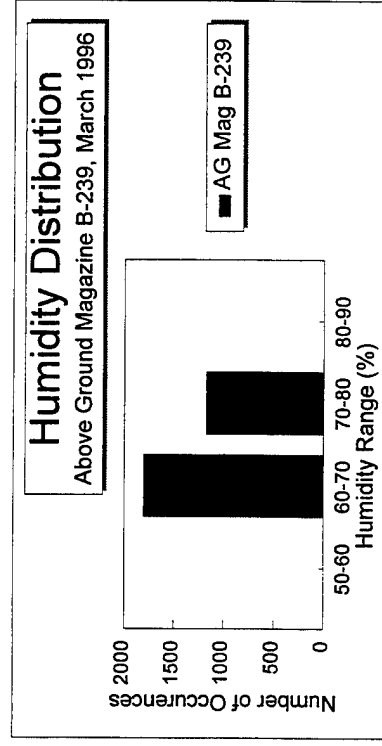
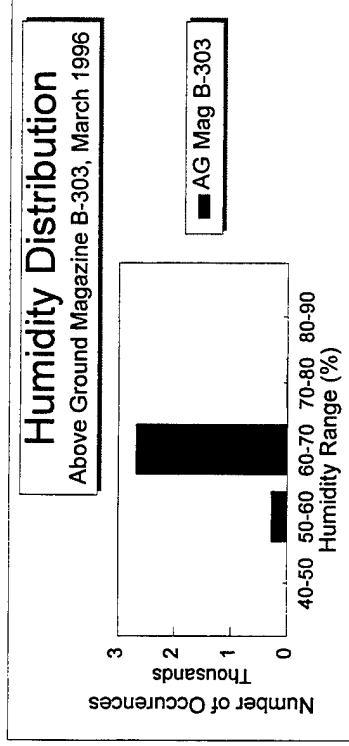
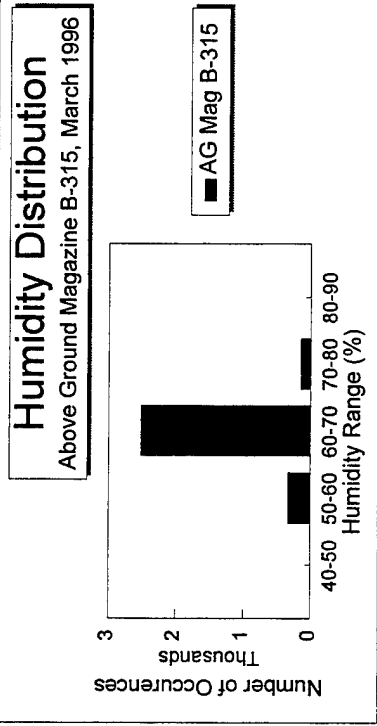
AG Mag B-163

Humidity Distribution

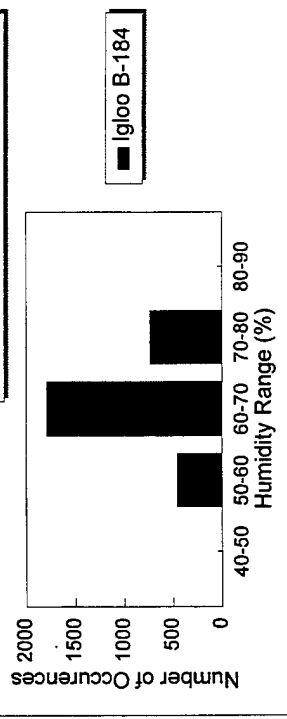
Above Ground Magazine B-182, March 1996



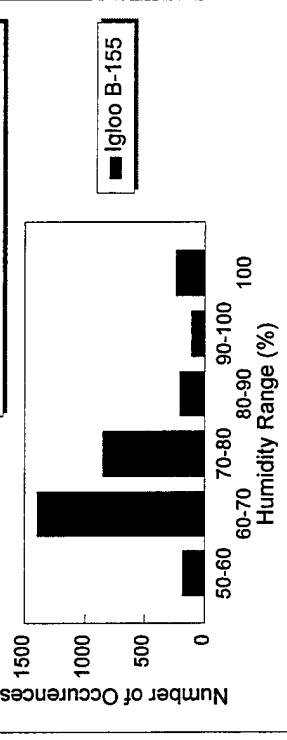
AG Mag B-182

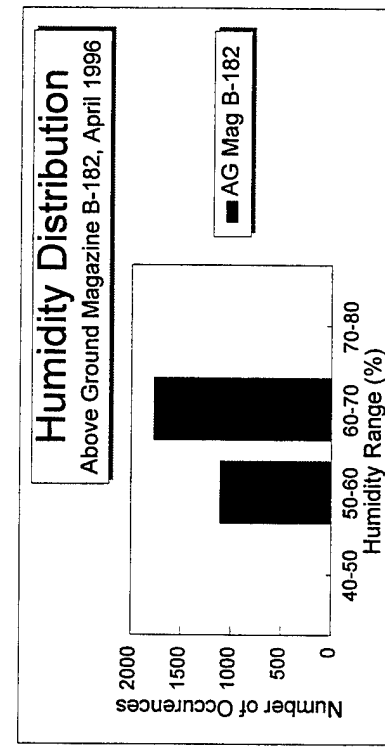
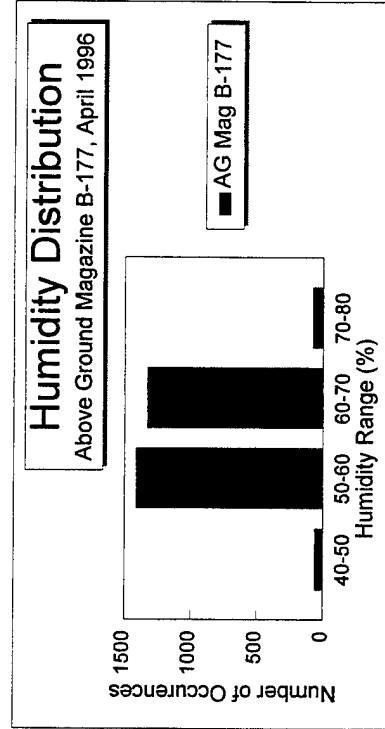
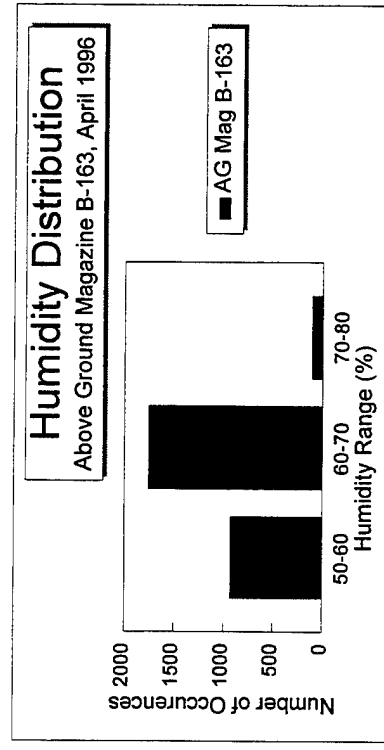
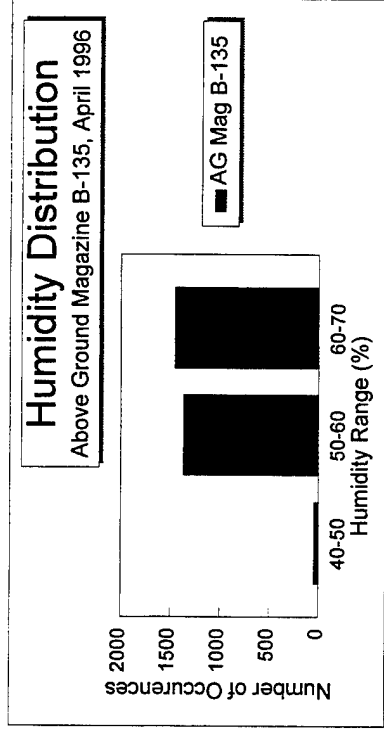
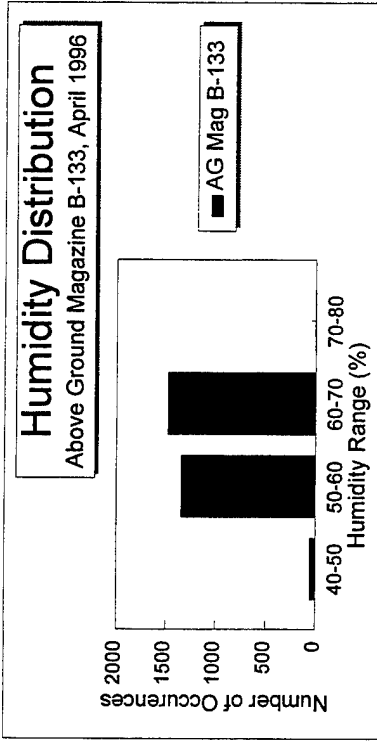
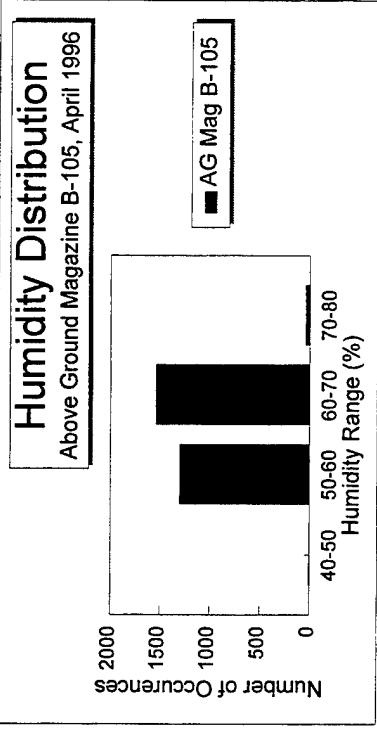


Humidity Distribution Igloo B-184, March 1996



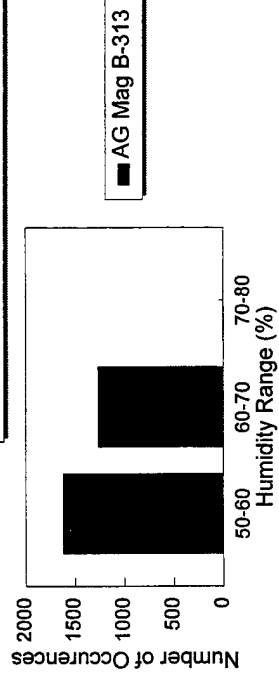
Humidity Distribution Igloo B-555, March 1996





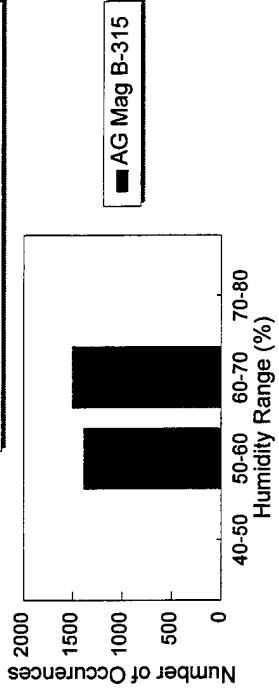
Humidity Distribution

Above Ground Magazine B-313, April 1996



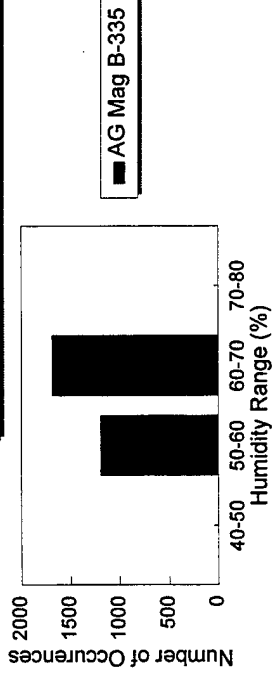
Humidity Distribution

Above Ground Magazine B-315, April 1996



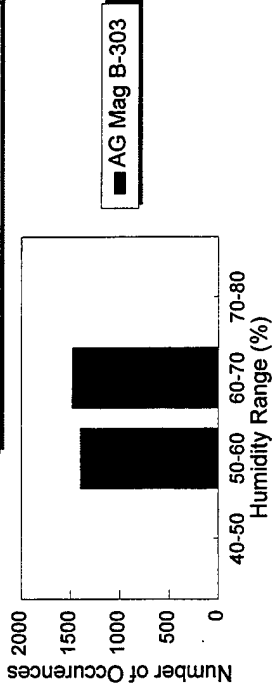
Humidity Distribution

Above Ground Magazine B-335, April 1996



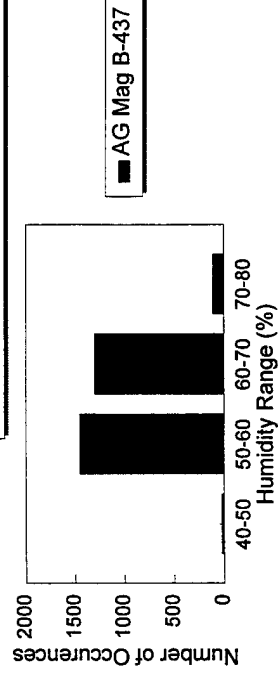
Humidity Distribution

Above Ground Magazine B-303, April 1996



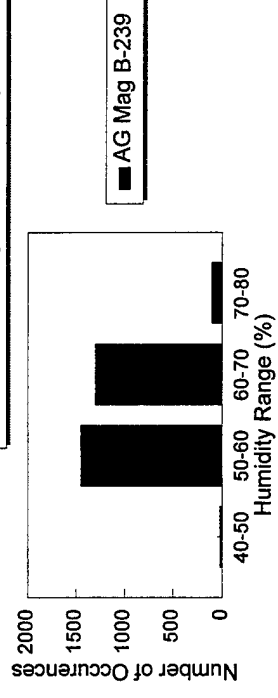
Humidity Distribution

Above Ground Magazine B-437, April 1996



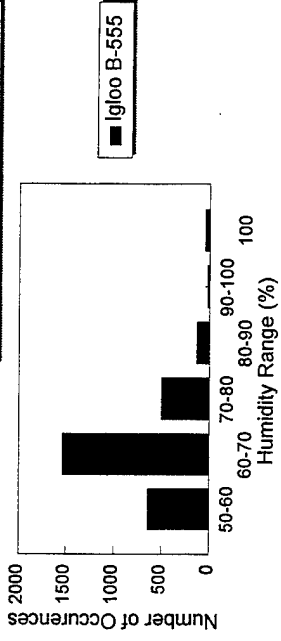
Humidity Distribution

Above Ground Magazine B-239, April 1996



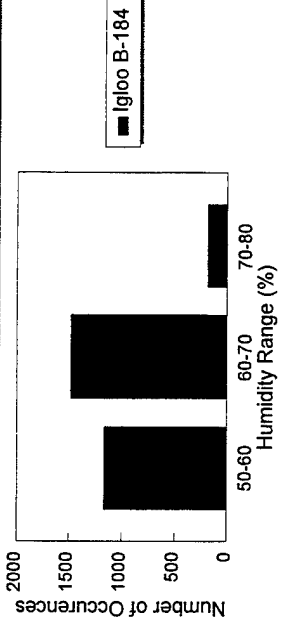
Humidity Distribution

Igloo B-555, April 1996



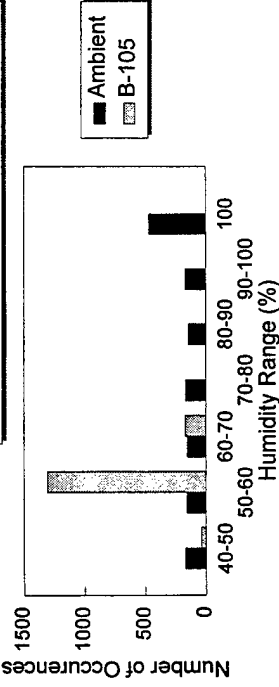
Humidity Distribution

Igloo B-184, April 1996



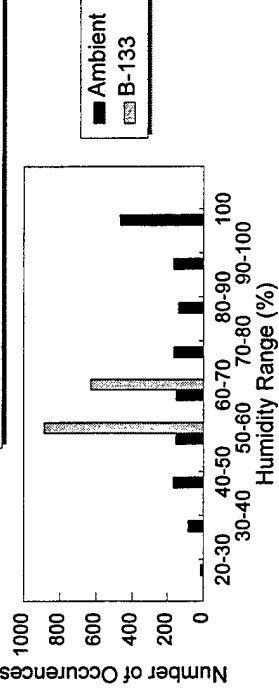
Humidity Distribution

Above Ground Magazine B-105, May 1996



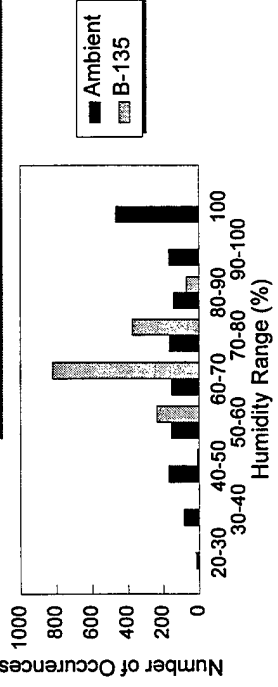
Humidity Distribution

Above Ground Magazine B-133, May 1996



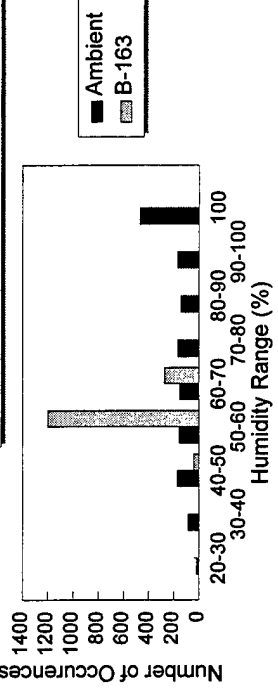
Humidity Distribution

Above Ground Magazine B-135, May 1996



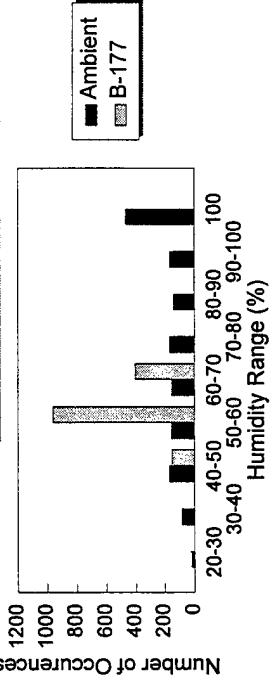
Humidity Distribution

Above Ground Magazine B-163, May 1996



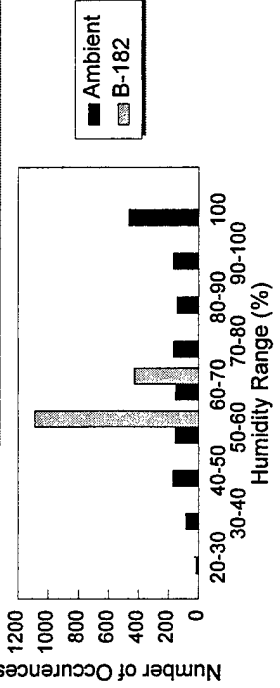
Humidity Distribution

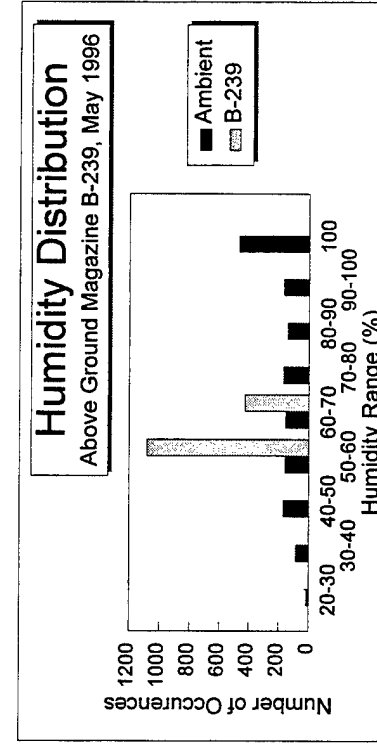
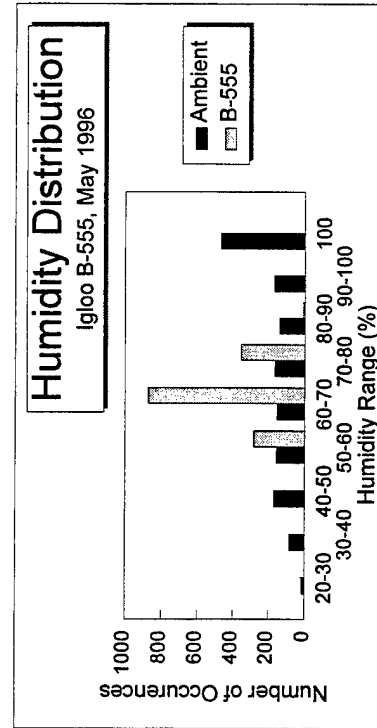
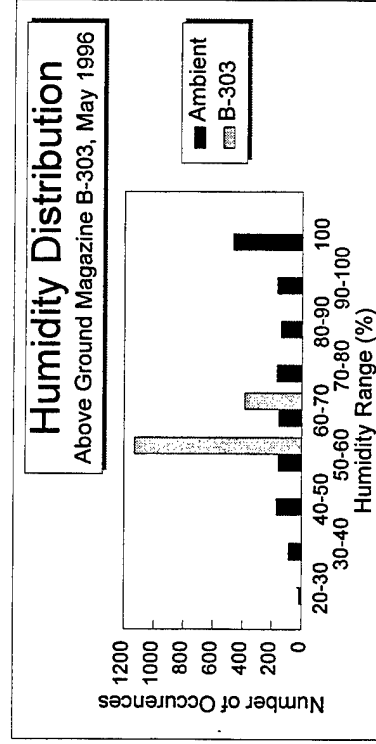
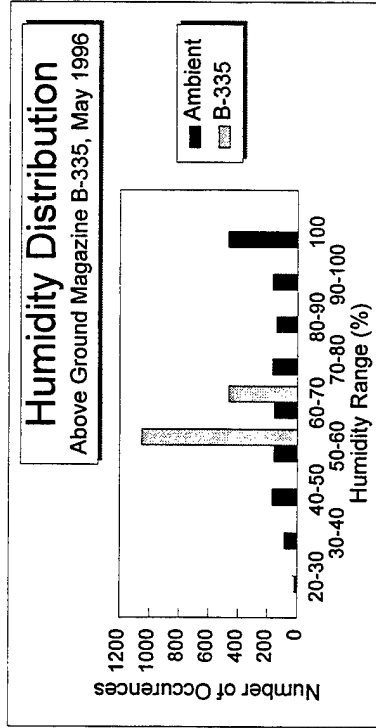
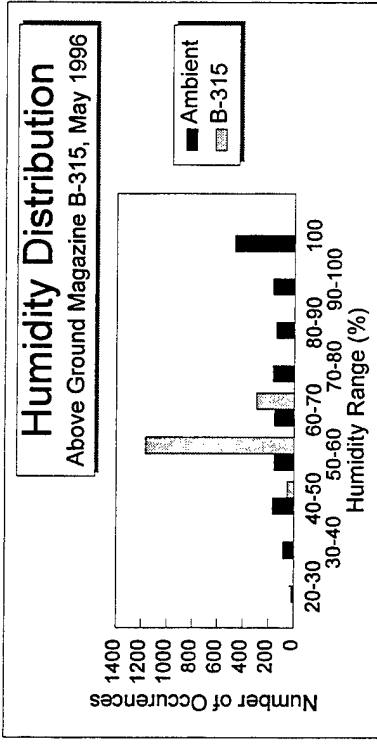
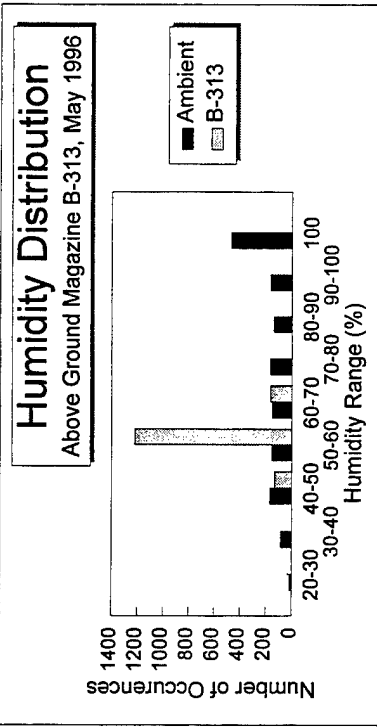
Above Ground Magazine B-177, May 1996



Humidity Distribution

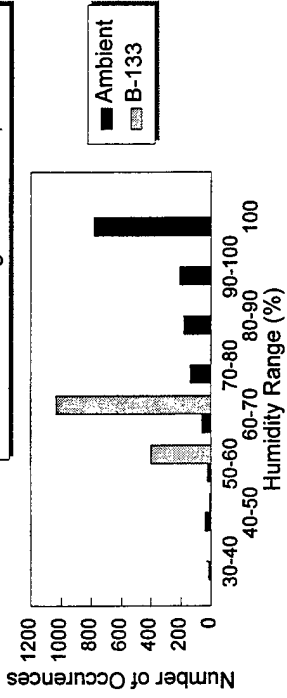
Above Ground Magazine B-182, May 1996





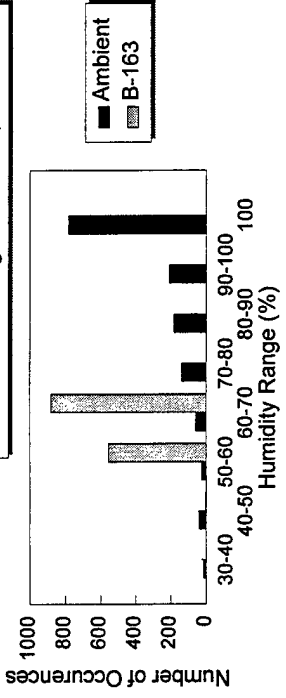
Humidity Distribution

Above Ground Magazine B-133, June 1996



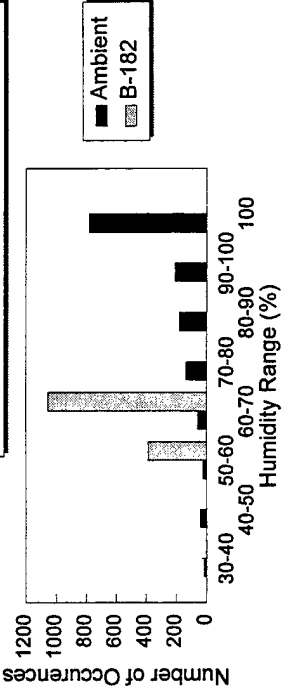
Humidity Distribution

Above Ground Magazine B-163, June 1996



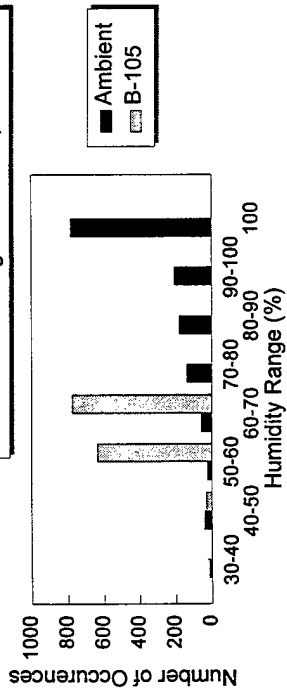
Humidity Distribution

Above Ground Magazine B-182, June 1996



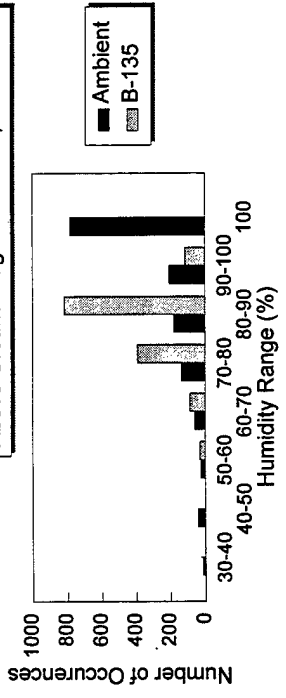
Humidity Distribution

Above Ground Magazine B-105, June 1996



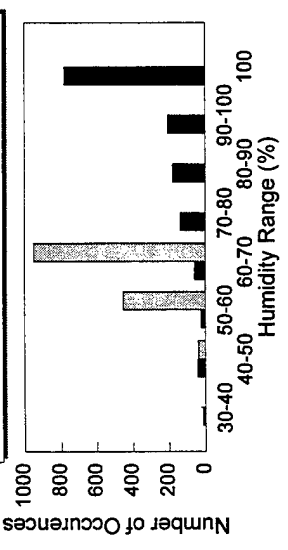
Humidity Distribution

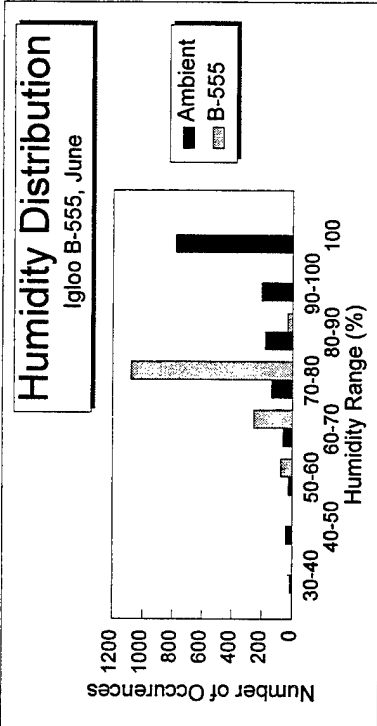
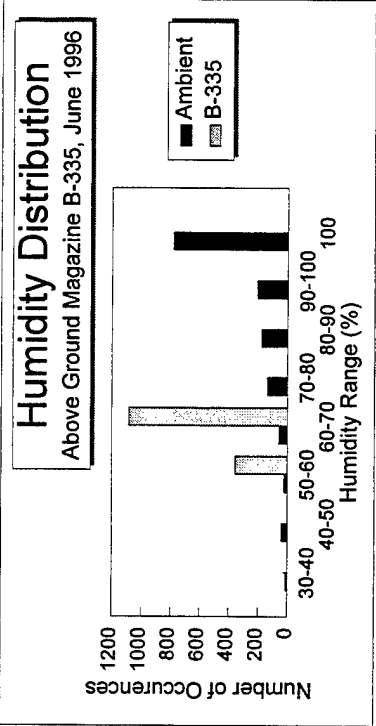
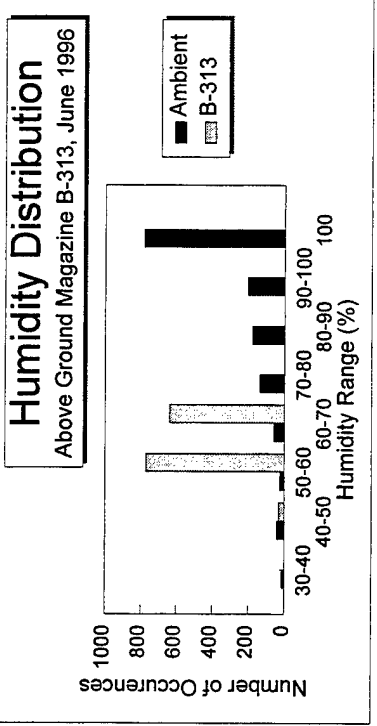
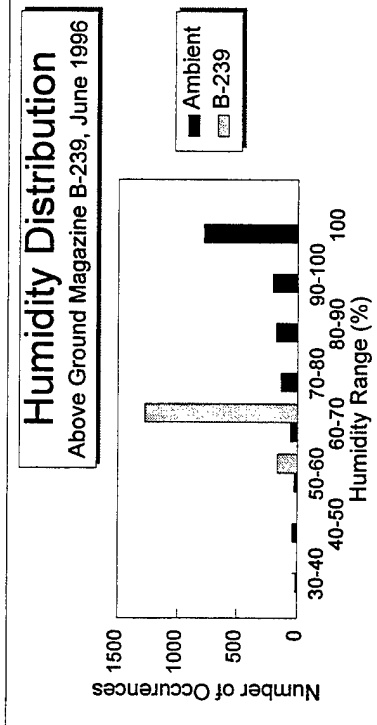
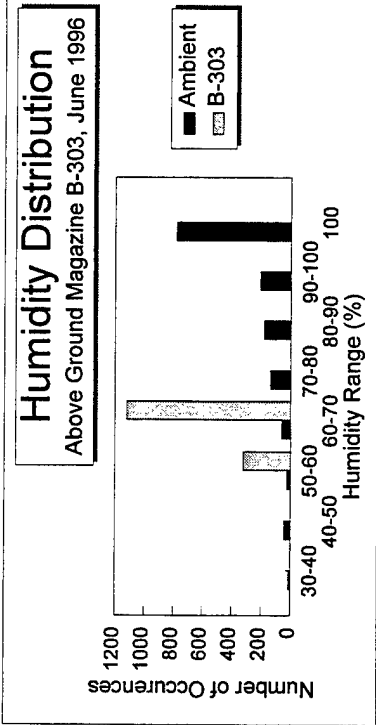
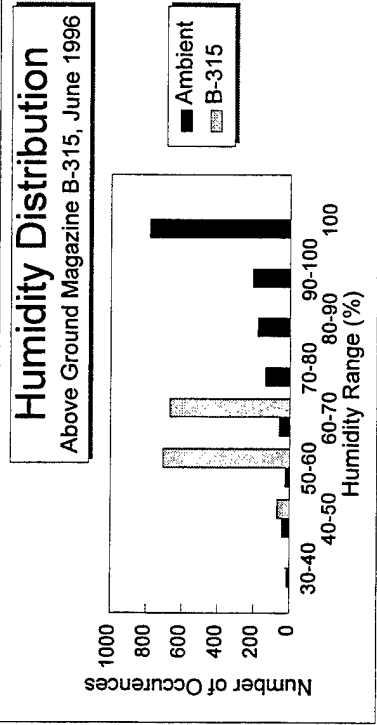
Above Ground Magazine B-135, June 1996



Humidity Distribution

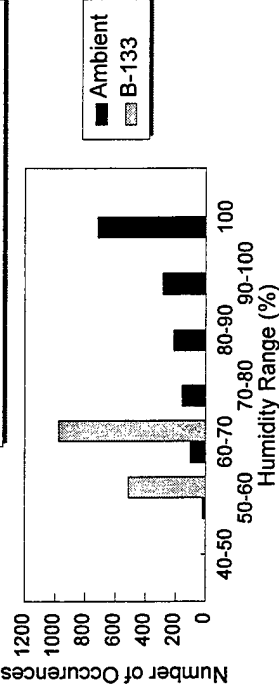
Above Ground Magazine B-177, June 1996





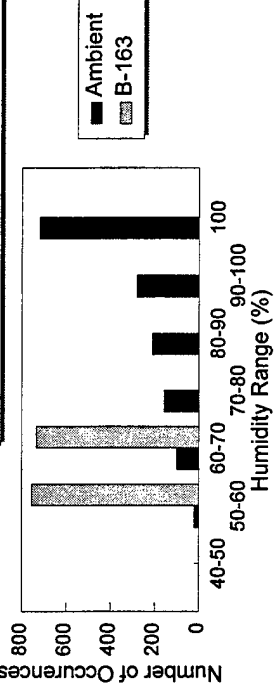
Humidity Distribution

Above Ground Magazine B-133, July 1996



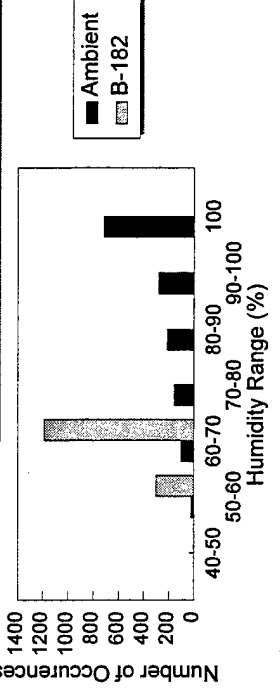
Humidity Distribution

Above Ground Magazine B-163, July 1996



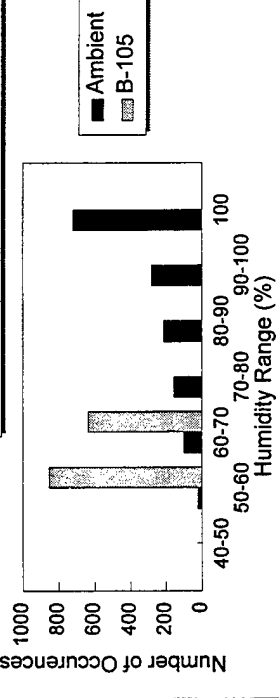
Humidity Distribution

Above Ground Magazine B-182, July 1996



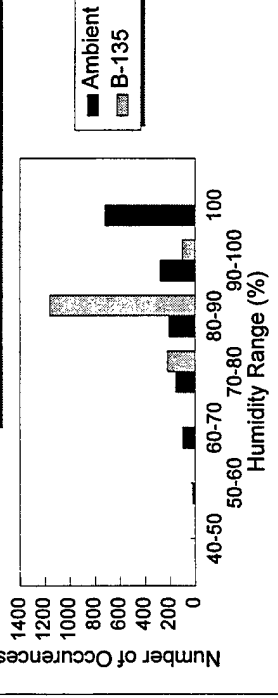
Humidity Distribution

Above Ground Magazine B-105, July 1996



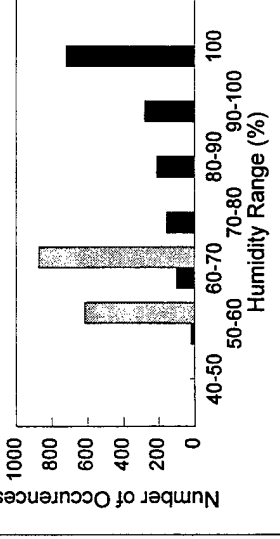
Humidity Distribution

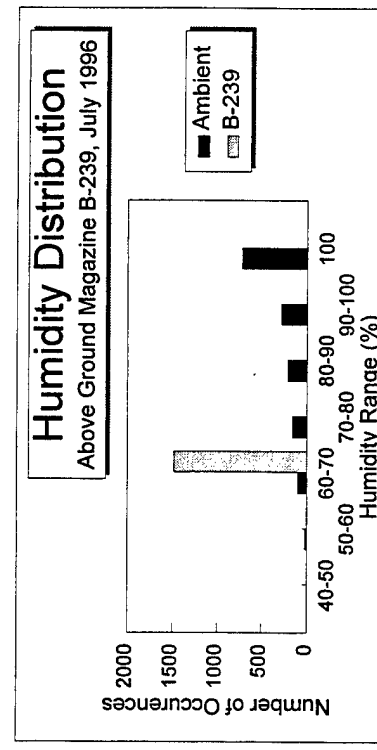
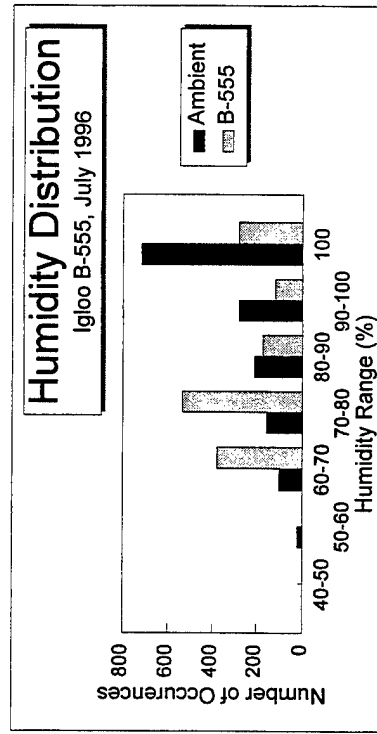
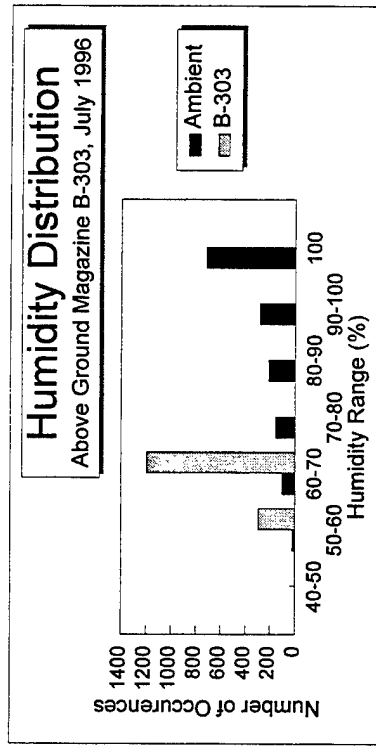
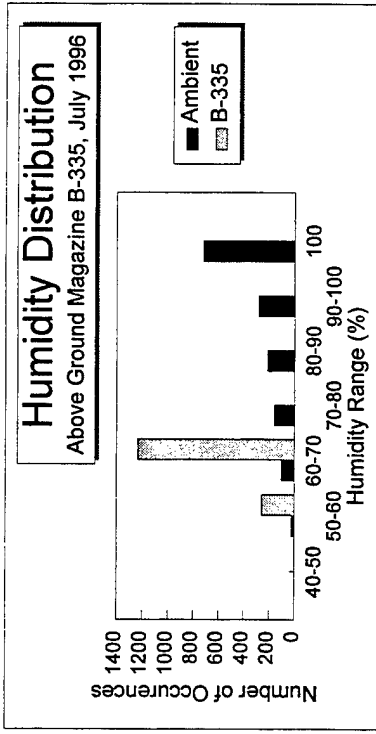
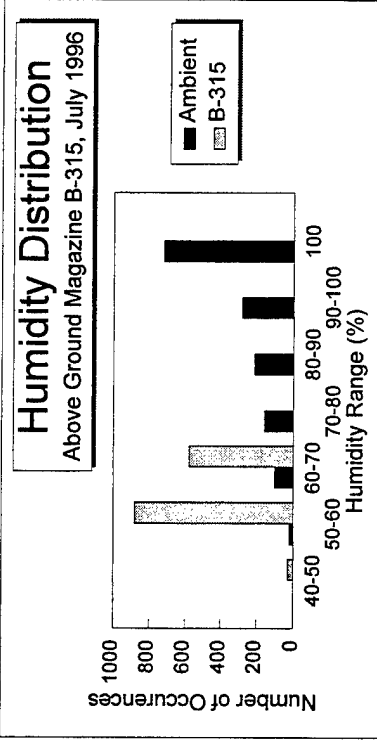
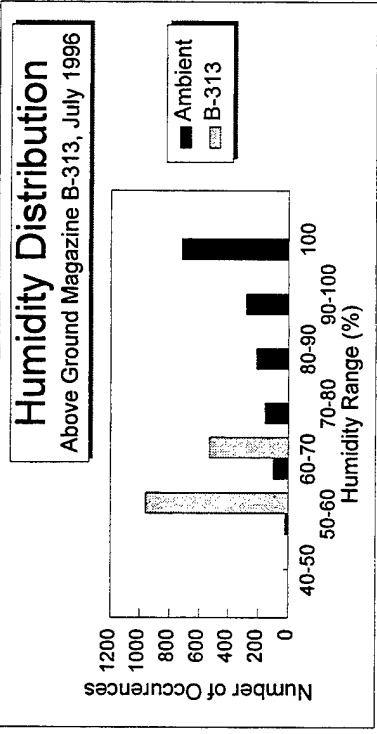
Above Ground Magazine B-135, July 1996



Humidity Distribution

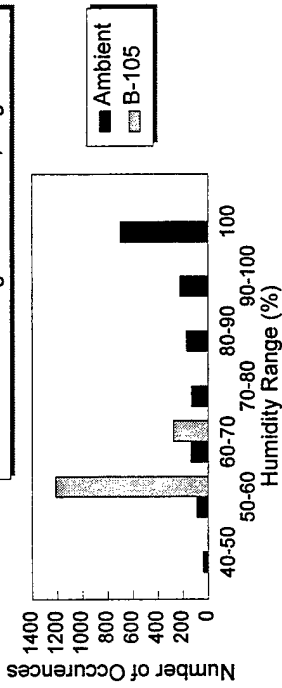
Above Ground Magazine B-177, July 1996





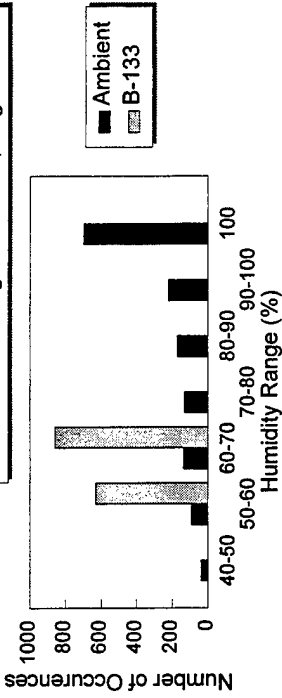
Humidity Distribution

Above Ground Magazine B-105, August 1996



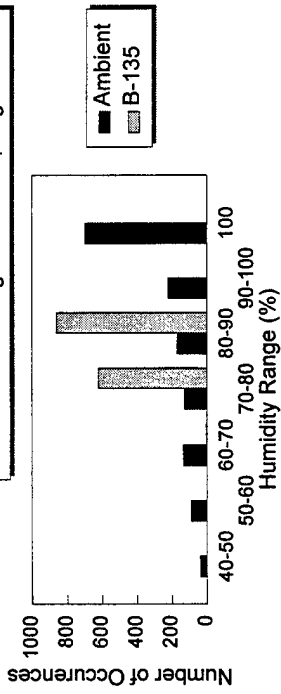
Humidity Distribution

Above Ground Magazine B-133, August 1996



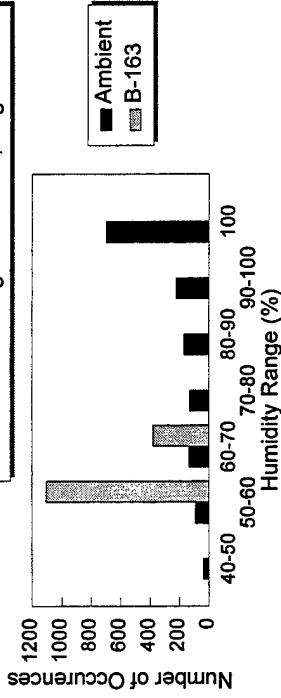
Humidity Distribution

Above Ground Magazine B-135, August 1996



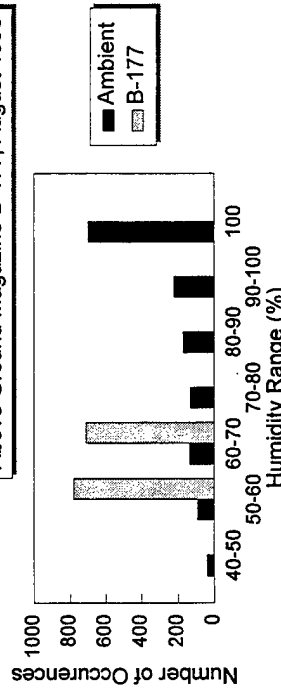
Humidity Distribution

Above Ground Magazine B-163, August 1996



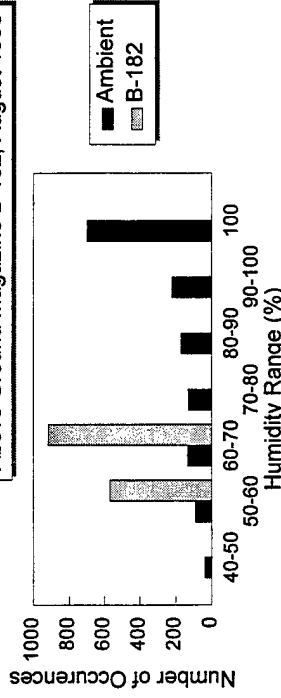
Humidity Distribution

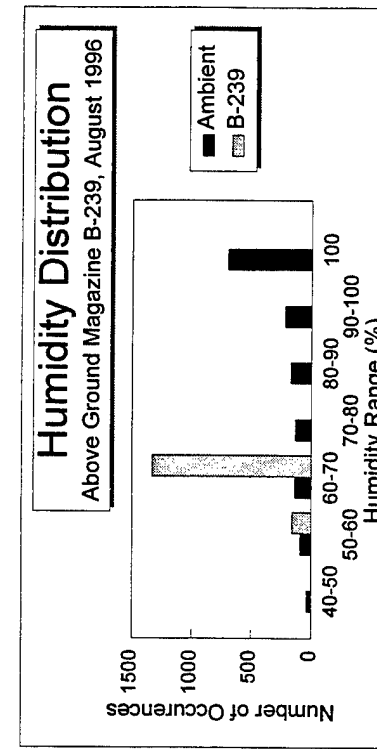
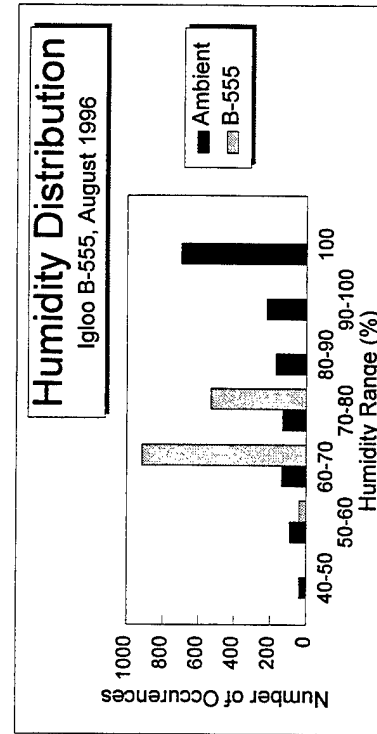
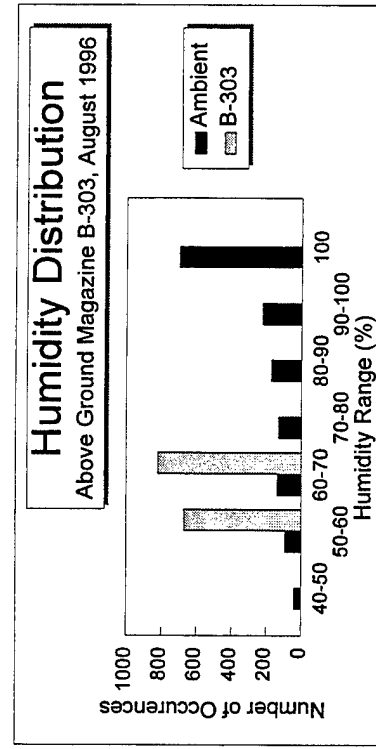
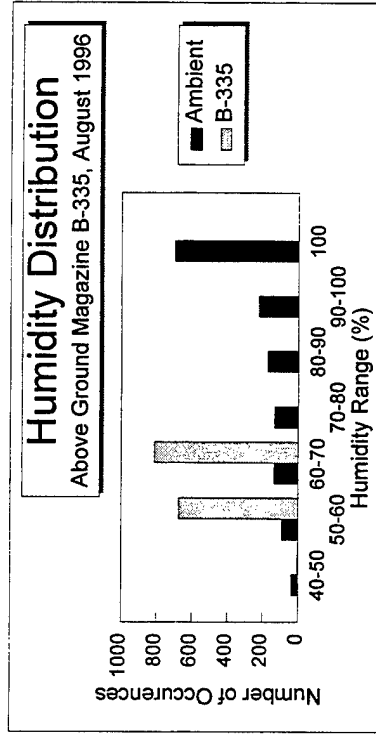
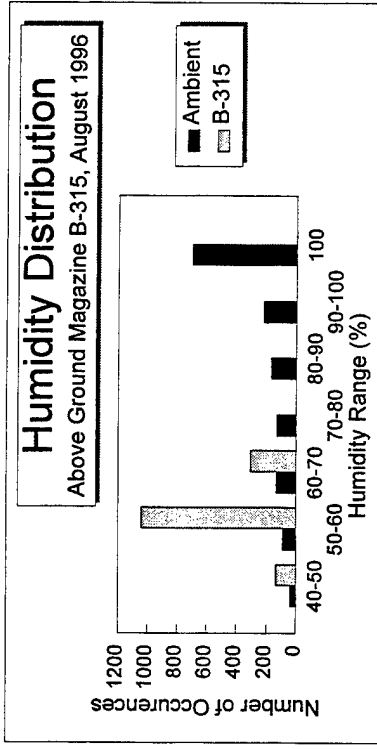
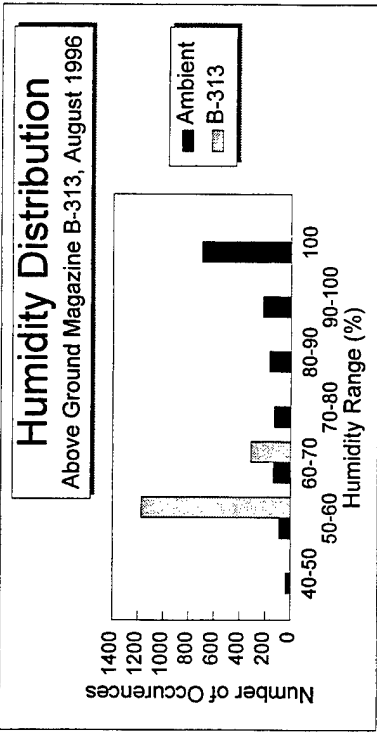
Above Ground Magazine B-177, August 1996



Humidity Distribution

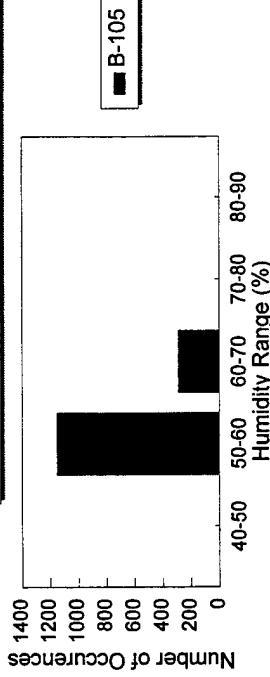
Above Ground Magazine B-182, August 1996





Humidity Distribution

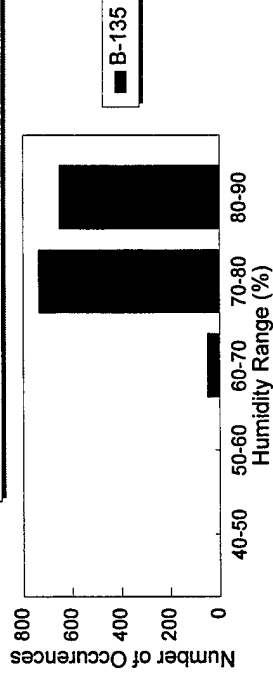
Above Ground Magazine B-105, September 1996



■ B-105

Humidity Distribution

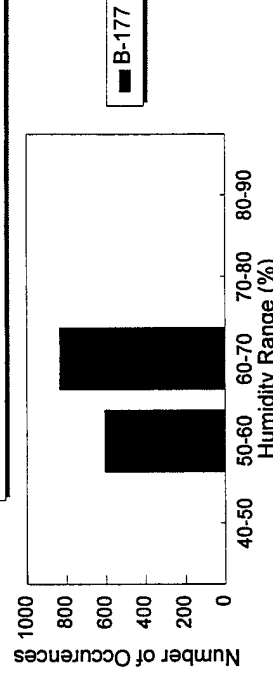
Above Ground Magazine B-135, September 1996



■ B-135

Humidity Distribution

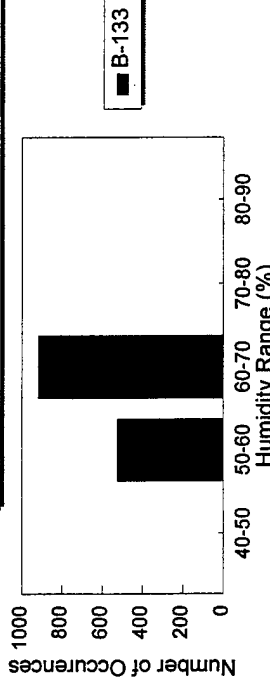
Above Ground Magazine B-177, September 1996



■ B-177

Humidity Distribution

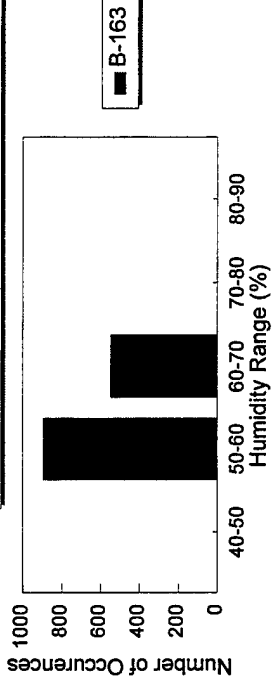
Above Ground Magazine B-133, September 1996



■ B-133

Humidity Distribution

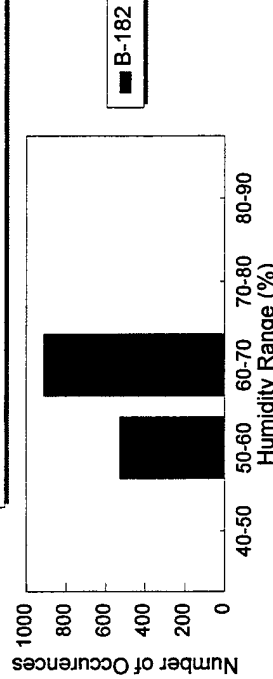
Above Ground Magazine B-163, September 1996



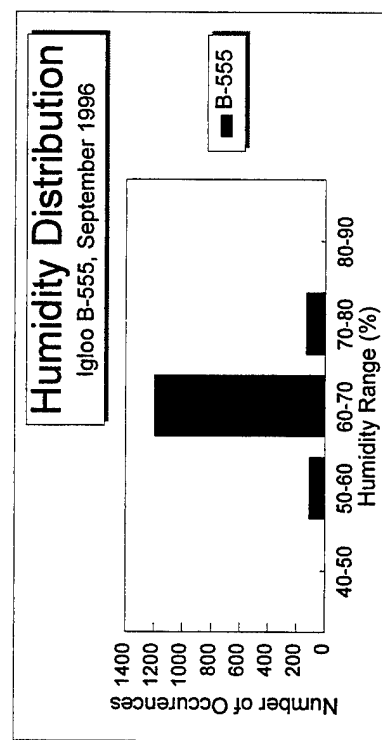
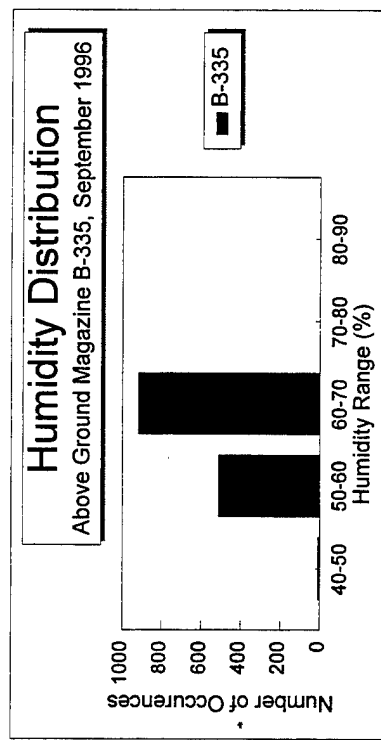
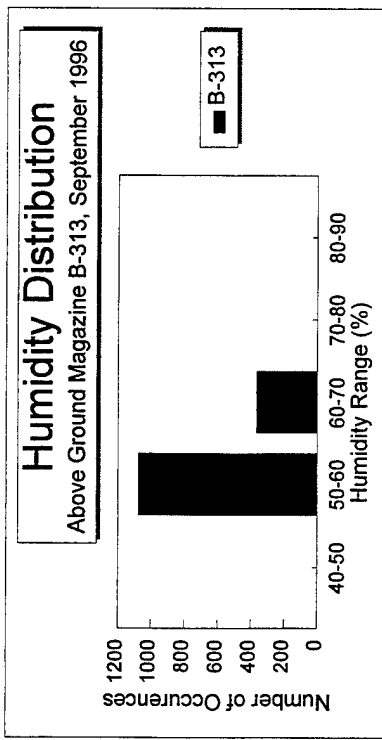
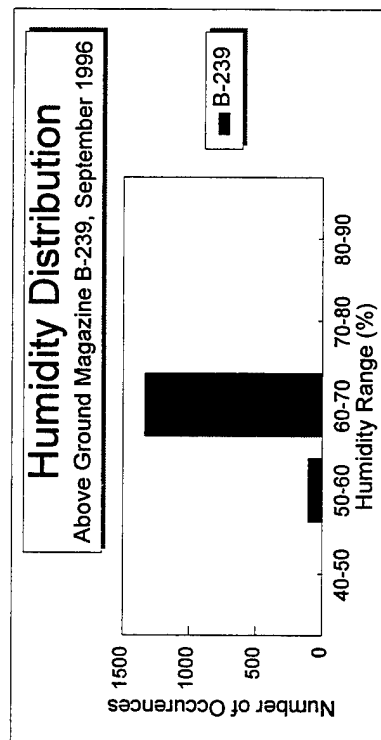
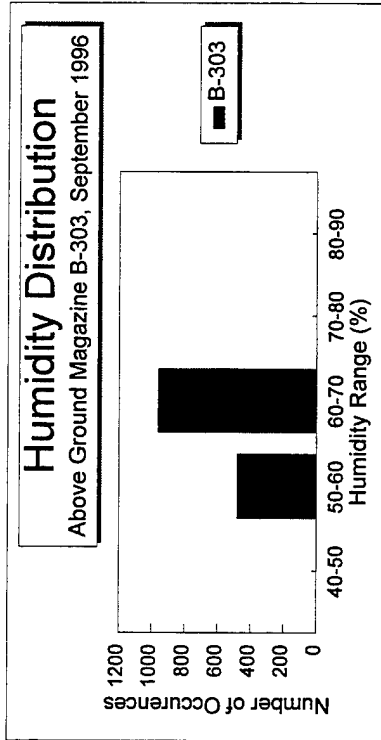
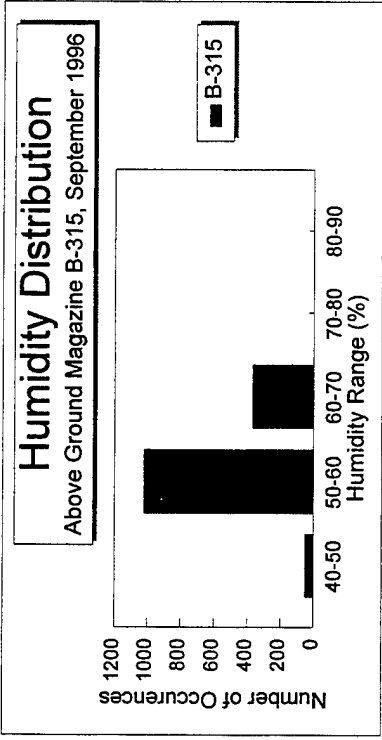
■ B-163

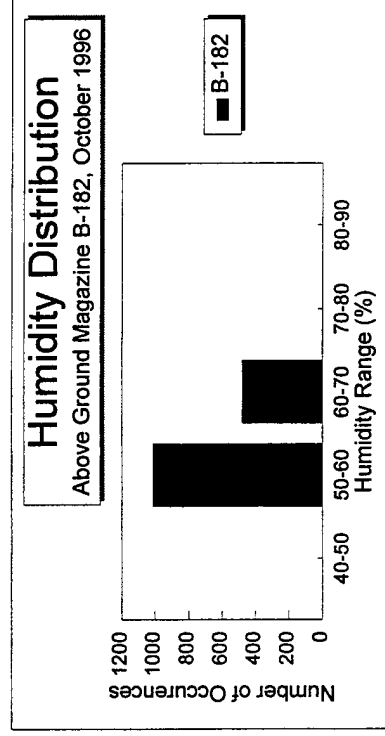
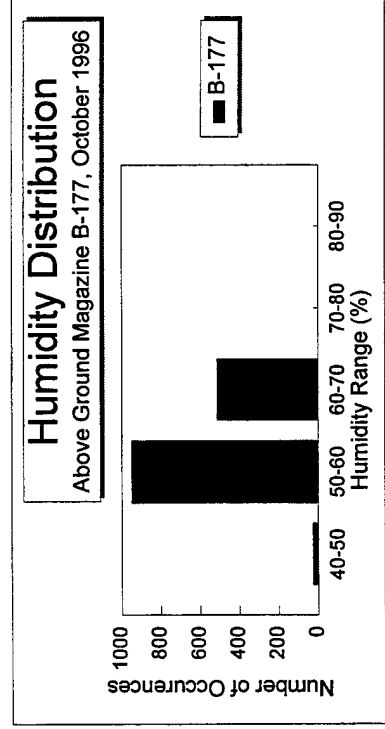
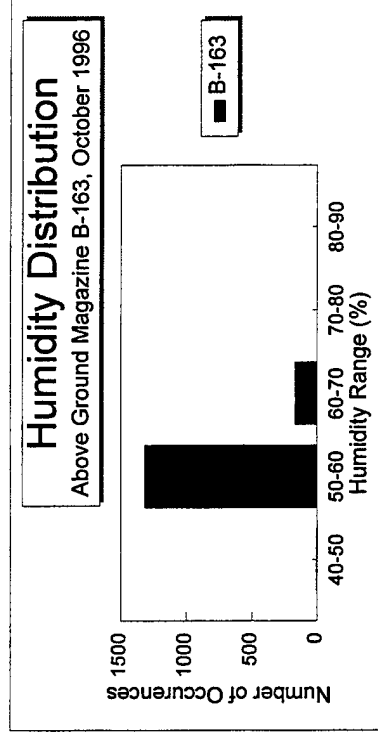
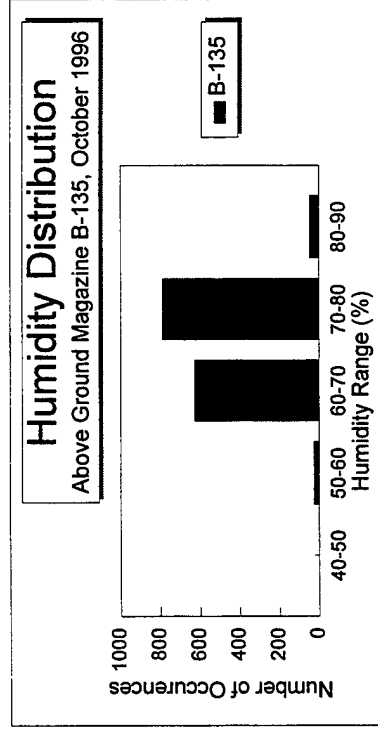
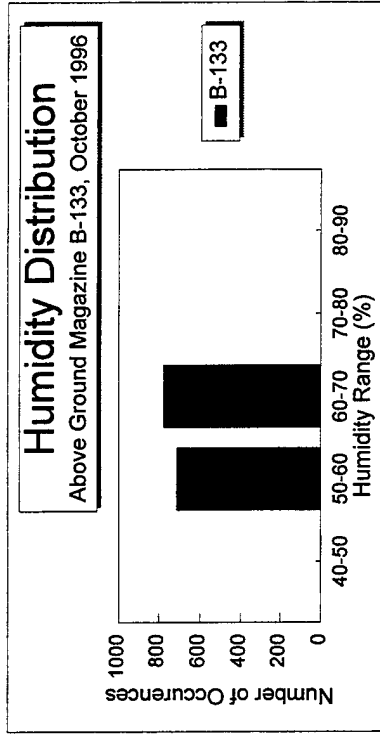
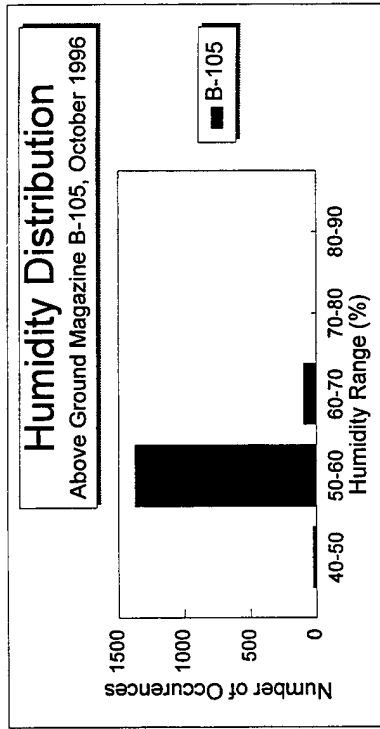
Humidity Distribution

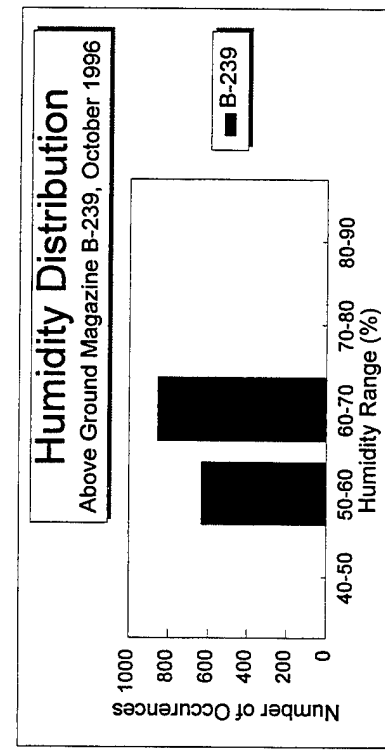
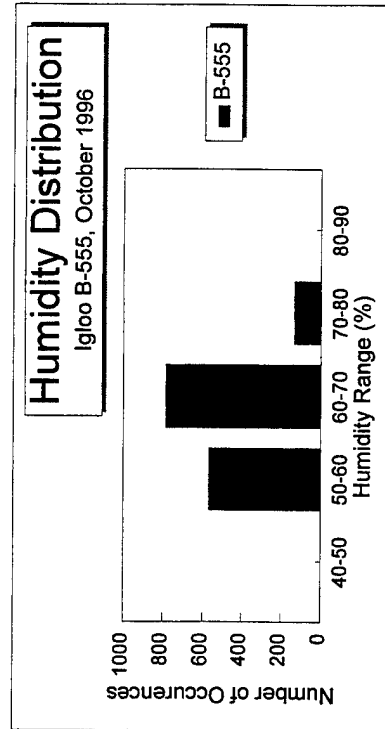
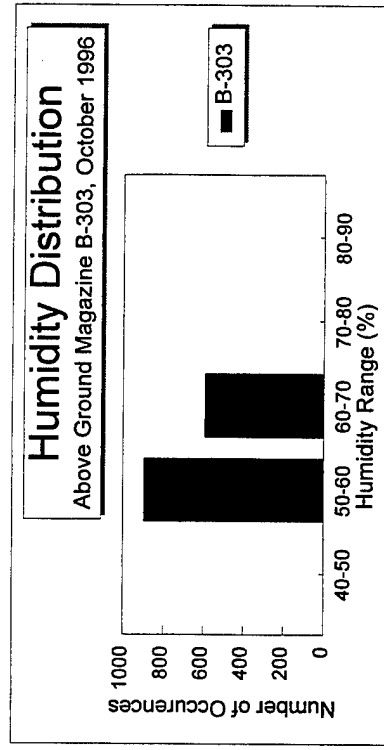
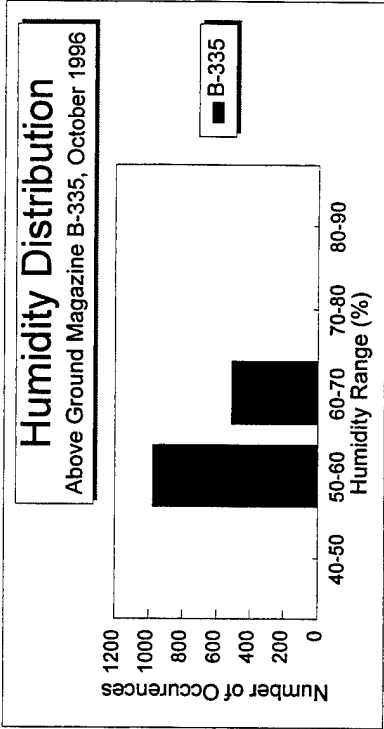
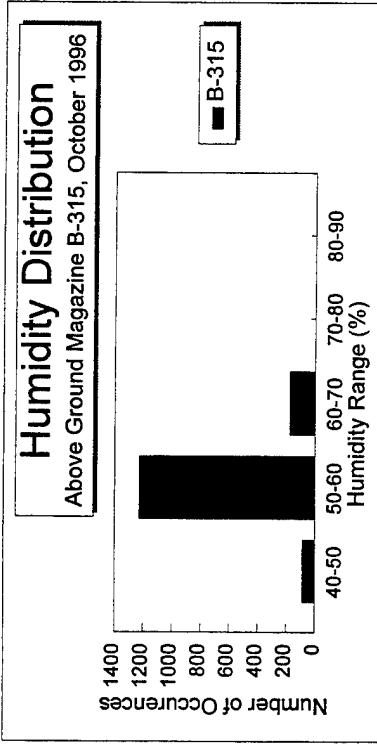
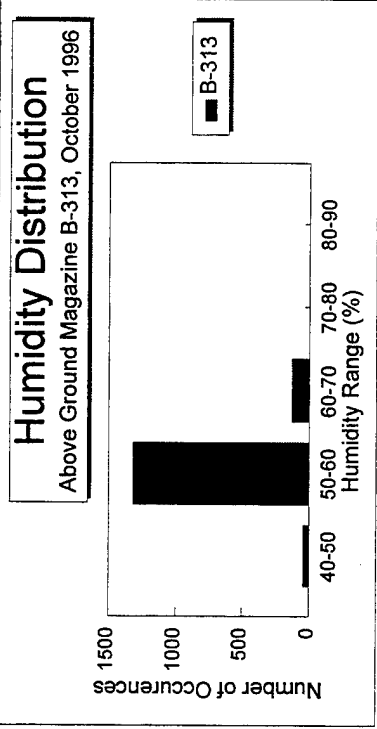
Above Ground Magazine B-182, September 1996



■ B-182

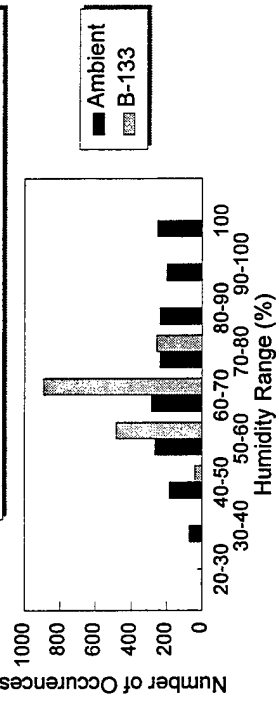






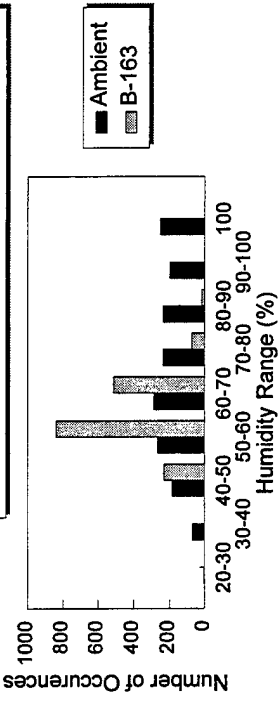
Humidity Distribution

Above Ground Magazine B-133, November 1996



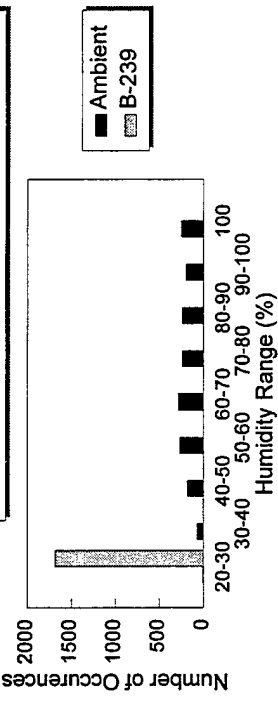
Humidity Distribution

Above Ground Magazine B-163, November 1996



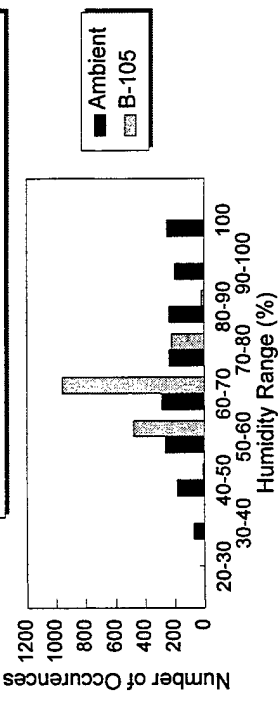
Humidity Distribution

Above Ground Magazine B-239, November 1996



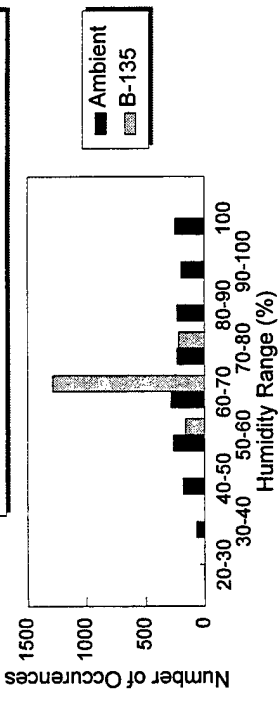
Humidity Distribution

Above Ground Magazine B-105, November 1996



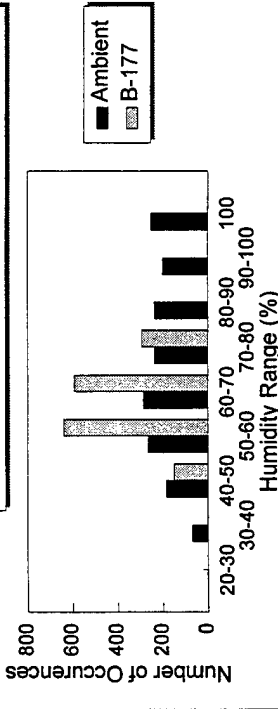
Humidity Distribution

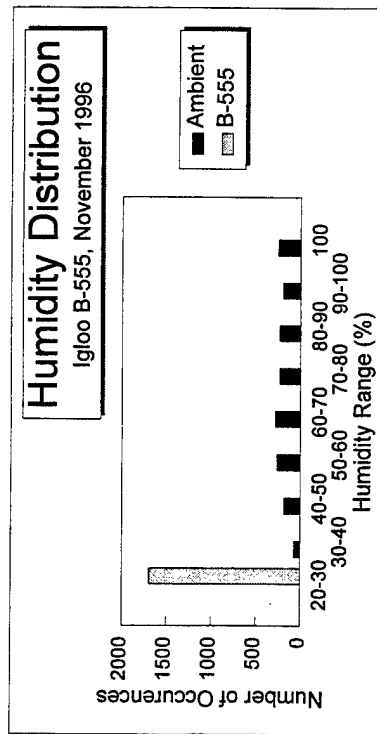
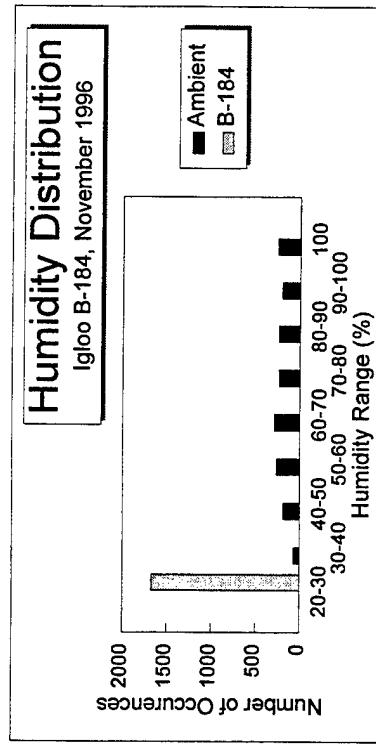
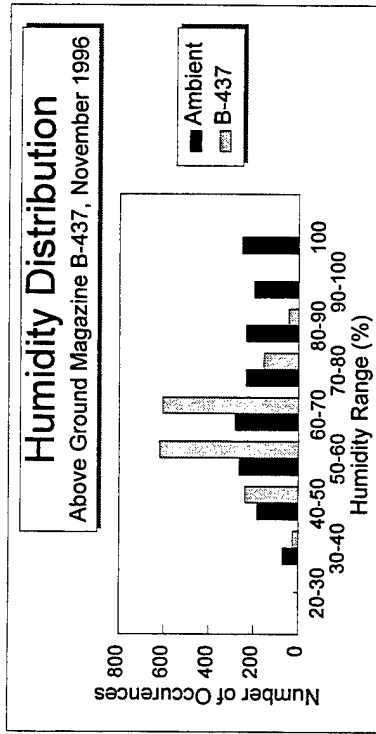
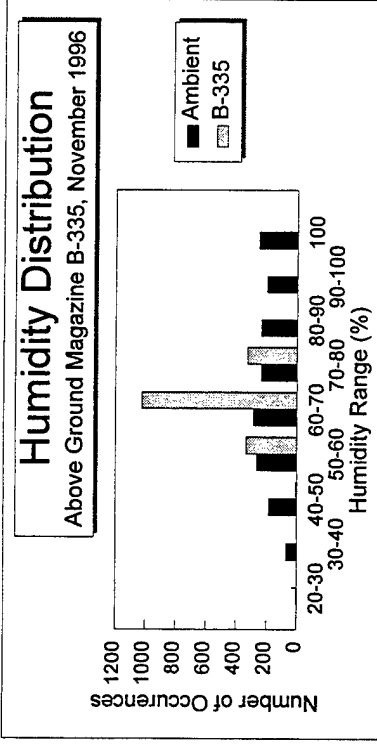
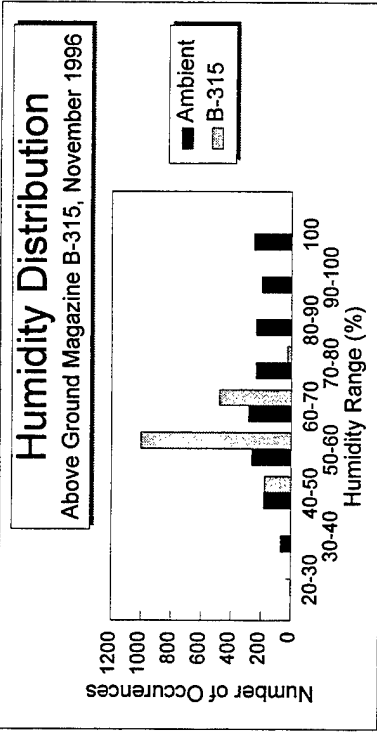
Above Ground Magazine B-135, November 1996



Humidity Distribution

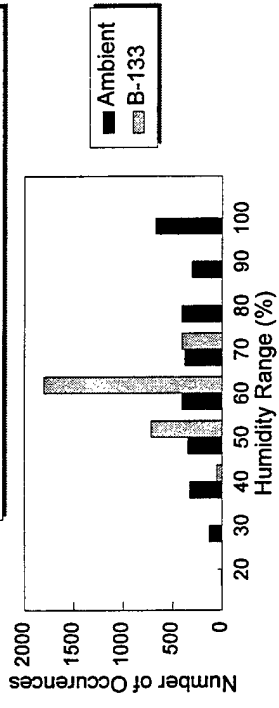
Above Ground Magazine B-177, November 1996





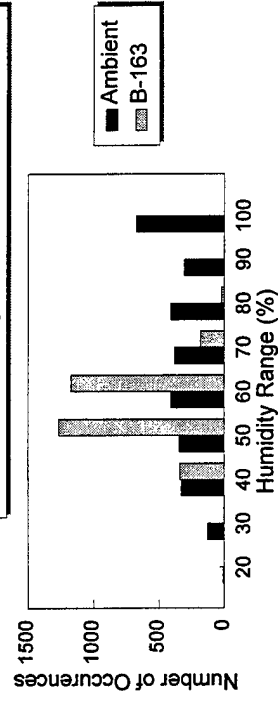
Humidity Distribution

Above Ground Magazine B-133, December 1996



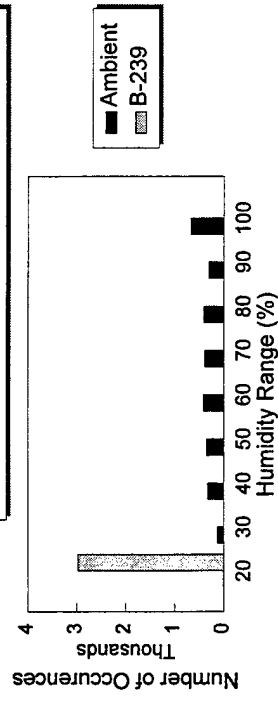
Humidity Distribution

Above Ground Magazine B-163, December 1996



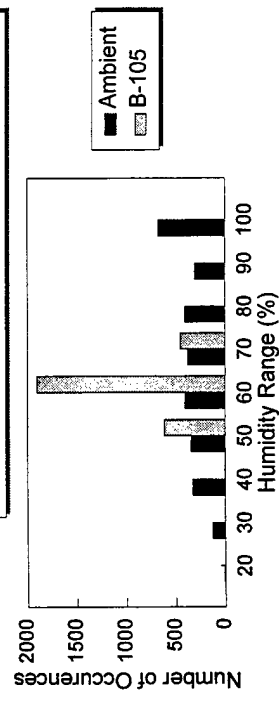
Humidity Distribution

Above Ground Magazine B-239, December 1996



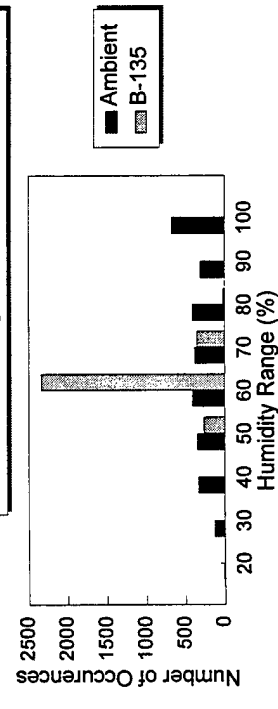
Humidity Distribution

Above Ground Magazine B-105, December 1996



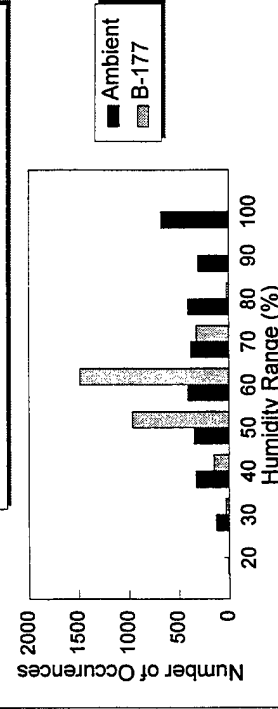
Humidity Distribution

Above Ground Magazine B-135, December 1996



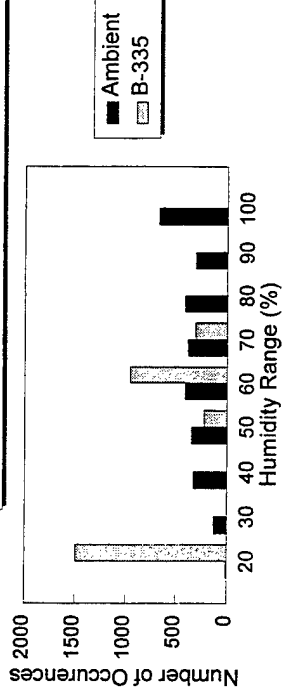
Humidity Distribution

Above Ground Magazine B-177, December 1996



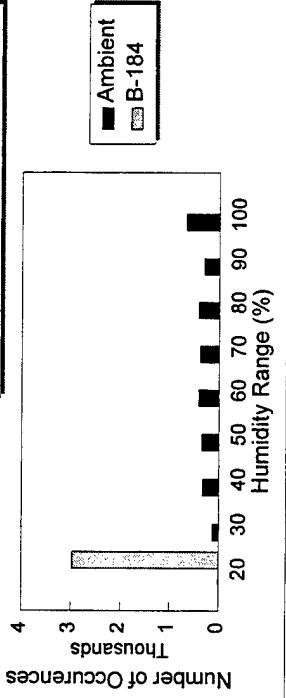
Humidity Distribution

Above Ground Magazine B-335, December 1996



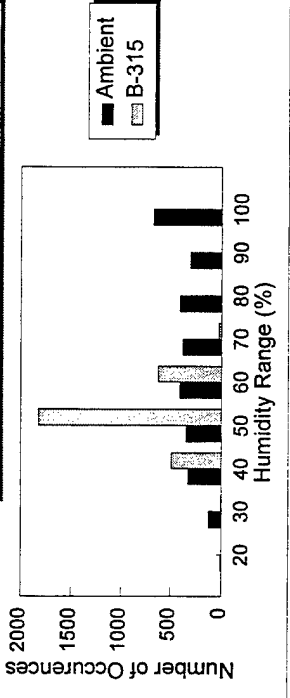
Humidity Distribution

Igloo B-184, December 1996



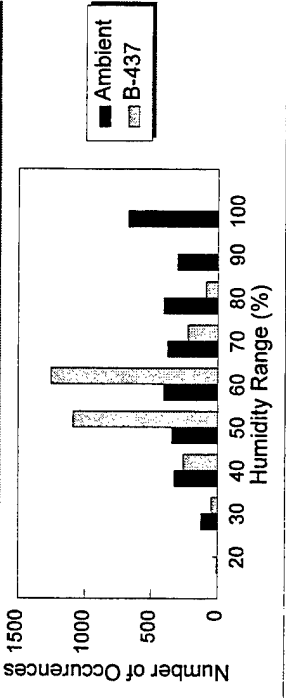
Humidity Distribution

Above Ground Magazine B-315, December 1996



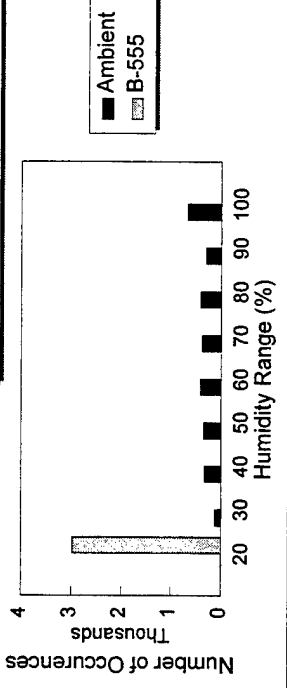
Humidity Distribution

Above Ground Magazine B-437, December 1996



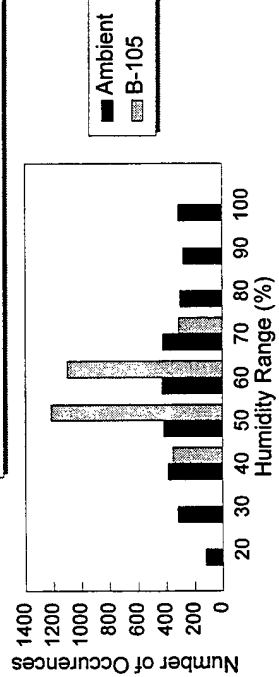
Humidity Distribution

Igloo B-555, December 1996



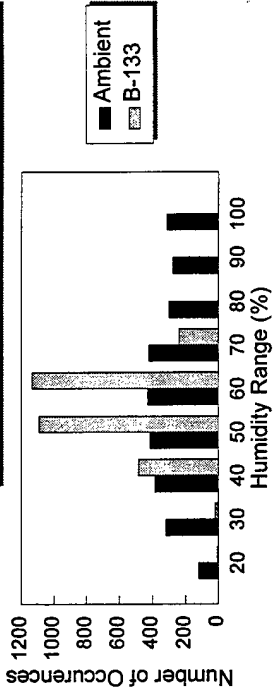
Humidity Distribution

Above Ground Magazine B-105, January 1997



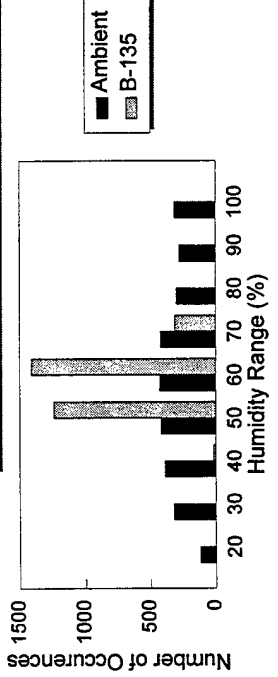
Humidity Distribution

Above Ground Magazine B-133, January 1997



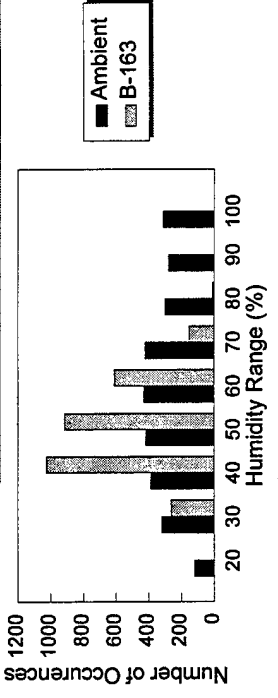
Humidity Distribution

Above Ground Magazine B-135, January 1997



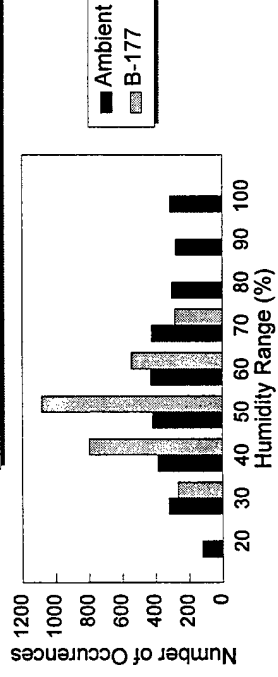
Humidity Distribution

Above Ground Magazine B-163, January 1997



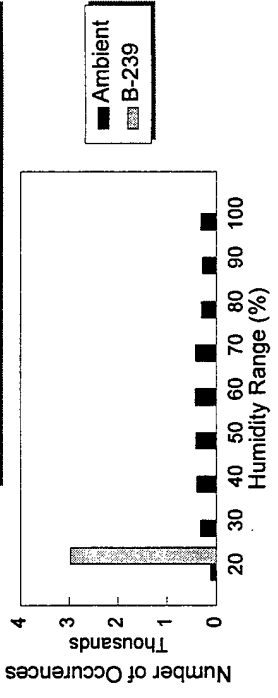
Humidity Distribution

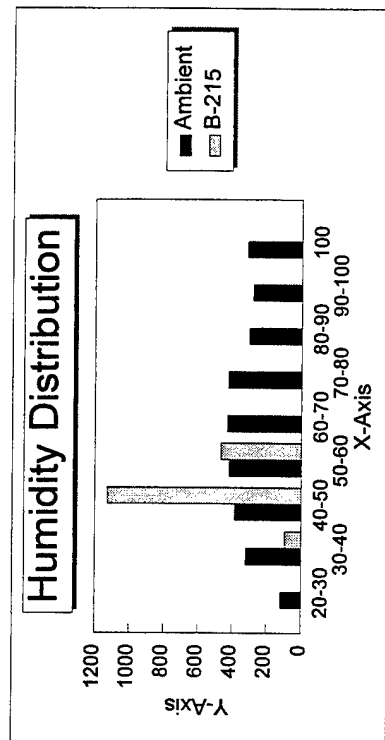
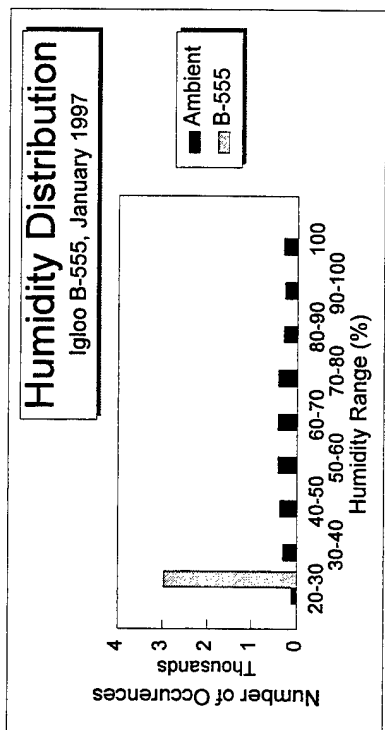
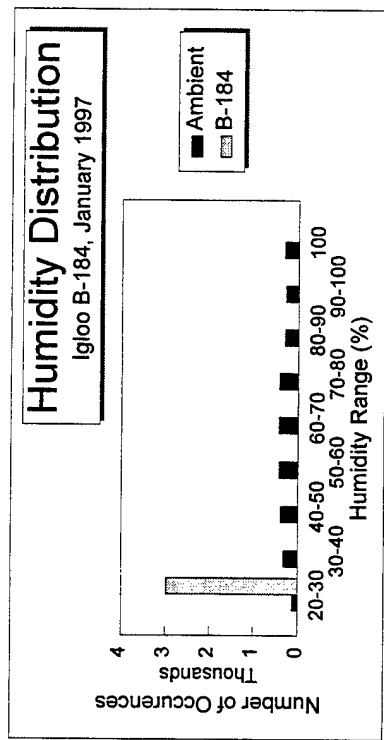
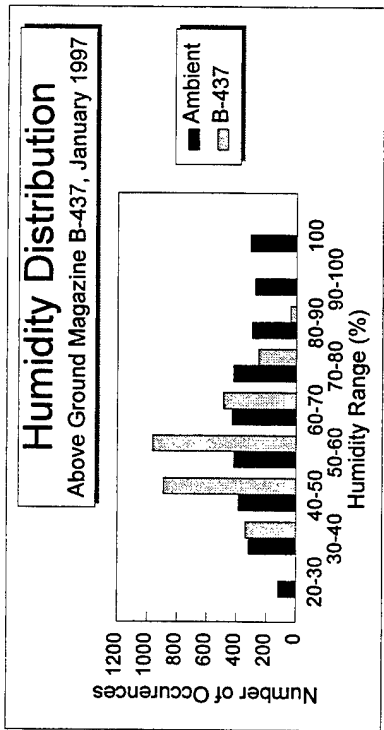
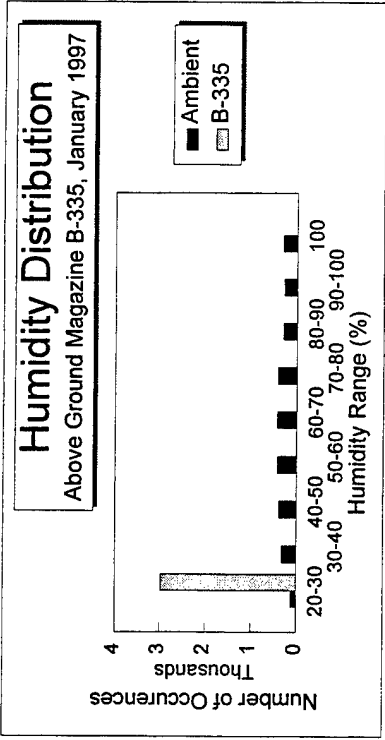
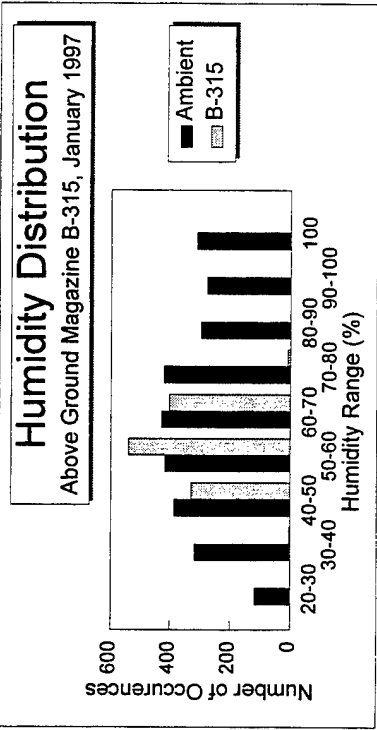
Above Ground Magazine B-177, January 1997



Humidity Distribution

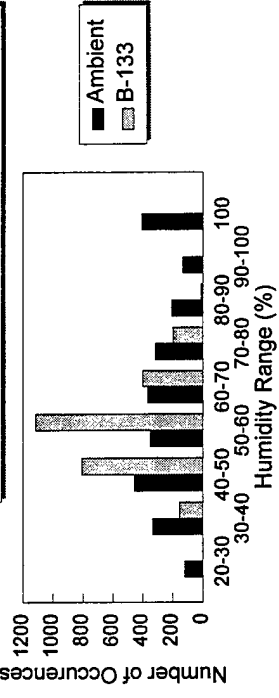
Above Ground Magazine B-239, January 1997





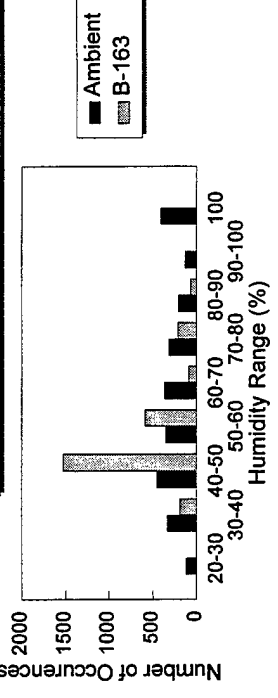
Humidity Distribution

Above Ground Magazine B-133, February 1997



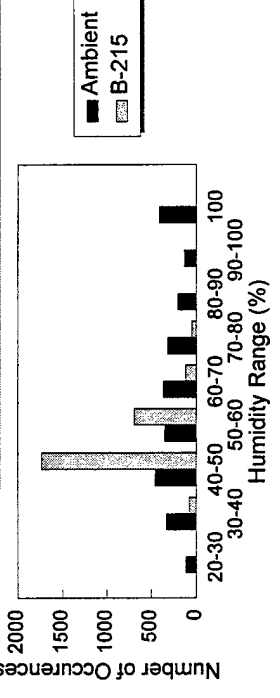
Humidity Distribution

Above Ground Magazine B-163, February 1997



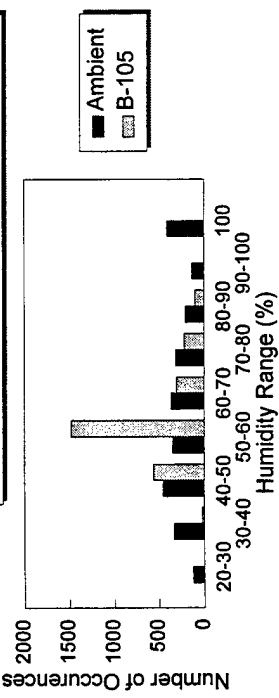
Humidity Distribution

Above Ground Magazine B-215, February 1997



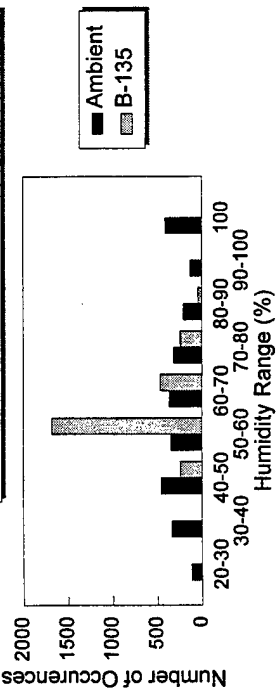
Humidity Distribution

Above Ground Magazine B-105, February 1997



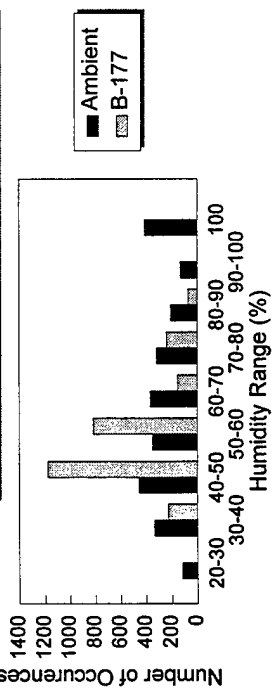
Humidity Distribution

Above Ground Magazine B-135, February 1997



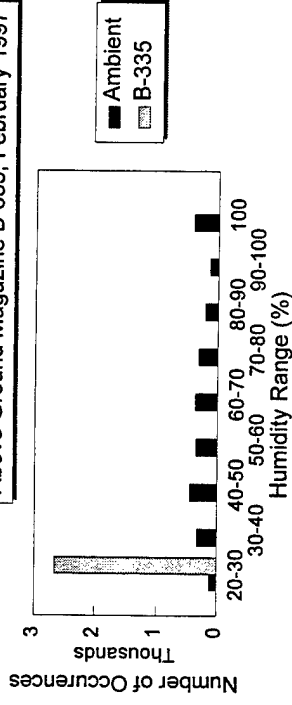
Humidity Distribution

Above Ground Magazine B-177, February 1997



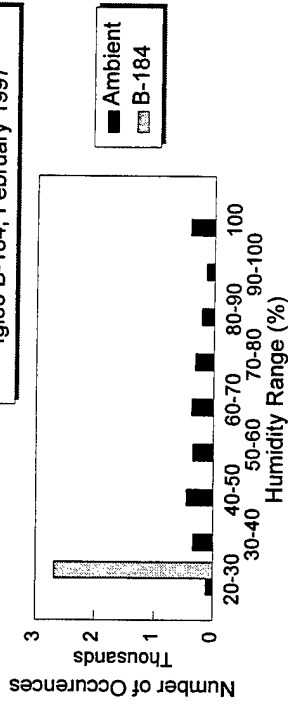
Humidity Distribution

Above Ground Magazine B-335, February 1997



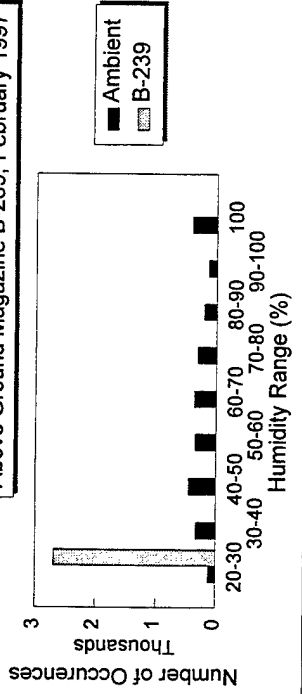
Humidity Distribution

Igloo B-184, February 1997



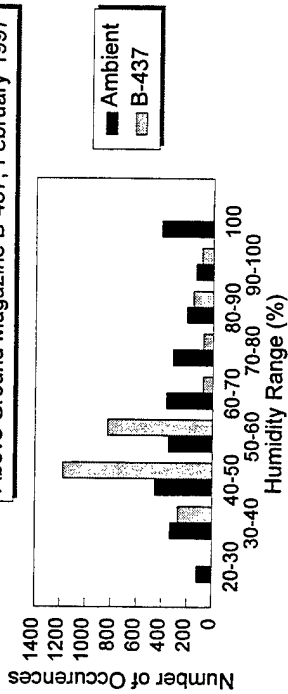
Humidity Distribution

Above Ground Magazine B-239, February 1997



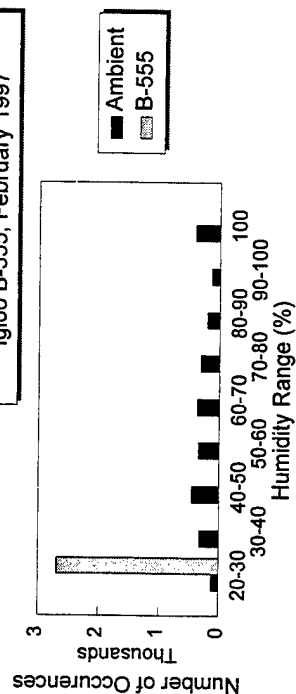
Humidity Distribution

Above Ground Magazine B-437, February 1997



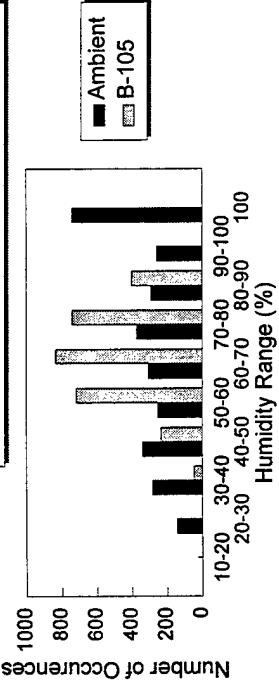
Humidity Distribution

Igloo B-555, February 1997



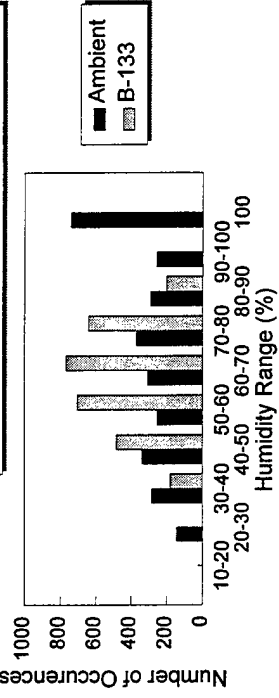
Humidity Distribution

Above Ground Magazine B-105, March 1997



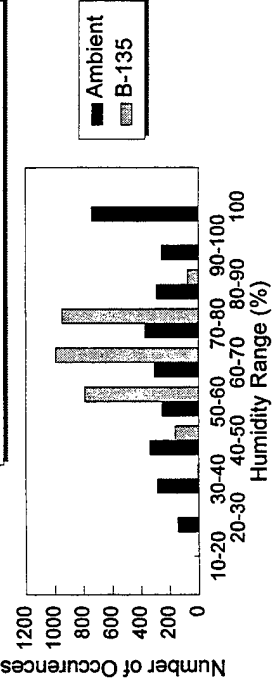
Humidity Distribution

Above Ground Magazine B-133, March 1997



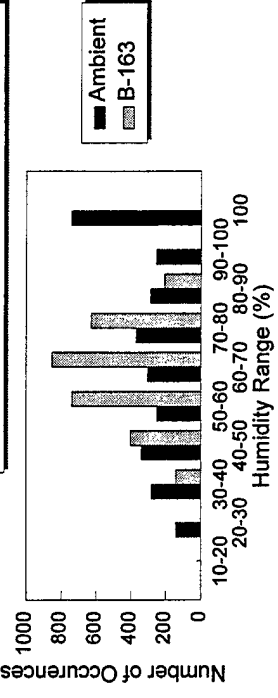
Humidity Distribution

Above Ground Magazine B-135, March 1997



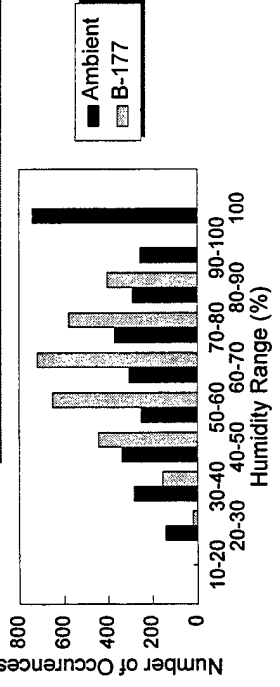
Humidity Distribution

Above Ground Magazine B-163, March 1997



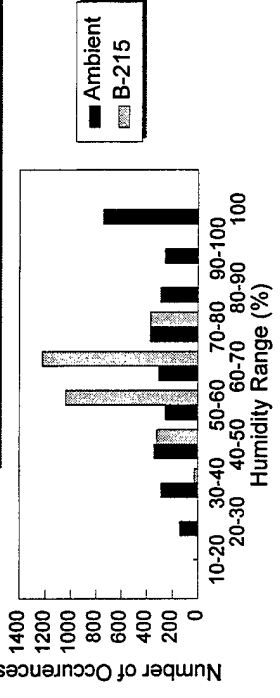
Humidity Distribution

Above Ground Magazine B-177, March 1997



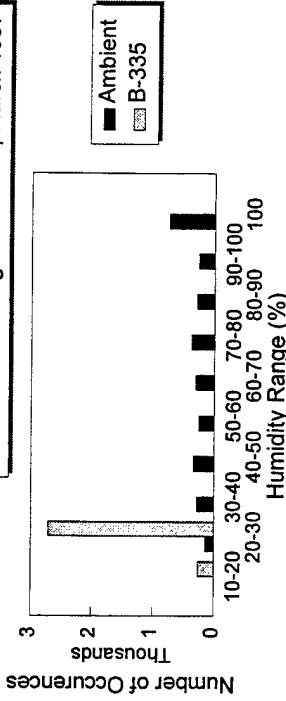
Humidity Distribution

Above Ground Magazine B-215, March 1997



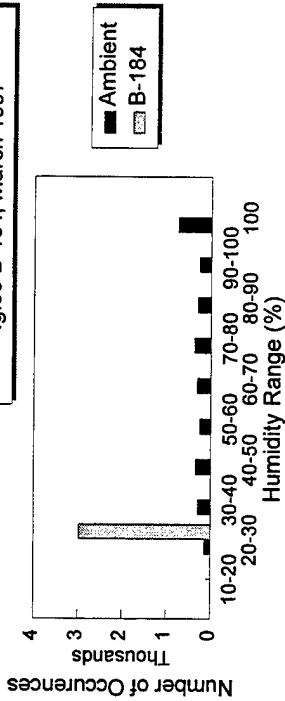
Humidity Distribution

Above Ground Magazine B-335, March 1997



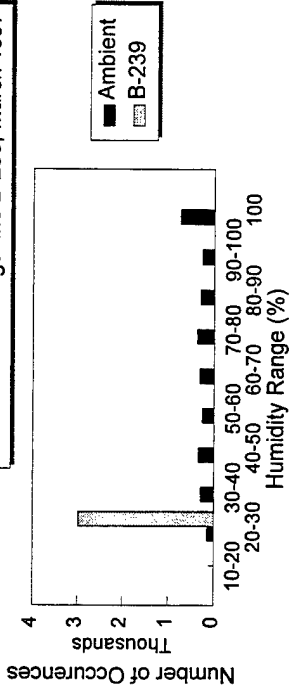
Humidity Distribution

Igloo B-184, March 1997



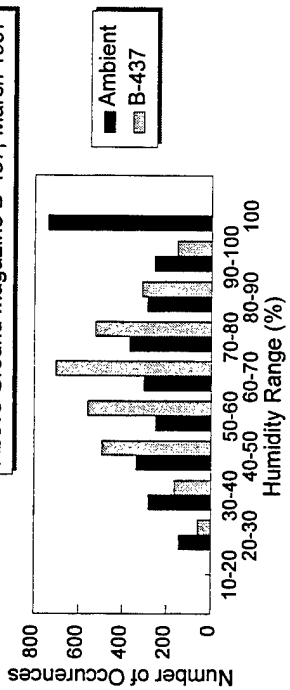
Humidity Distribution

Above Ground Magazine B-239, March 1997



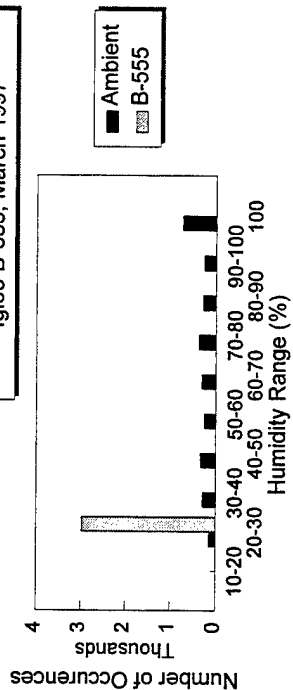
Humidity Distribution

Above Ground Magazine B-437, March 1997

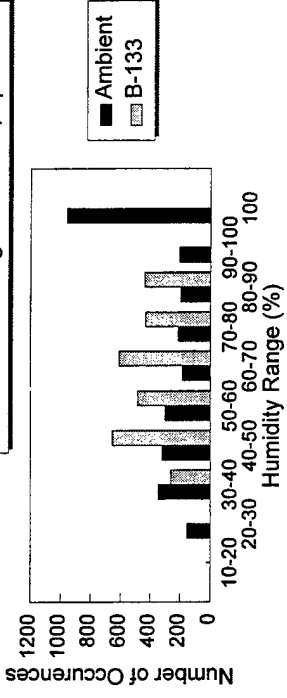


Humidity Distribution

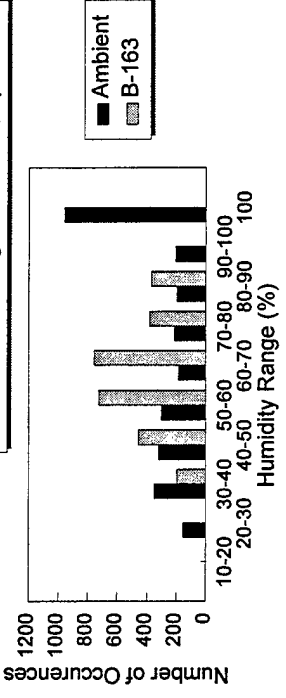
Igloo B-555, March 1997



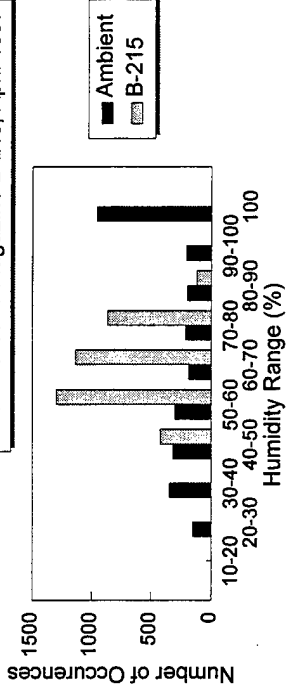
Humidity Distribution
Above Ground Magazine B-133, April 1997



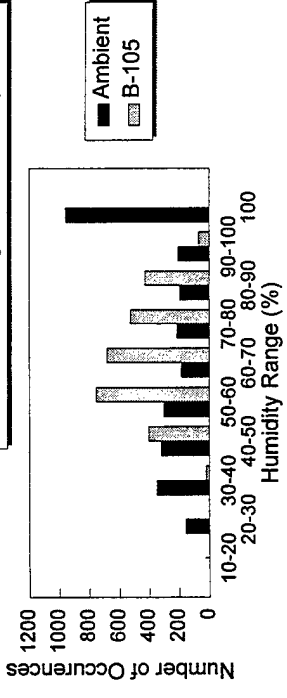
Humidity Distribution
Above Ground Magazine B-163, April 1997



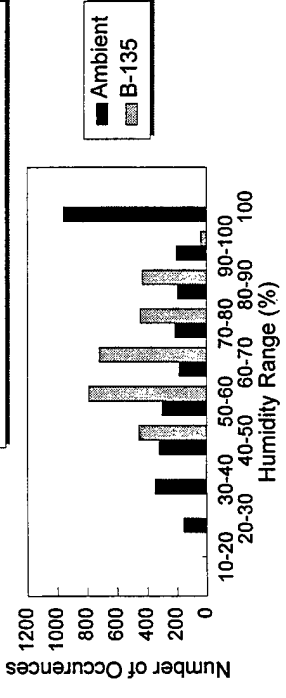
Humidity Distribution
Above Ground Magazine B-215, April 1997



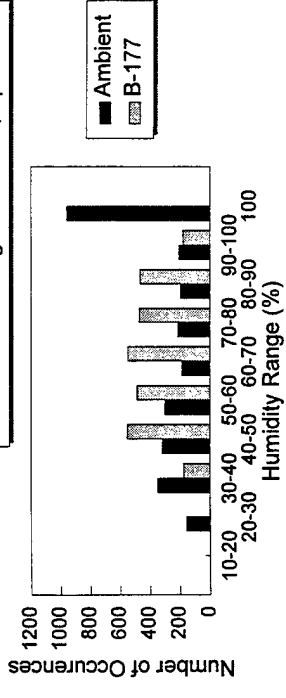
Humidity Distribution
Above Ground Magazine B-105, April 1997

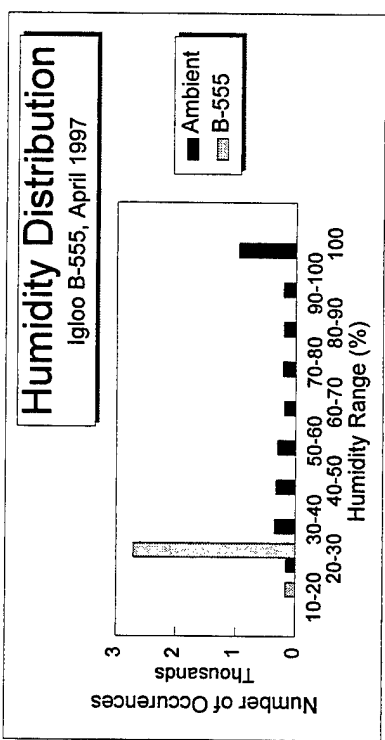
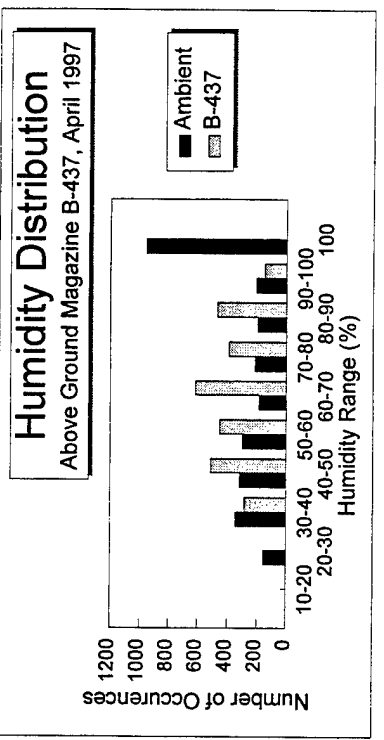
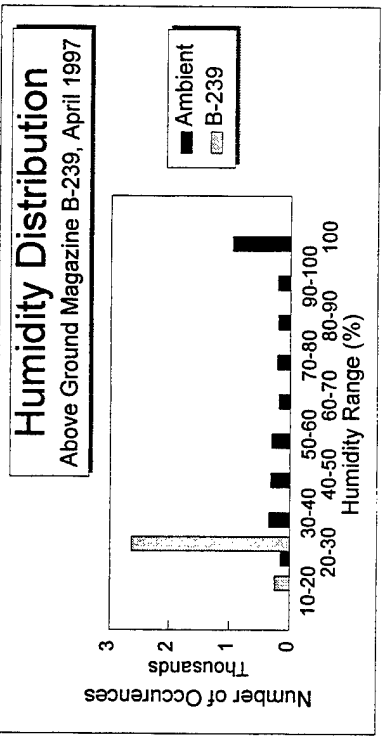
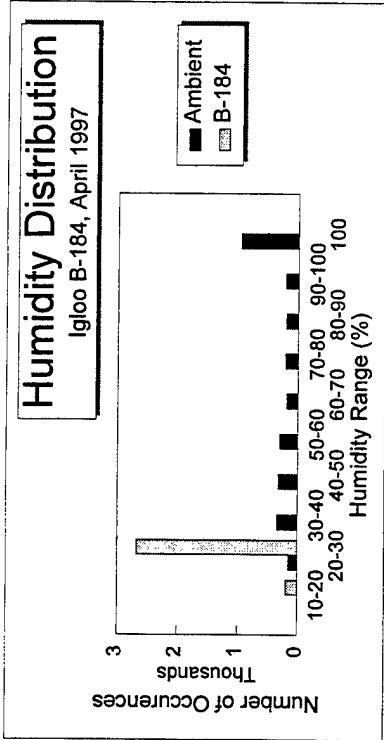
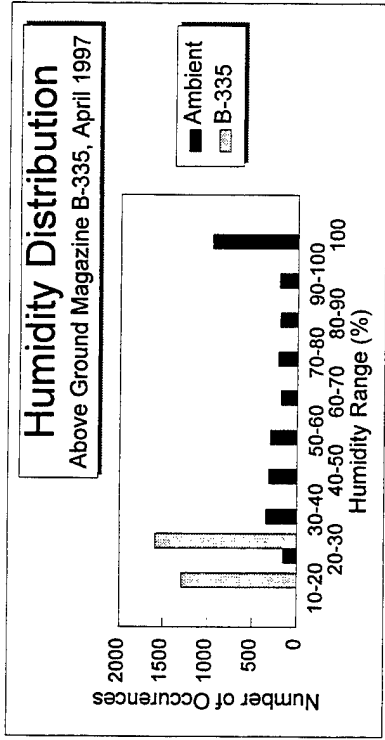


Humidity Distribution
Above Ground Magazine B-135, April 1997



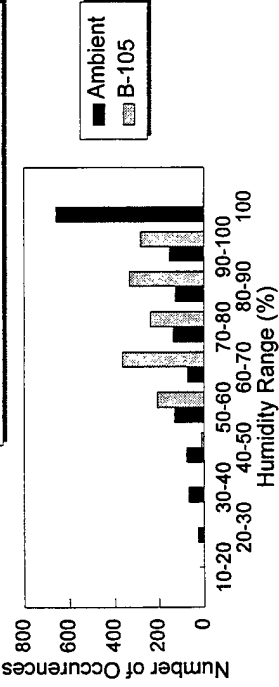
Humidity Distribution
Above Ground Magazine B-177, April 1997





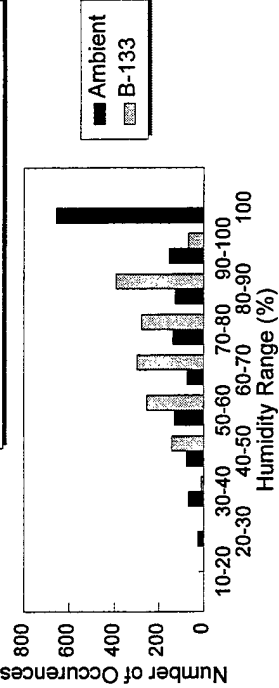
Humidity Distribution

Above Ground Magazine B-105, May 1997



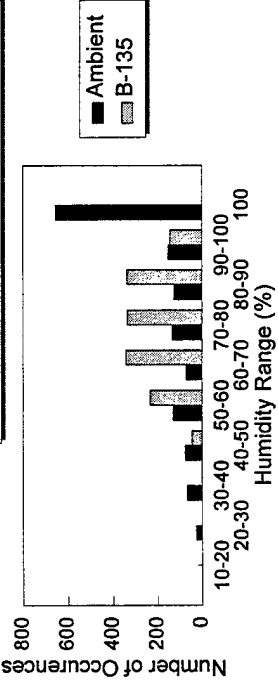
Humidity Distribution

Above Ground Magazine B-133, May 1997



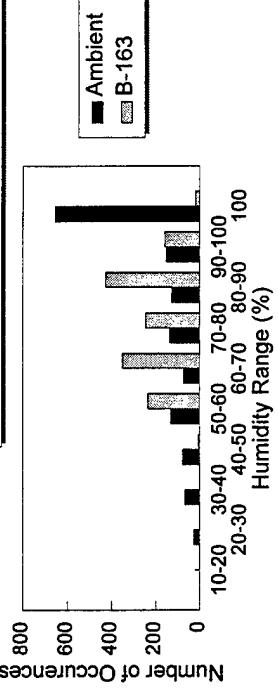
Humidity Distribution

Above Ground Magazine B-135, May 1997



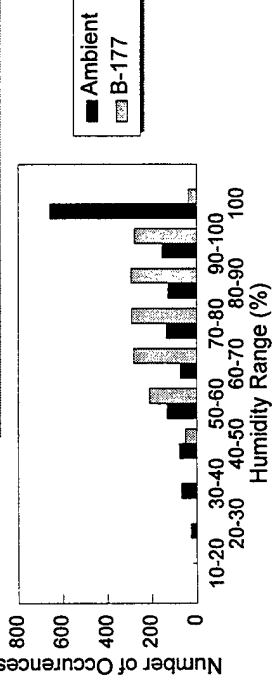
Humidity Distribution

Above Ground Magazine B-163, May 1997



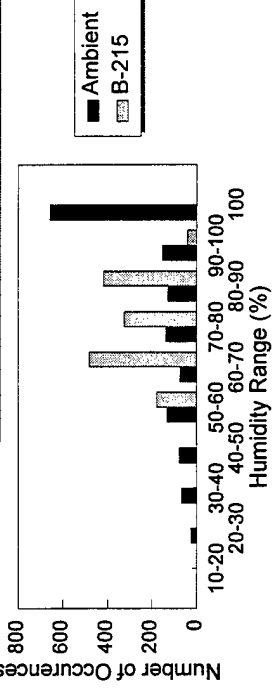
Humidity Distribution

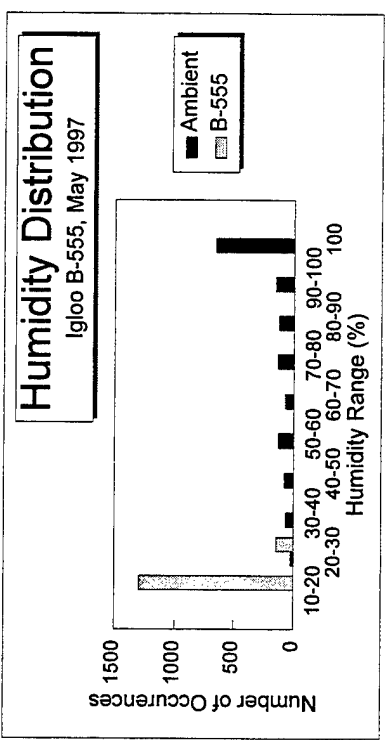
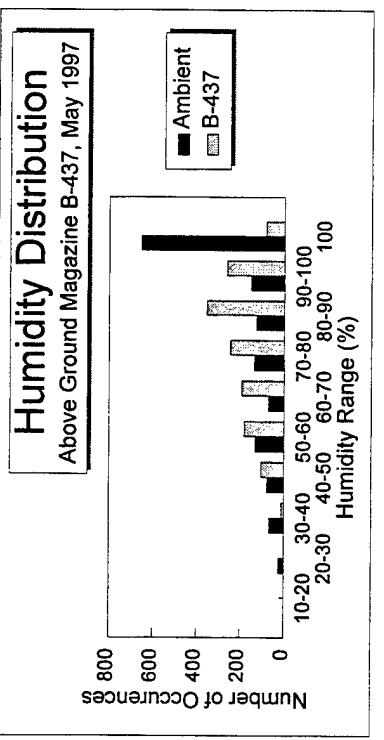
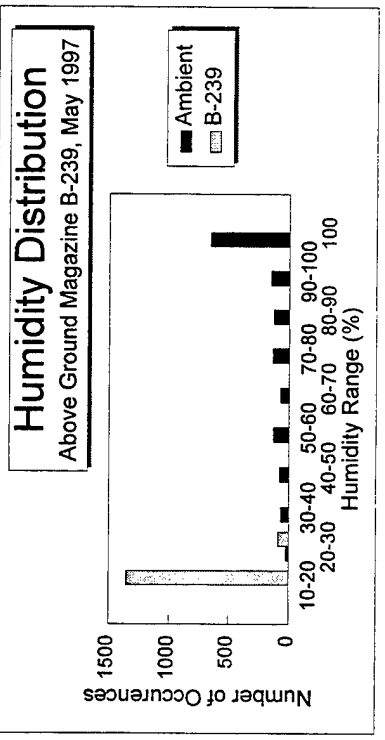
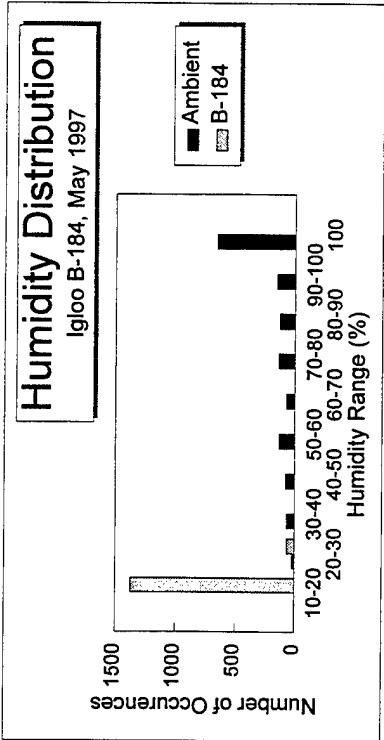
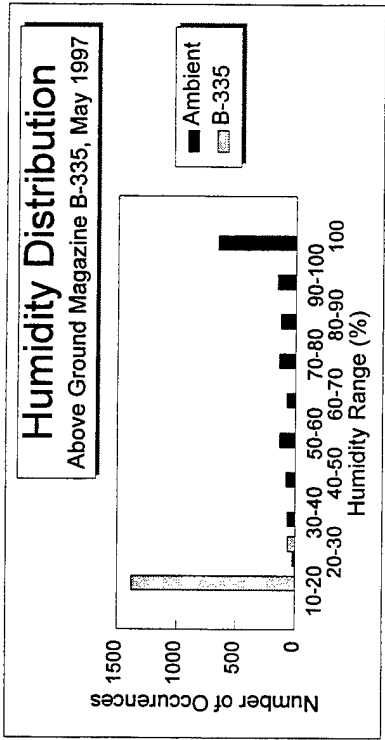
Above Ground Magazine B-177, May 1997



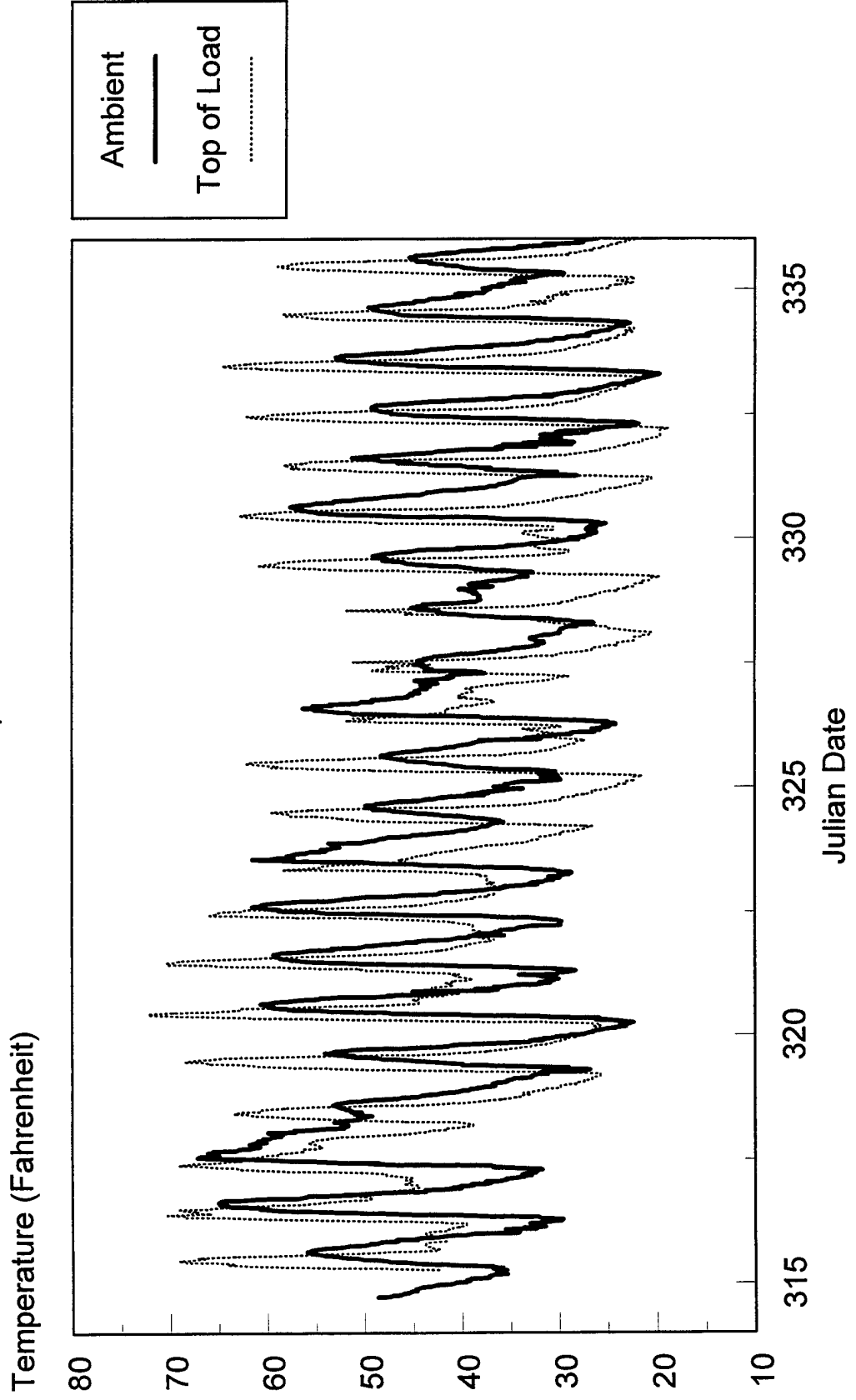
Humidity Distribution

Above Ground Magazine B-215, May 1997

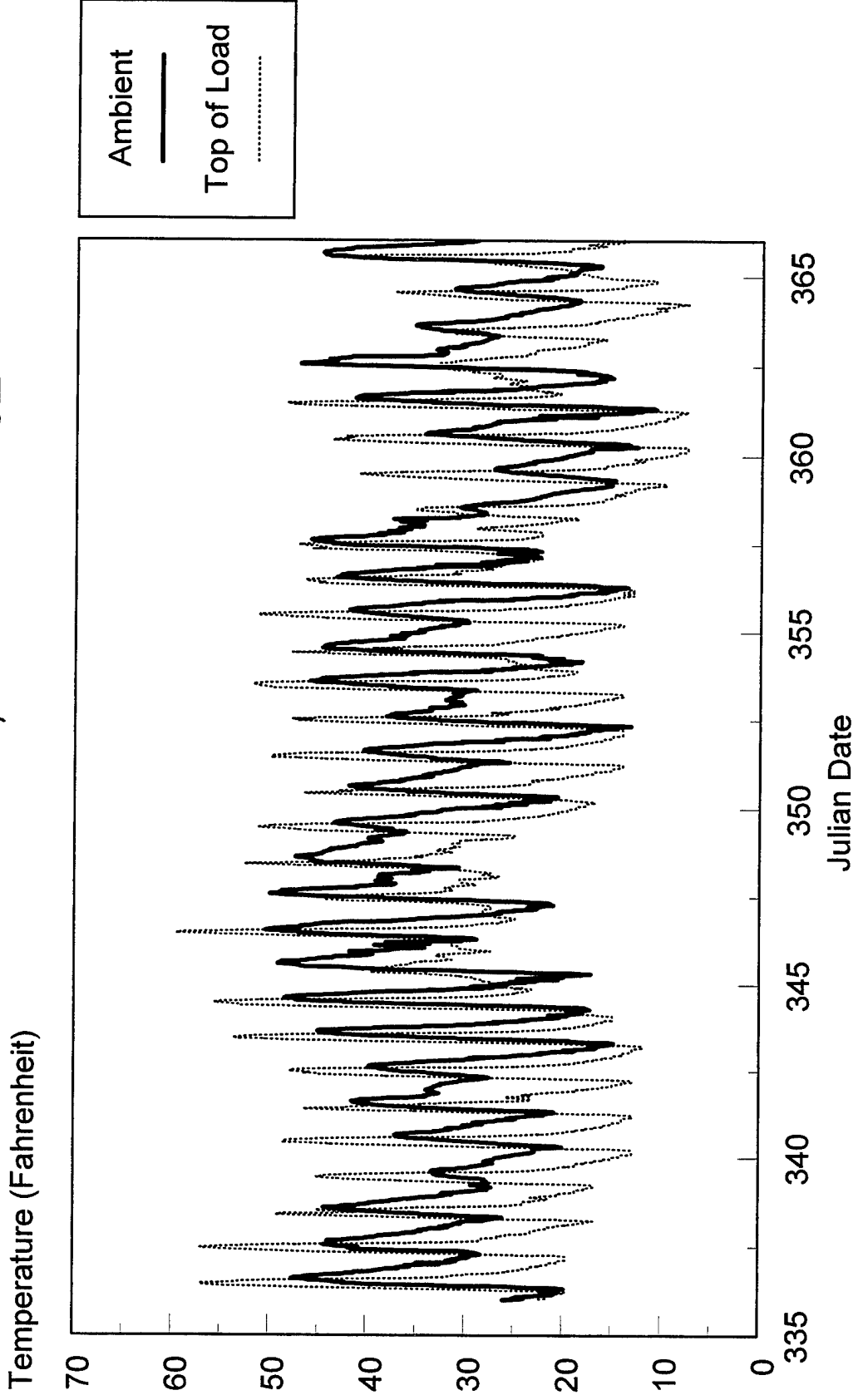




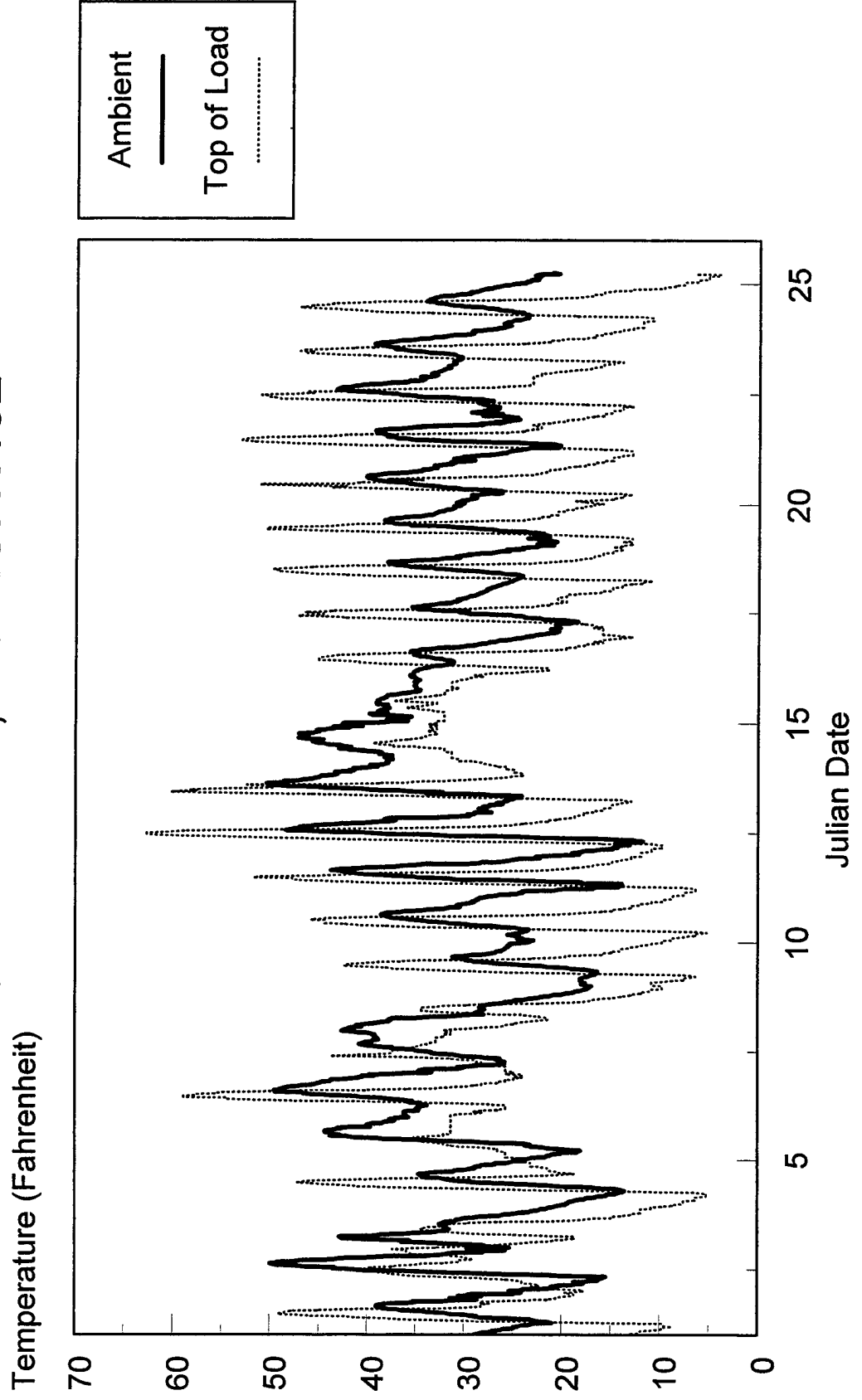
1995 Ammunition Storage Monitoring
2nd ID, South Korea
Quonset Hut, DODIC: N402



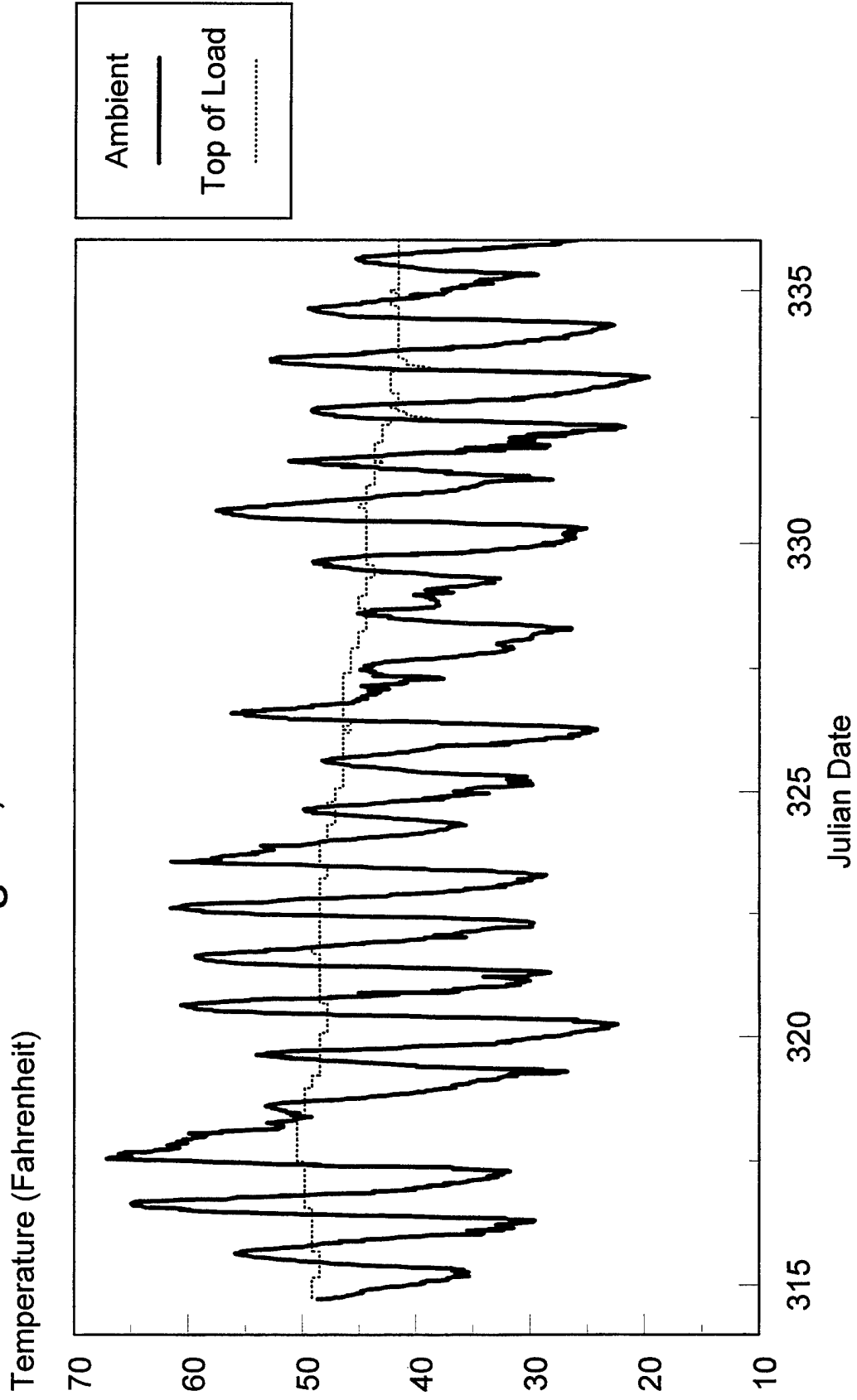
1995 Ammunition Storage Monitoring
2nd ID, South Korea
Quonset Hut, DODIC: N402



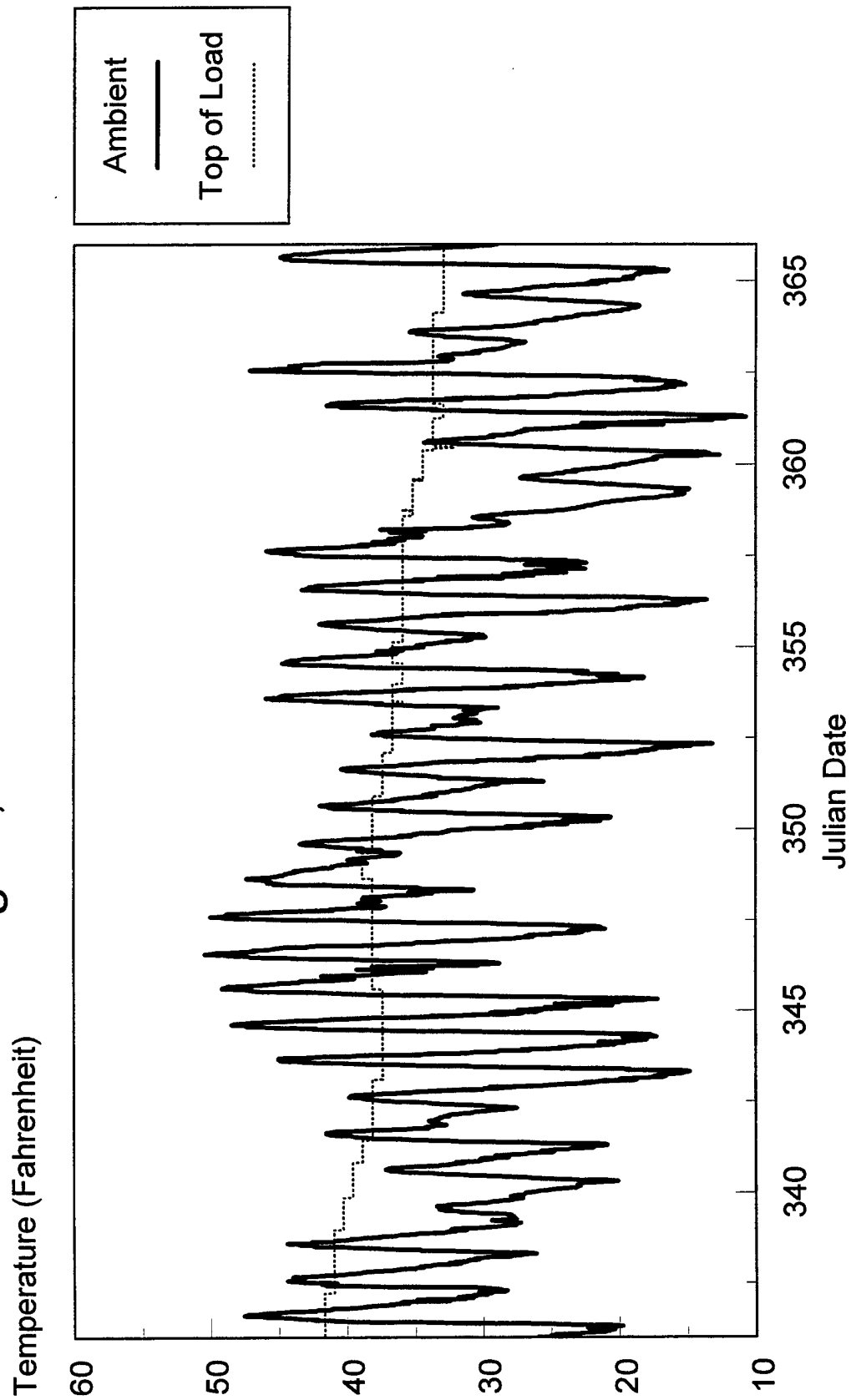
1996 Ammunition Storage Monitoring
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Quonset Hut, DODIC: N402



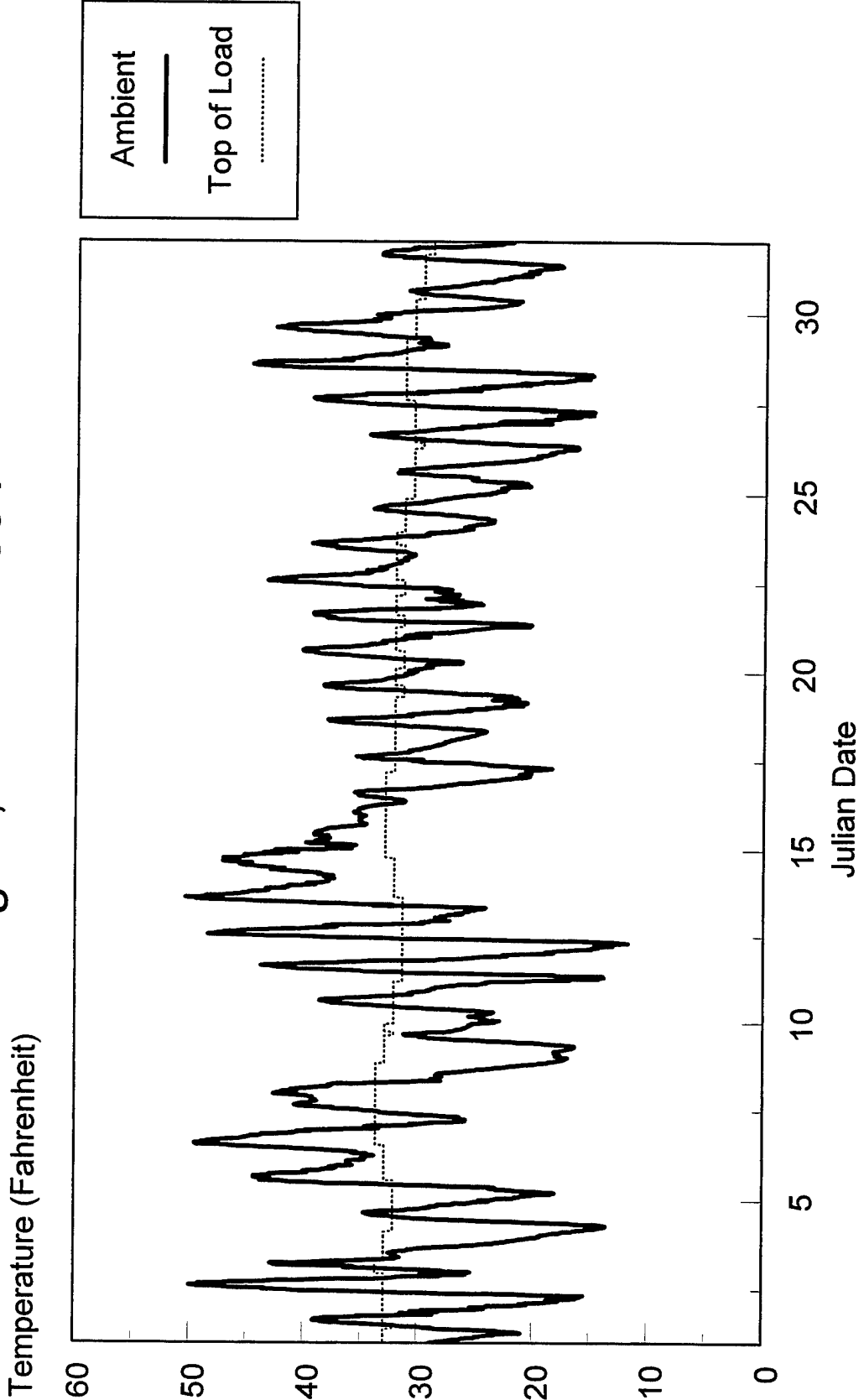
1995 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684



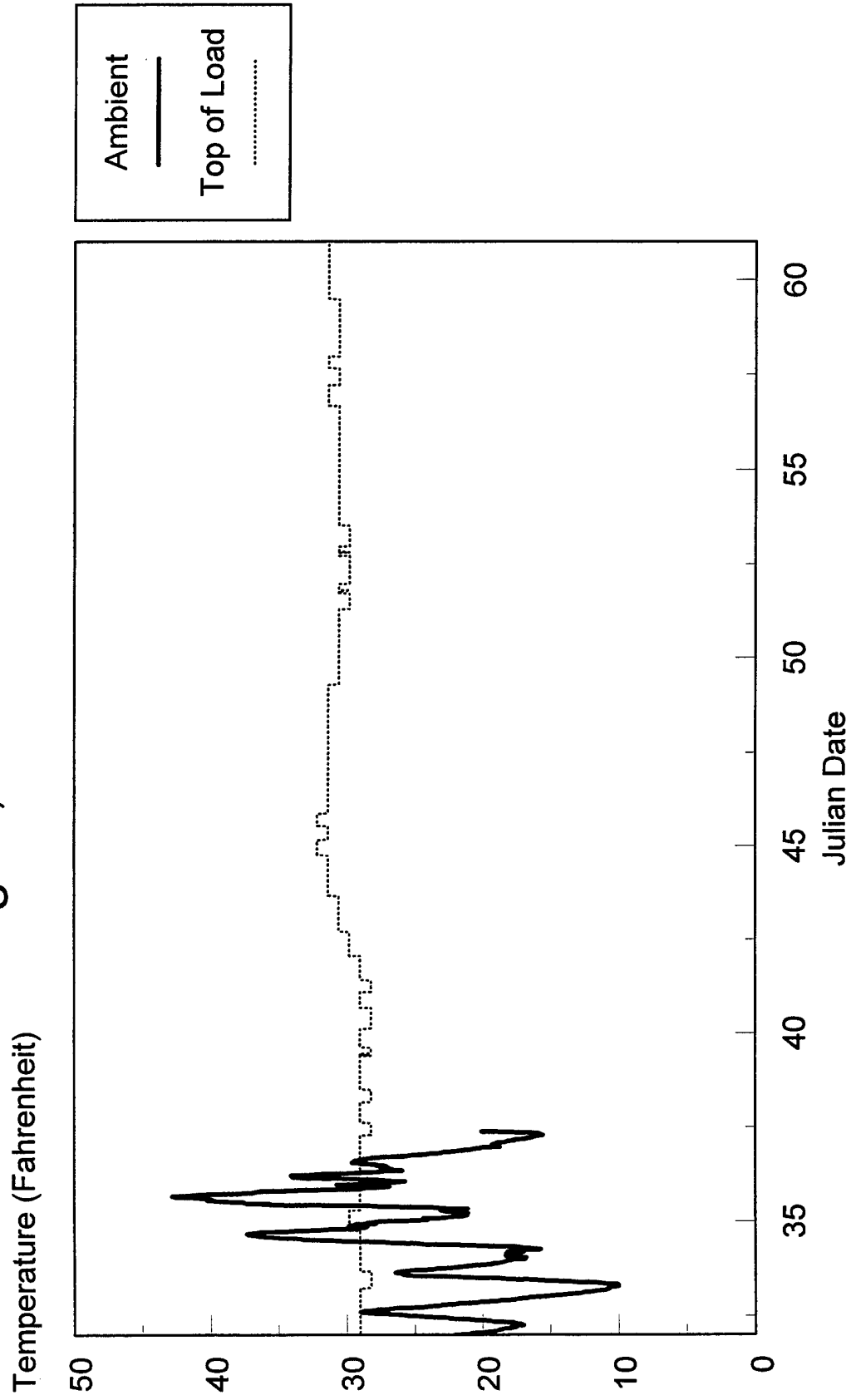
1995 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684



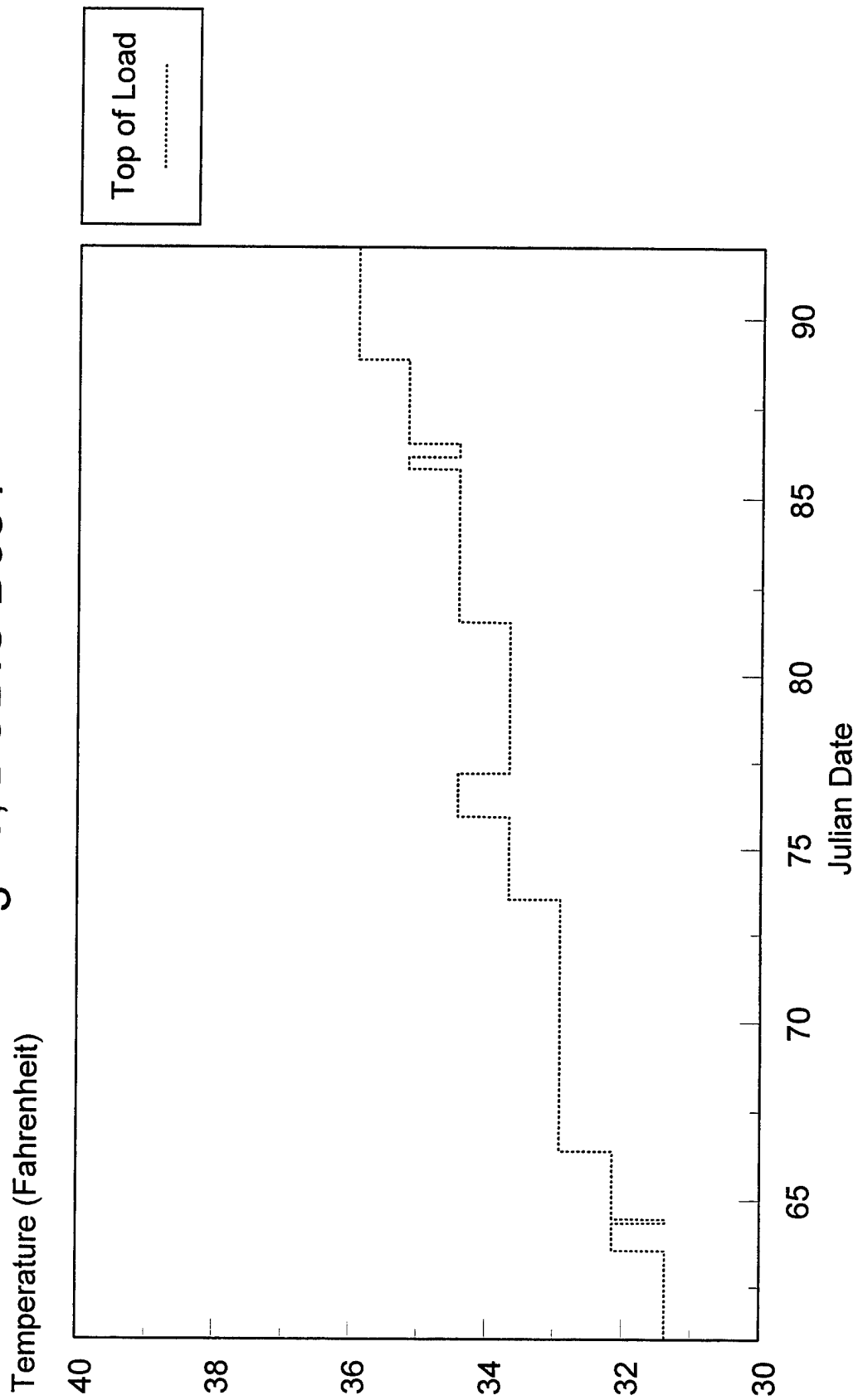
1996 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684



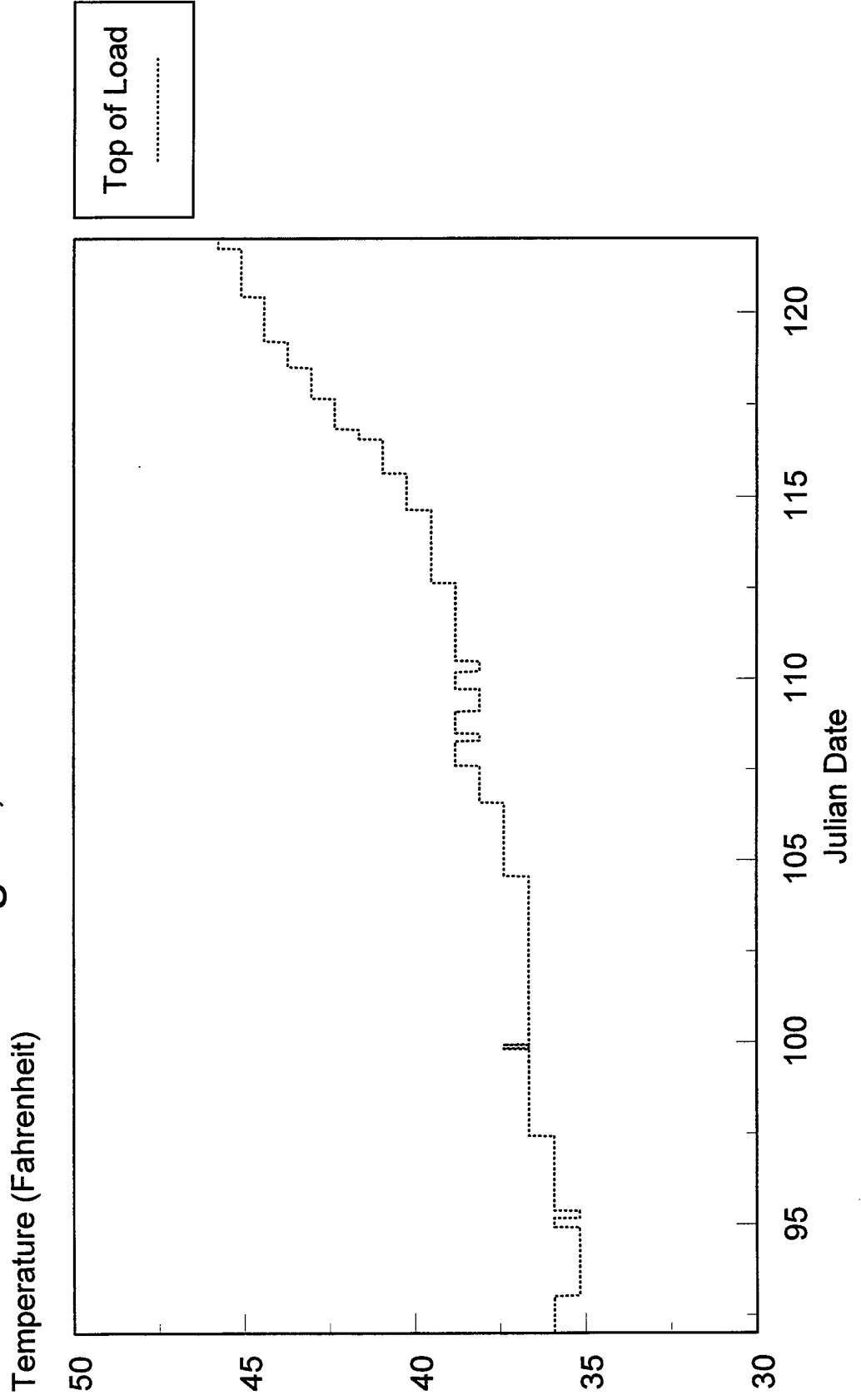
1996 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684



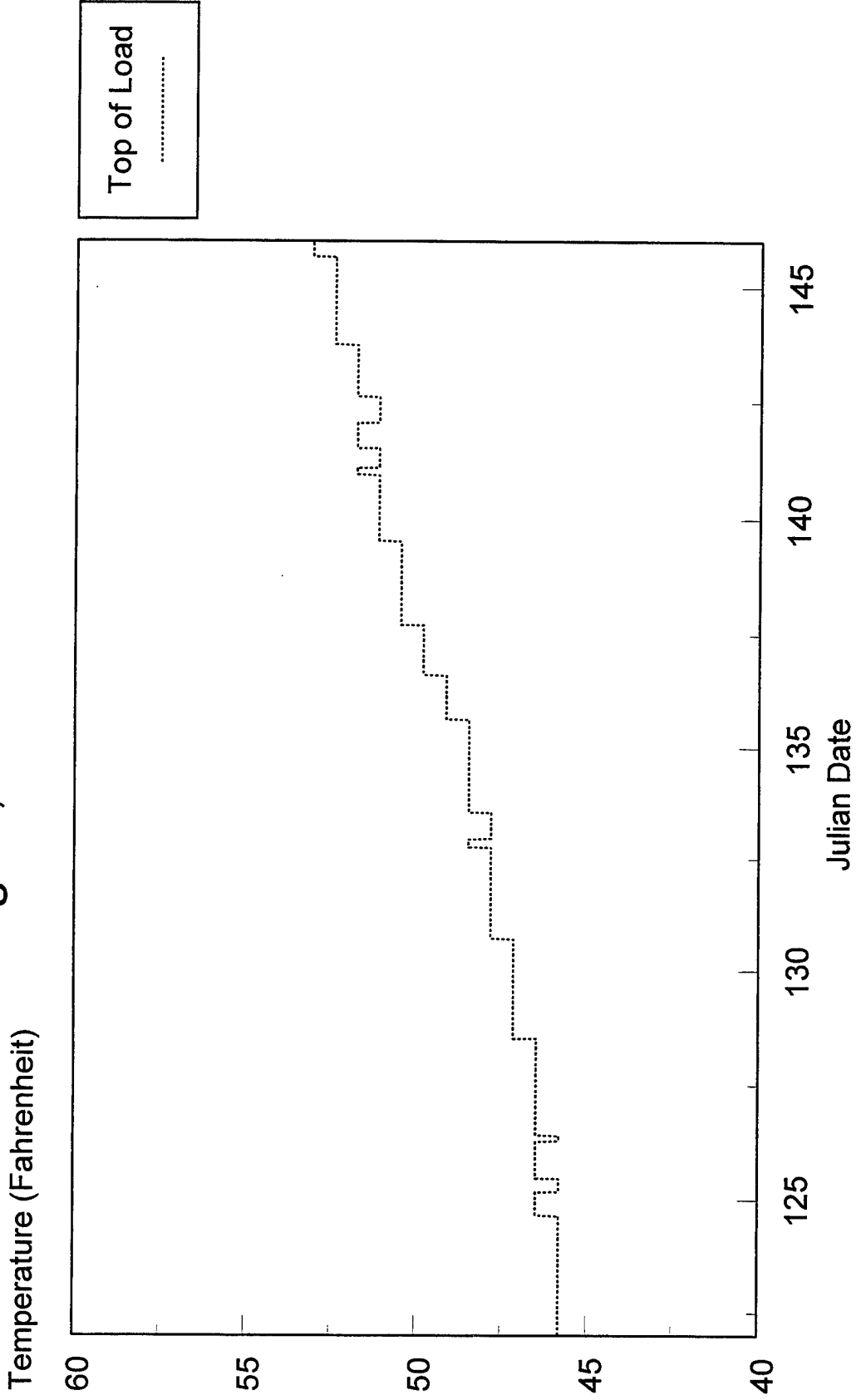
1996 Ammunition Storage Monitoring
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Igloo, DODIC D684



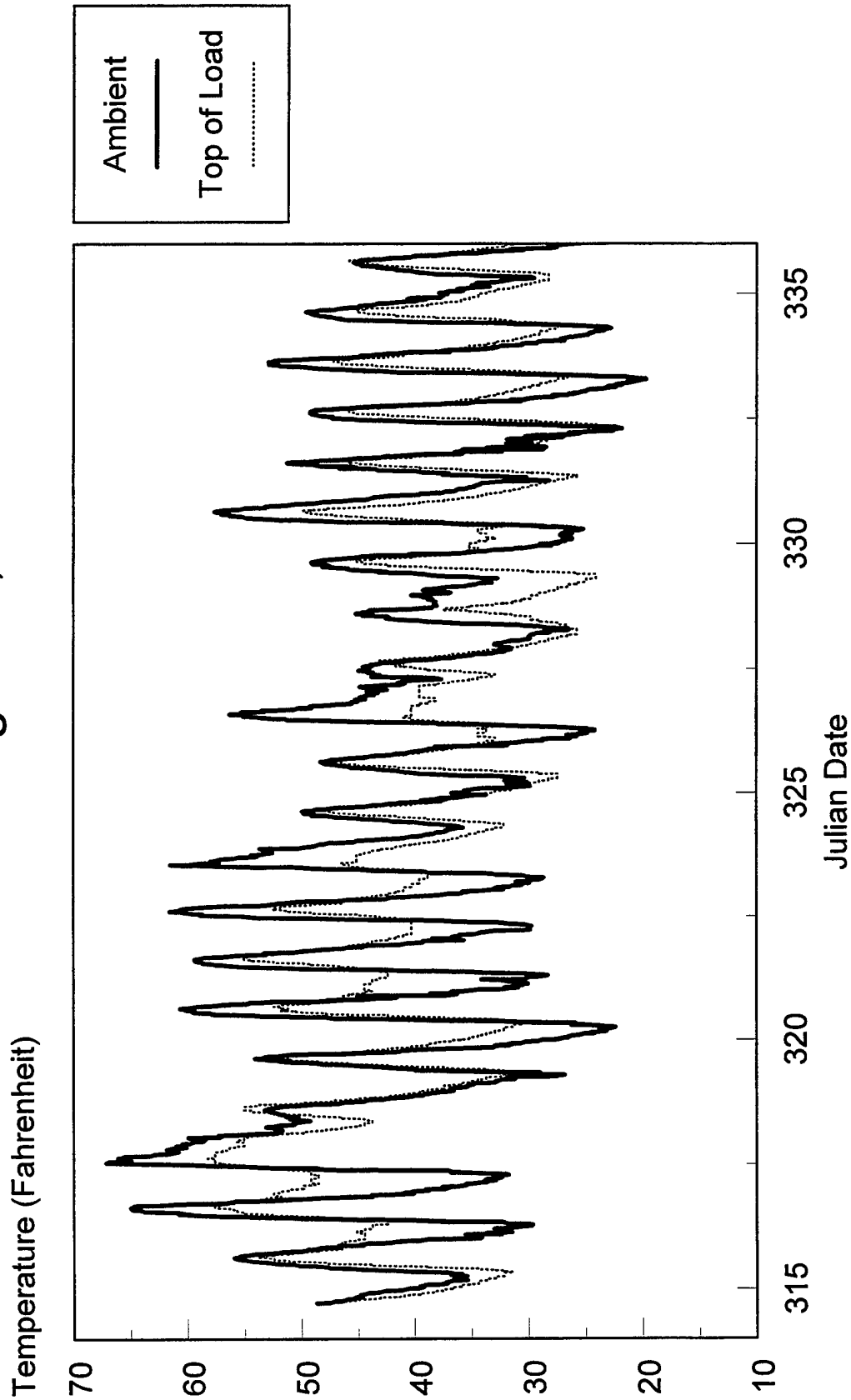
1996 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684



1996 Ammunition Storage Monitoring
2nd ID, South Korea
Igloo, DODIC D684

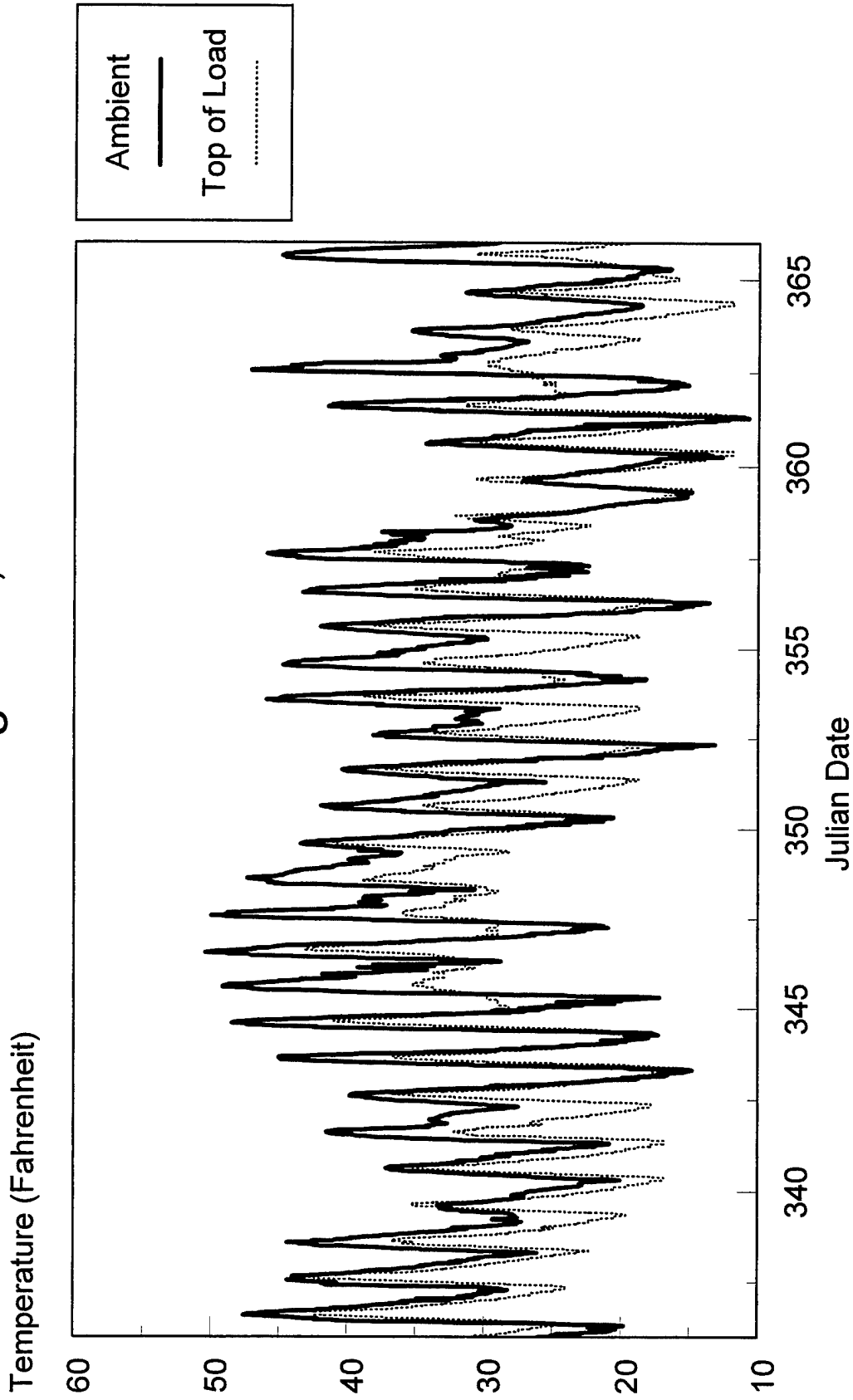


1995 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC:N464

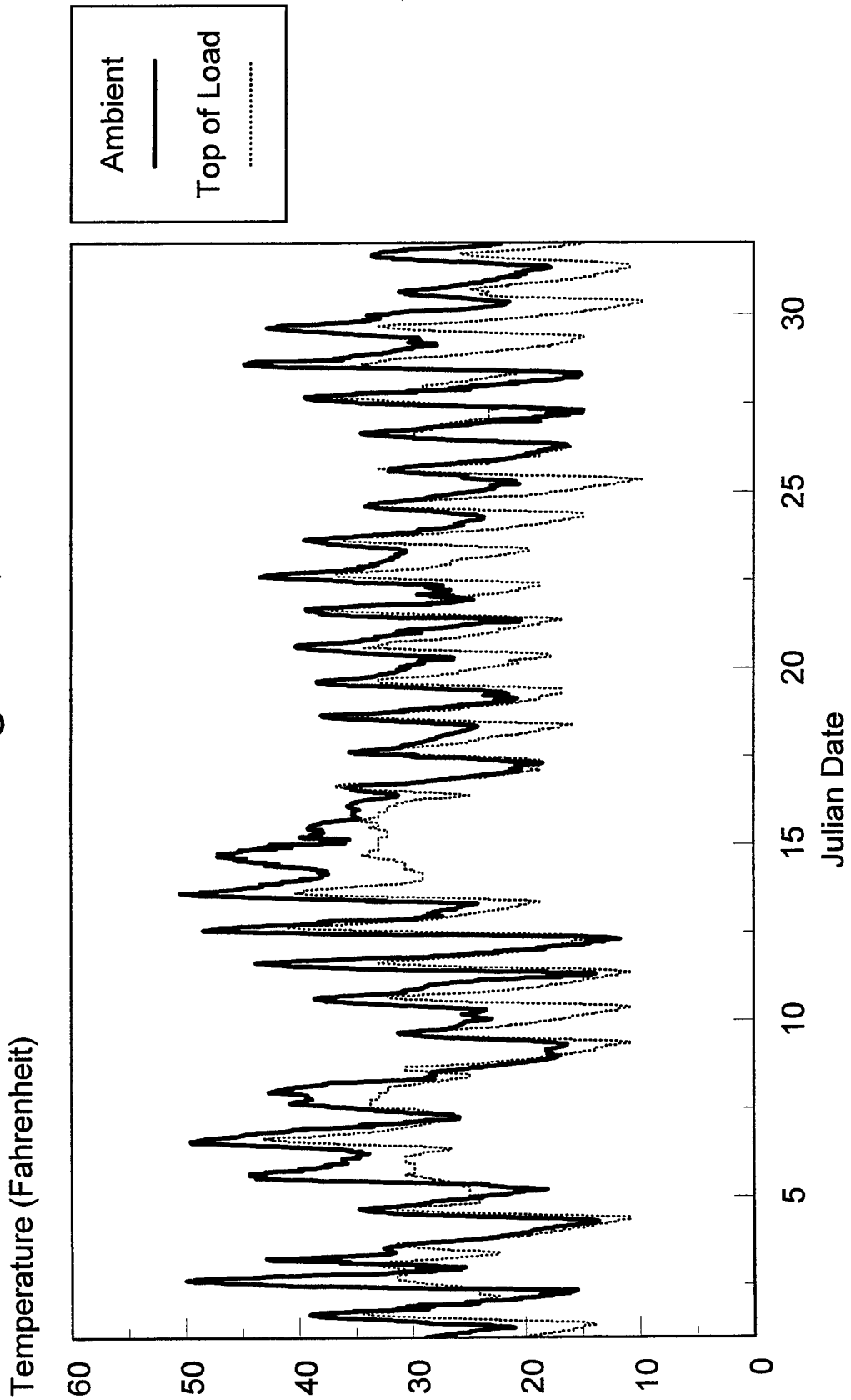


1995 Ammunition Storage Monitoring
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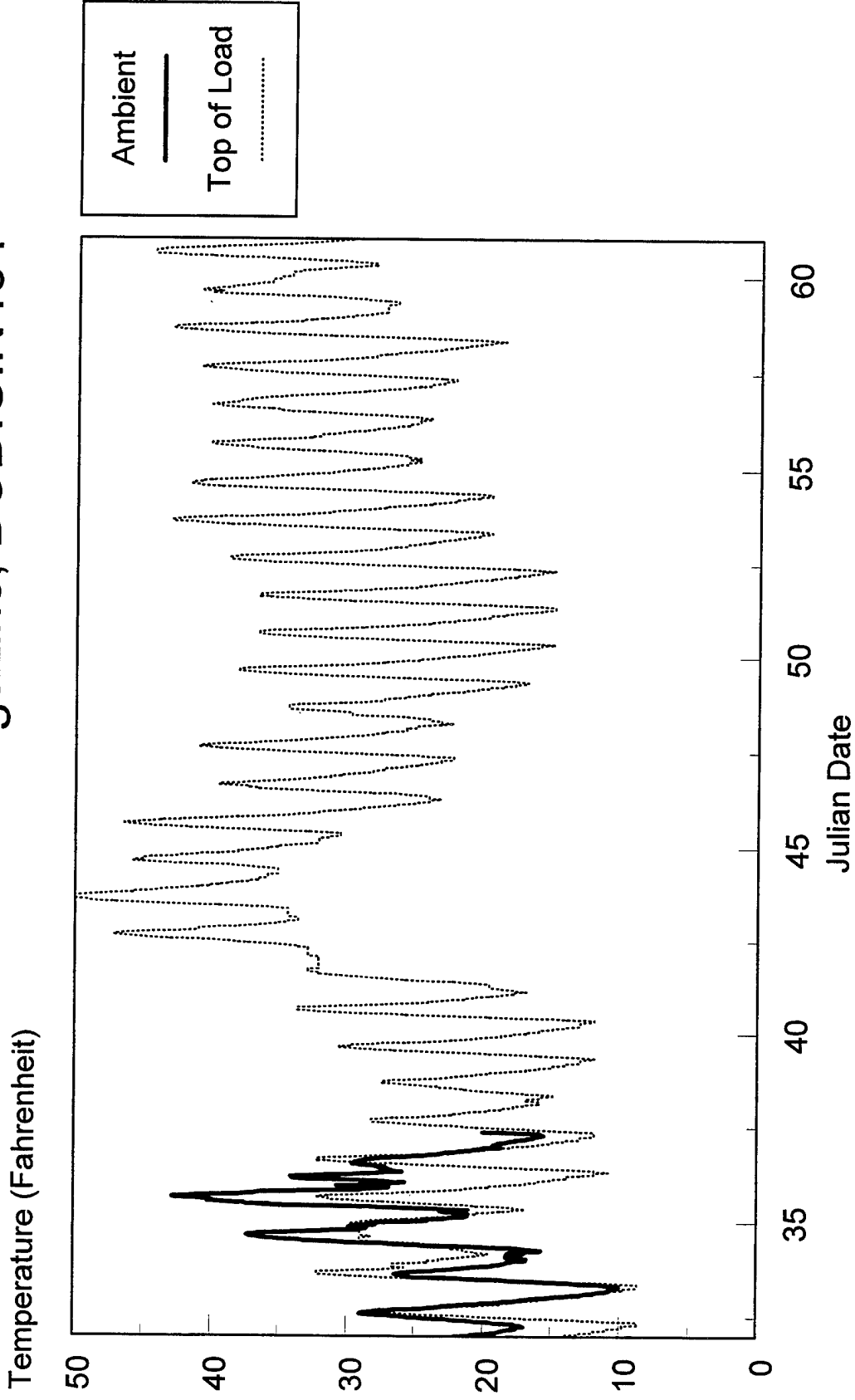
Above Ground Magazine, DODIC:N464



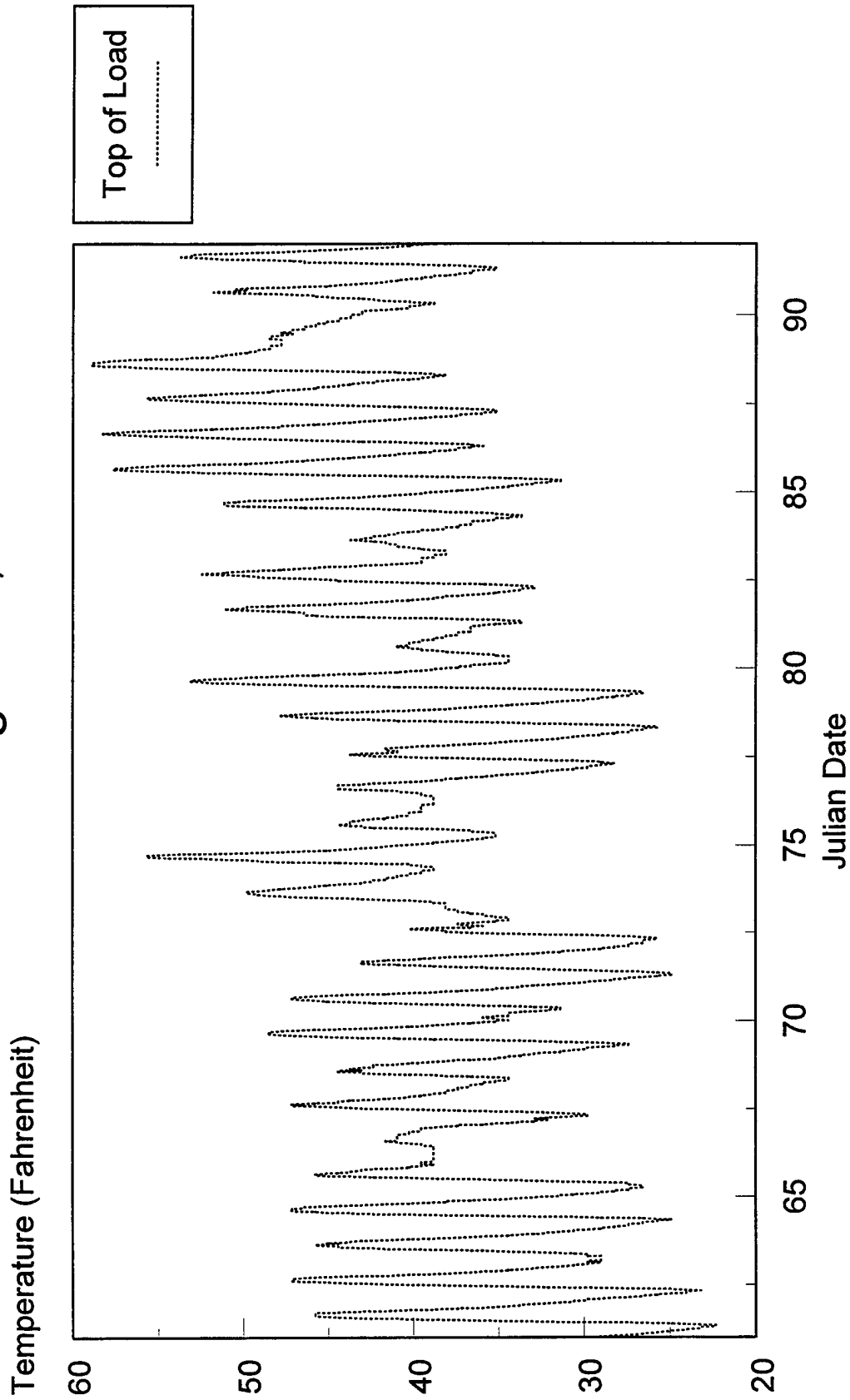
1996 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC:N464



1996 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC:N464

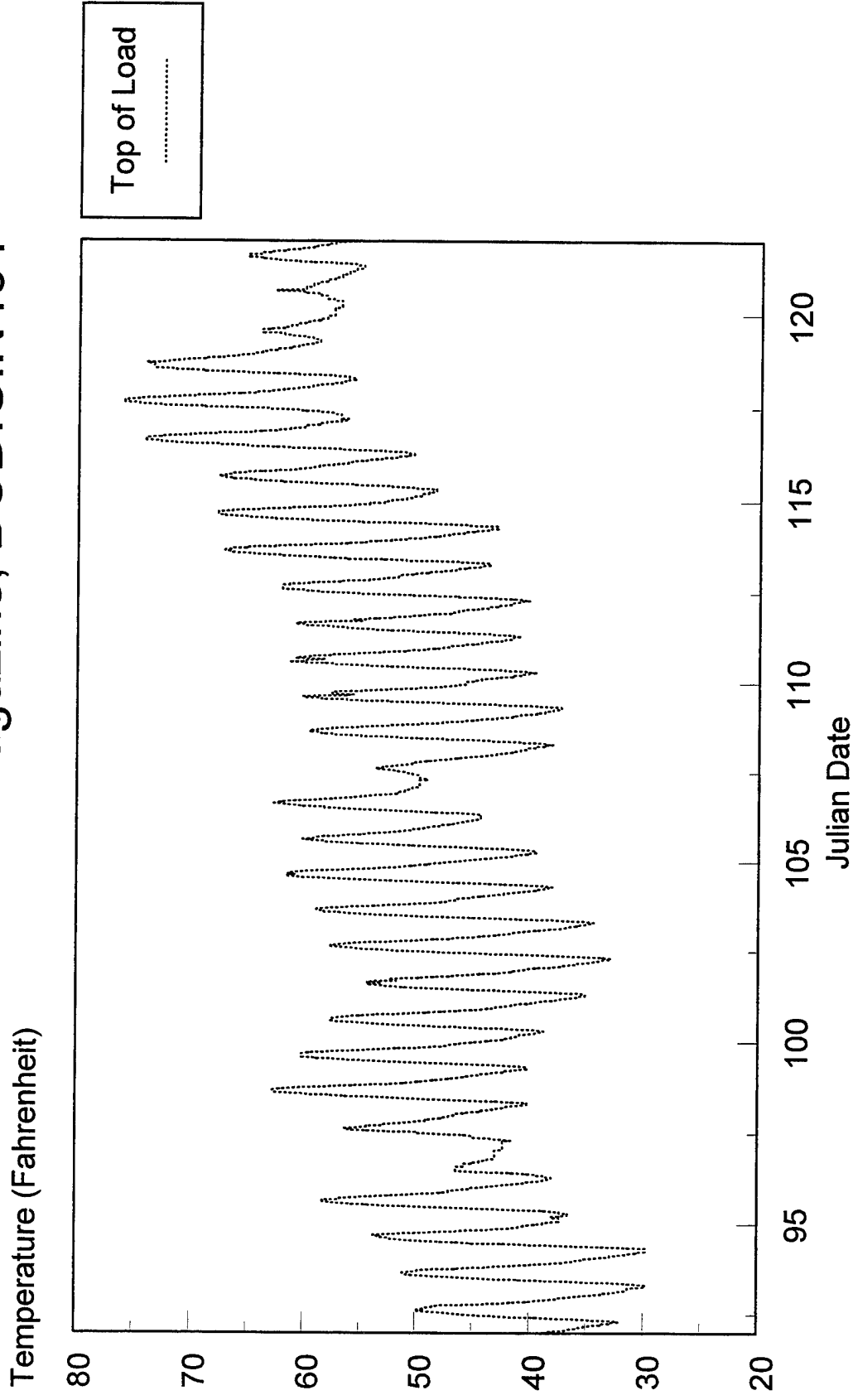


1996 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC:N464

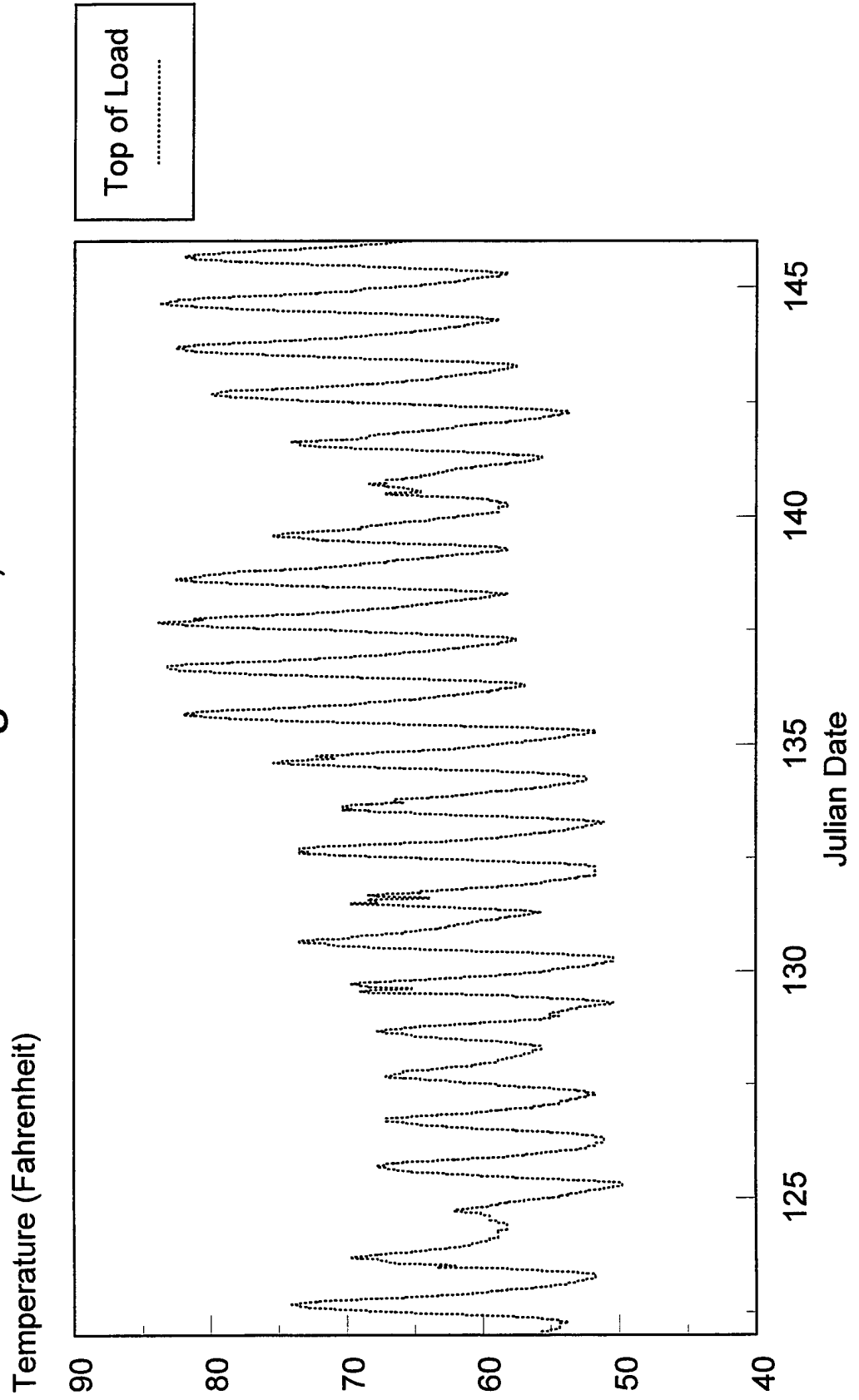


1996 Ammunition Storage Monitoring
2nd ID, South Korea

Above Ground Magazine, DODIC:N464

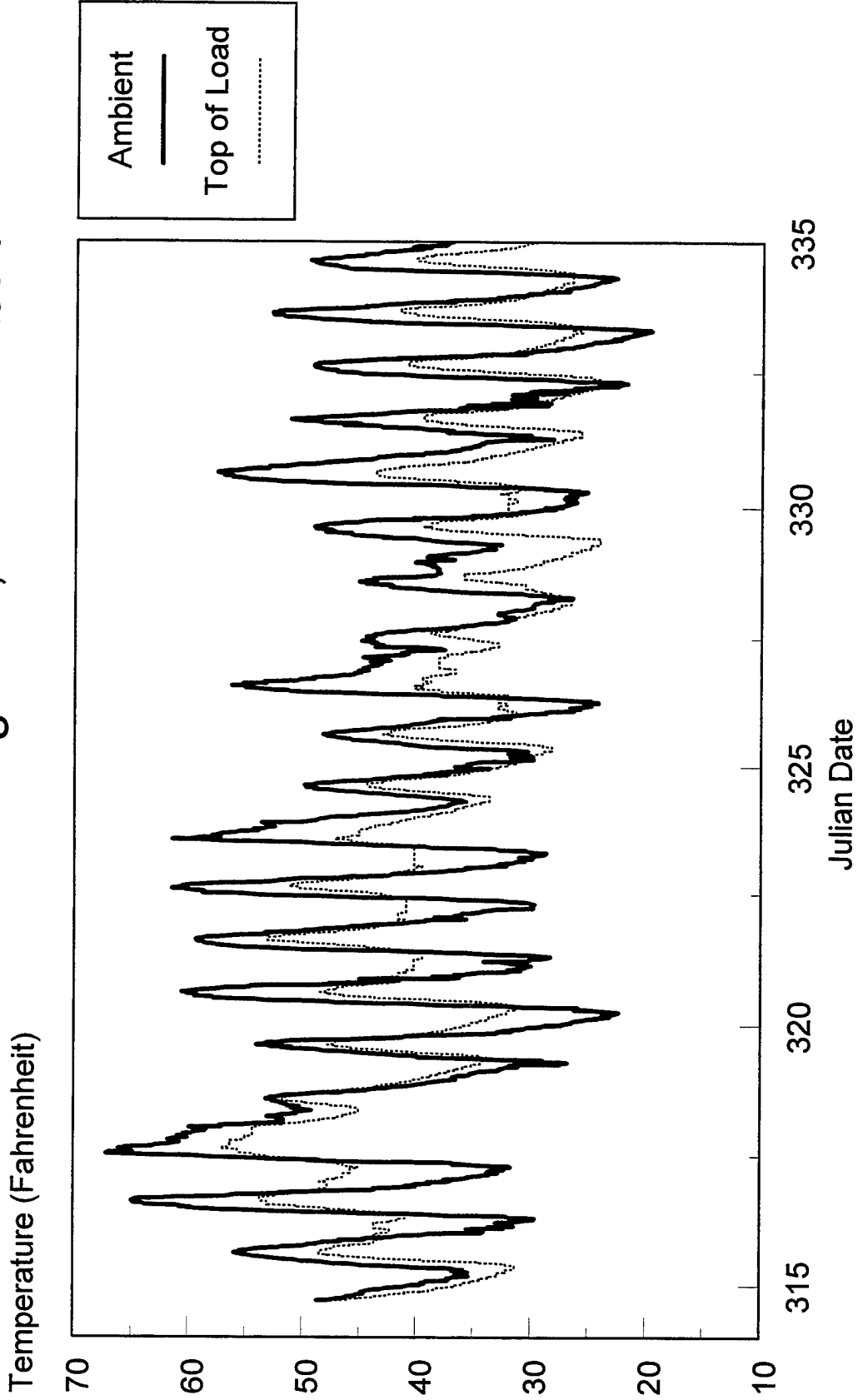


1996 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC:N464

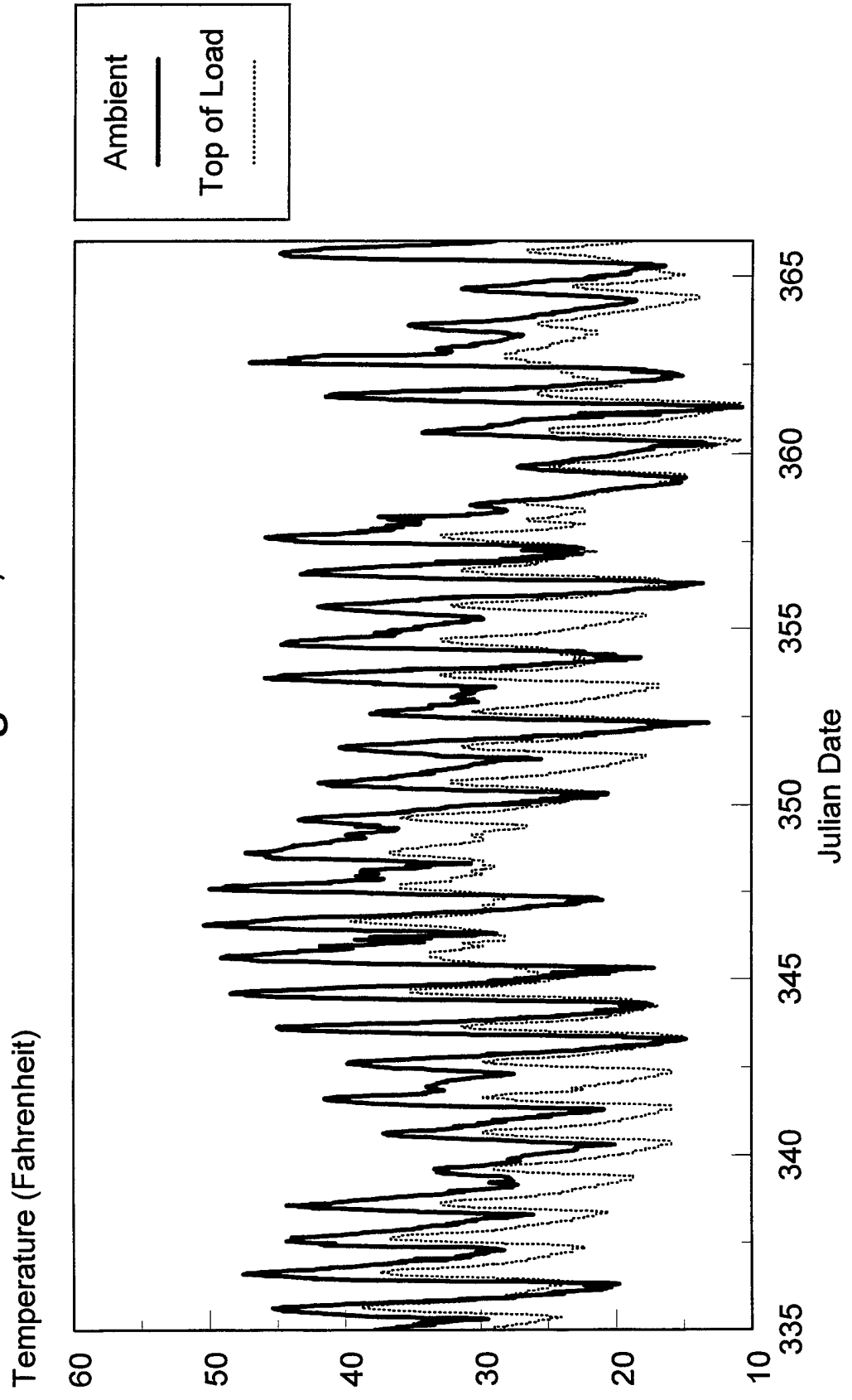


1995 Ammunition Storage Monitoring
2nd ID, South Korea

Above Ground Magazine, DODIC: A974

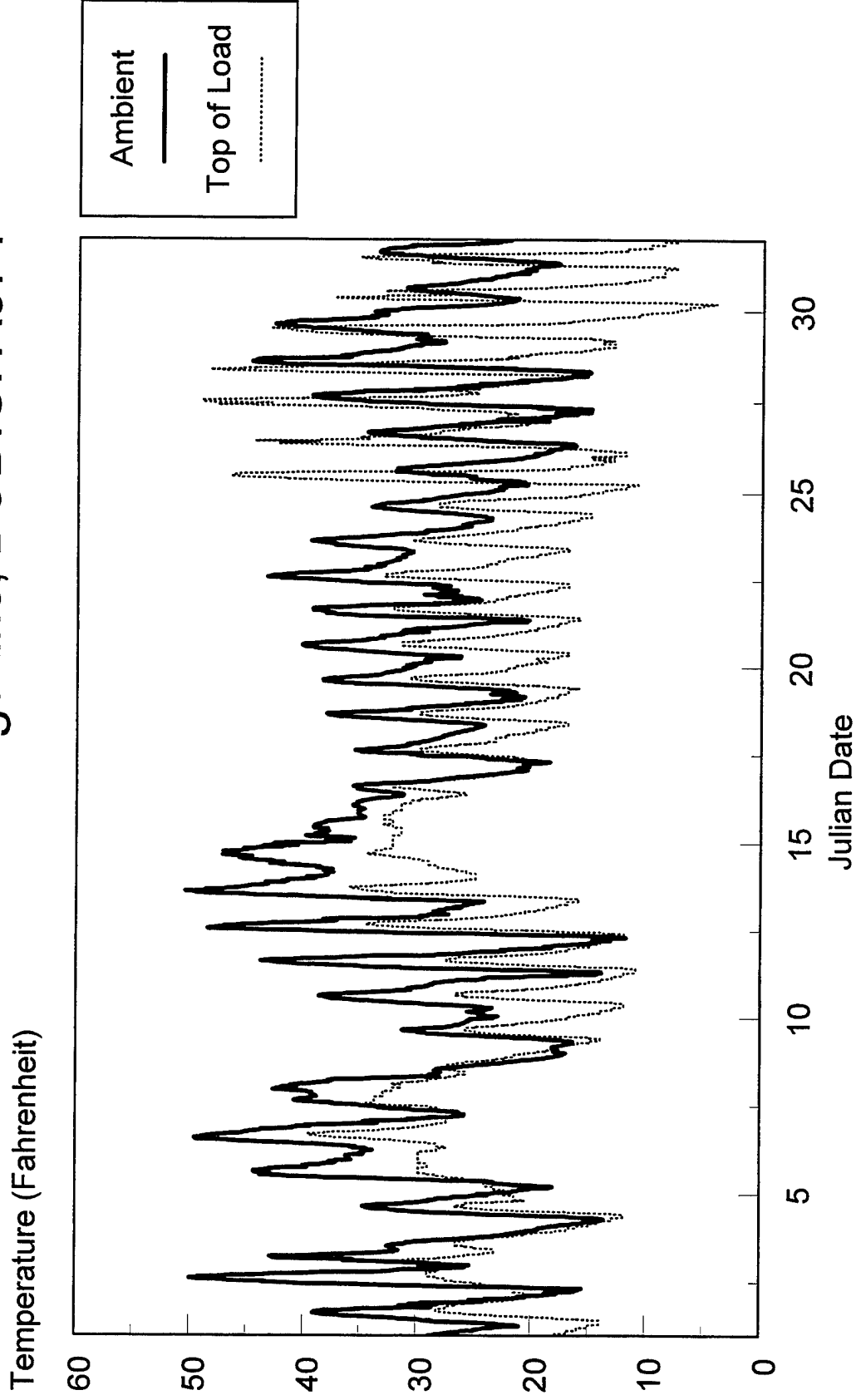


1995 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC: A974



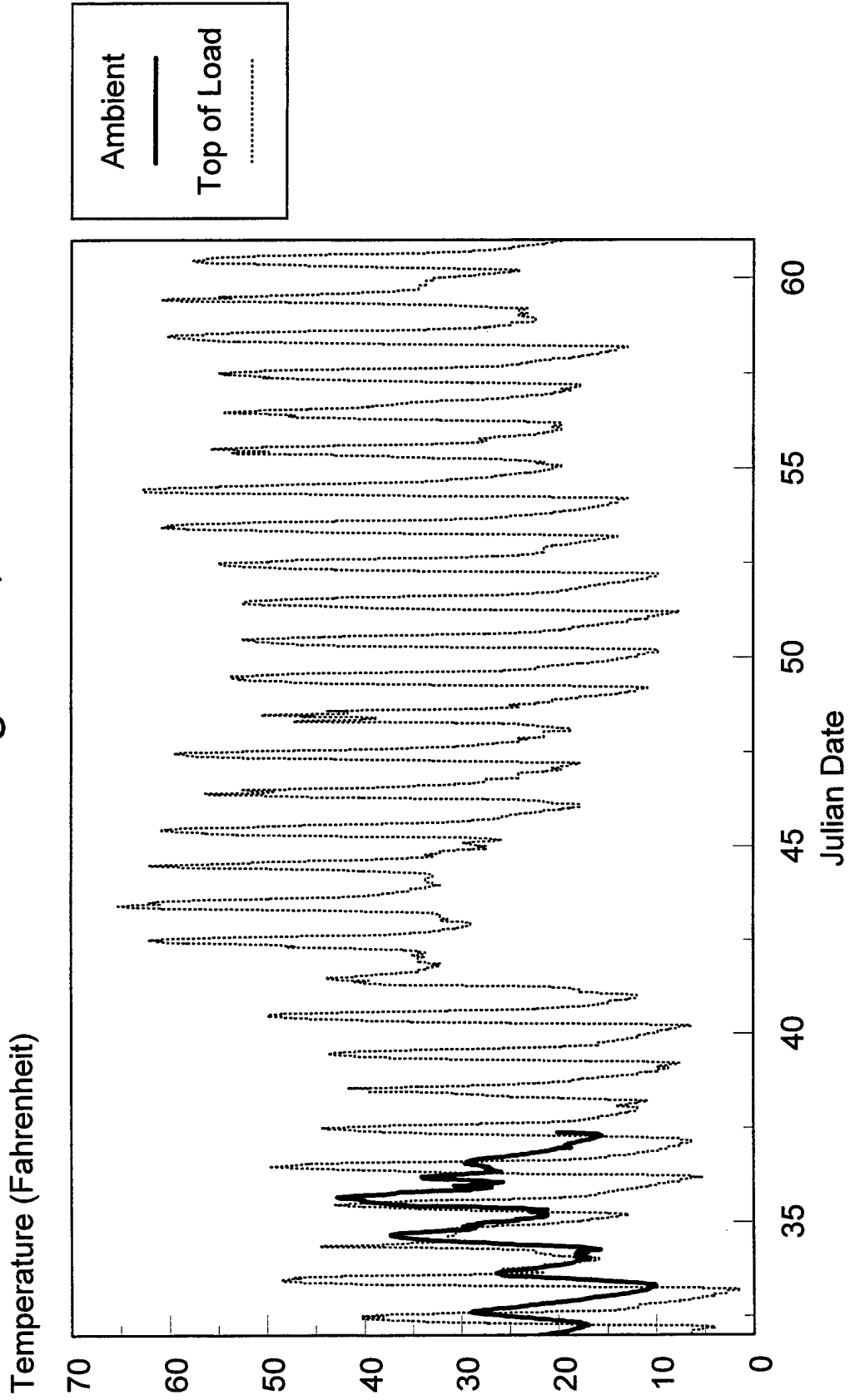
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2nd ID, South Korea

Above Ground Magazine, DODIC: A974



1996 Ammunition Storage Monitoring
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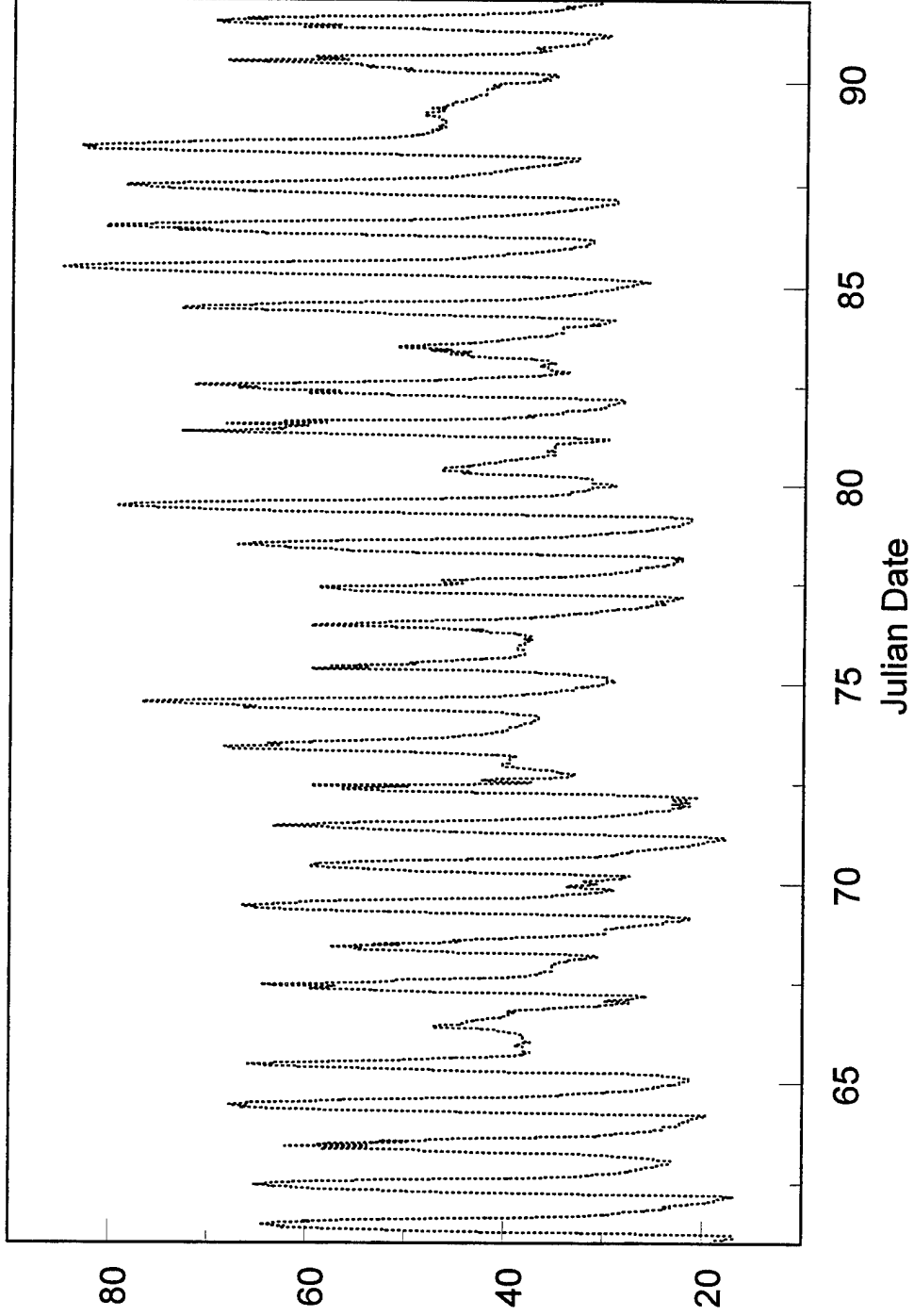
Above Ground Magazine, DODIC: A974



1996 Ammunition Storage Monitoring
2nd ID, South Korea

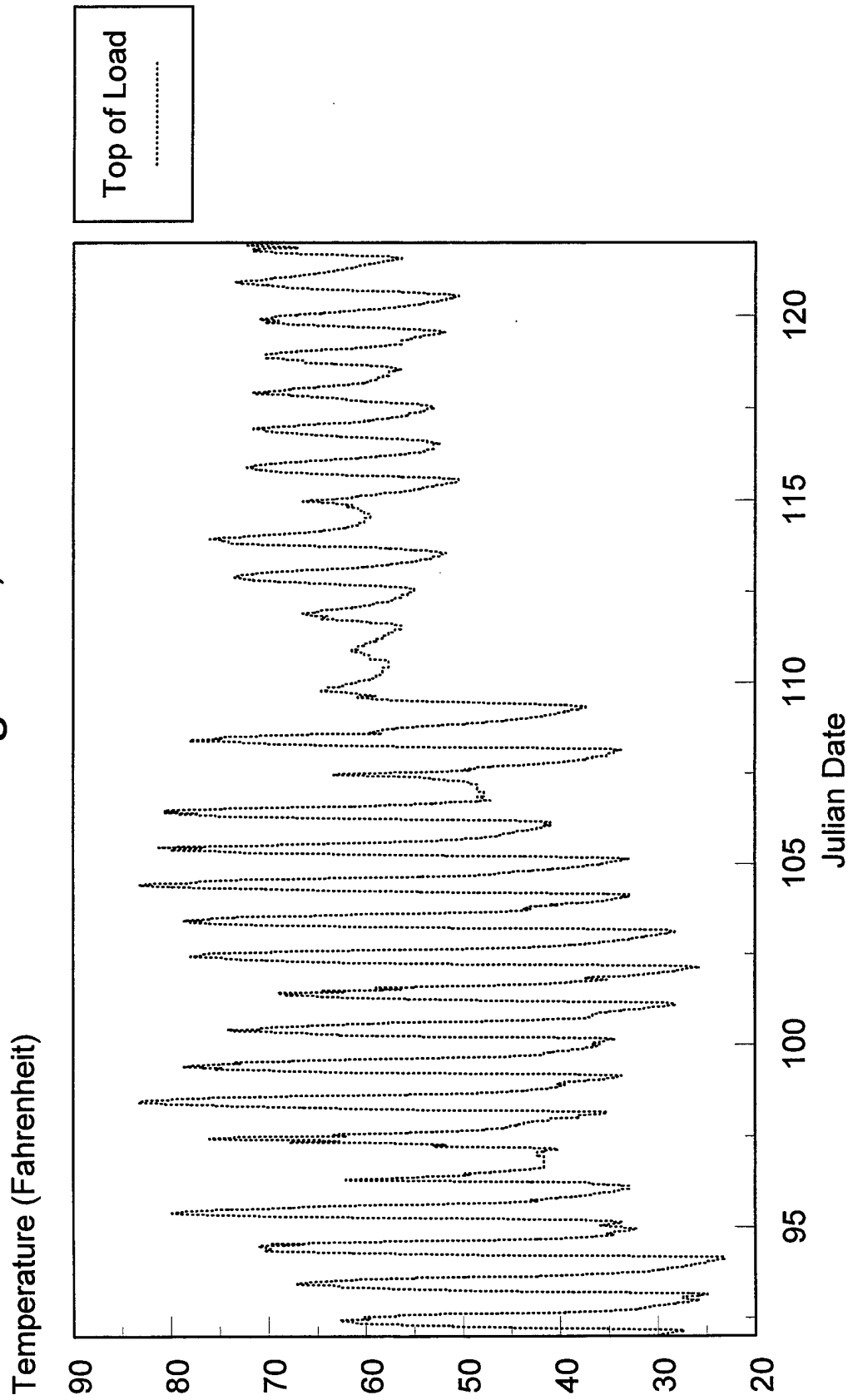
Above Ground Magazine, DODIC: A974

Temperature (Fahrenheit)



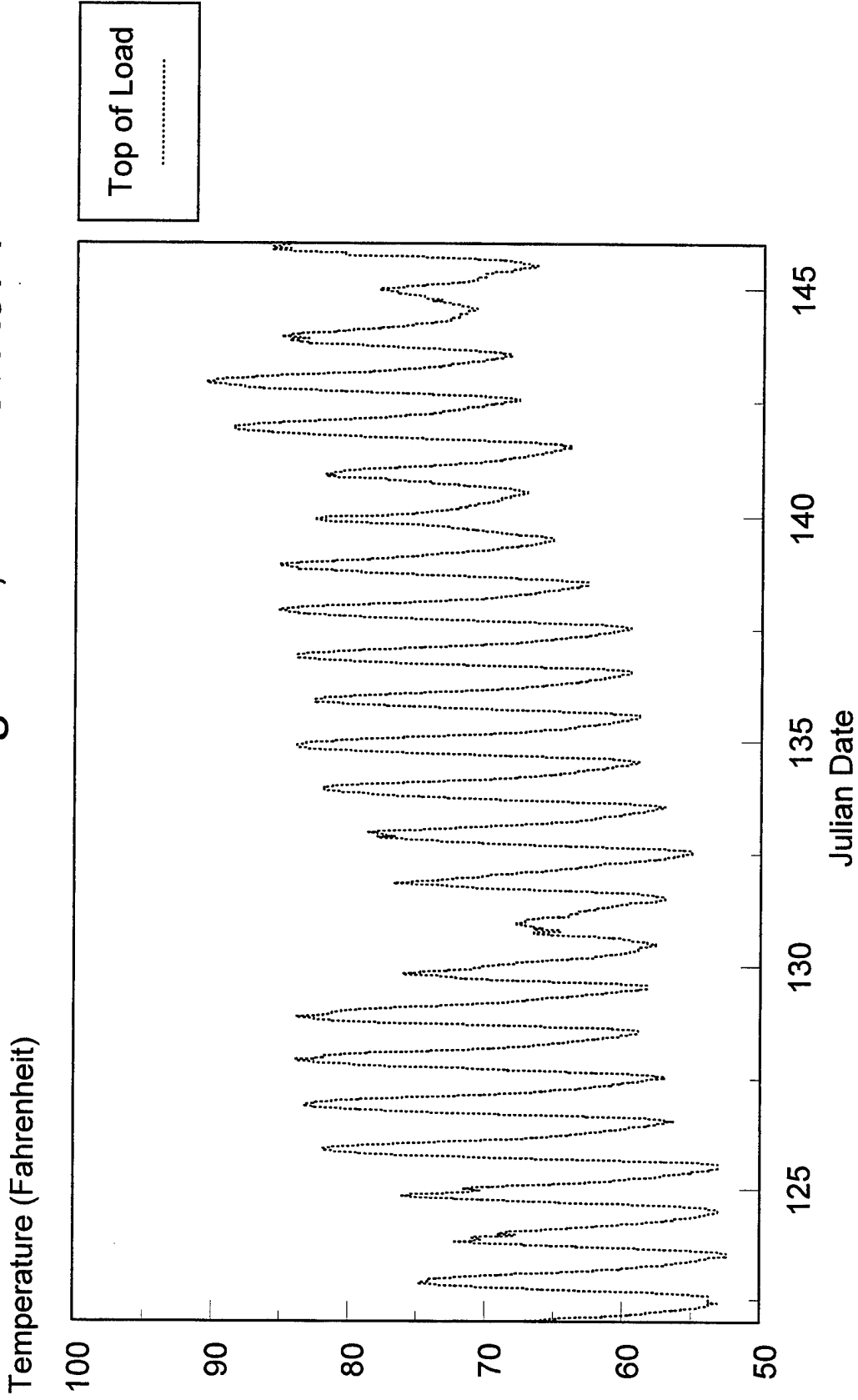
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Above Ground Magazine, DODIC: A974



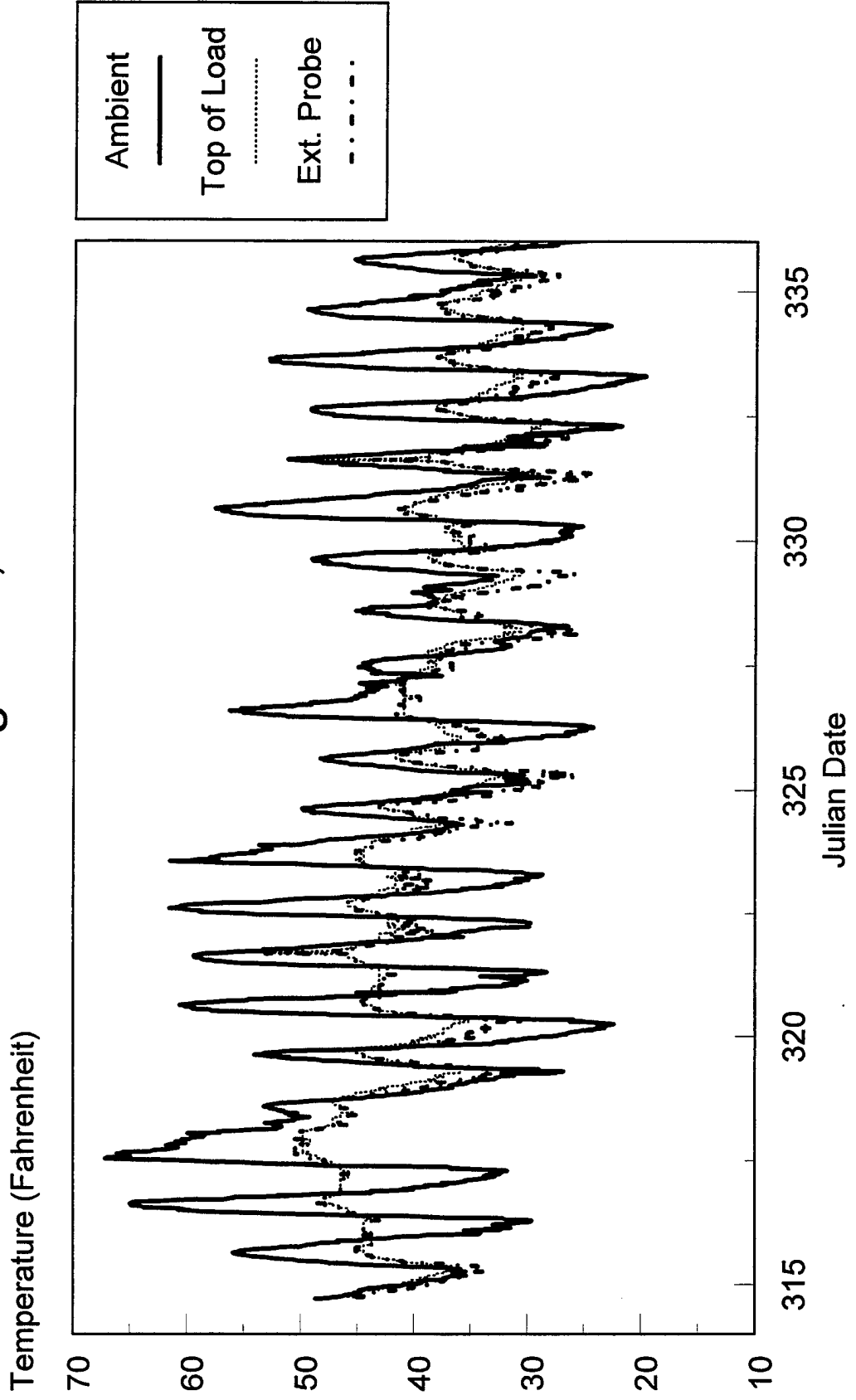
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2nd ID, South Korea

Above Ground Magazine, DODIC: A974

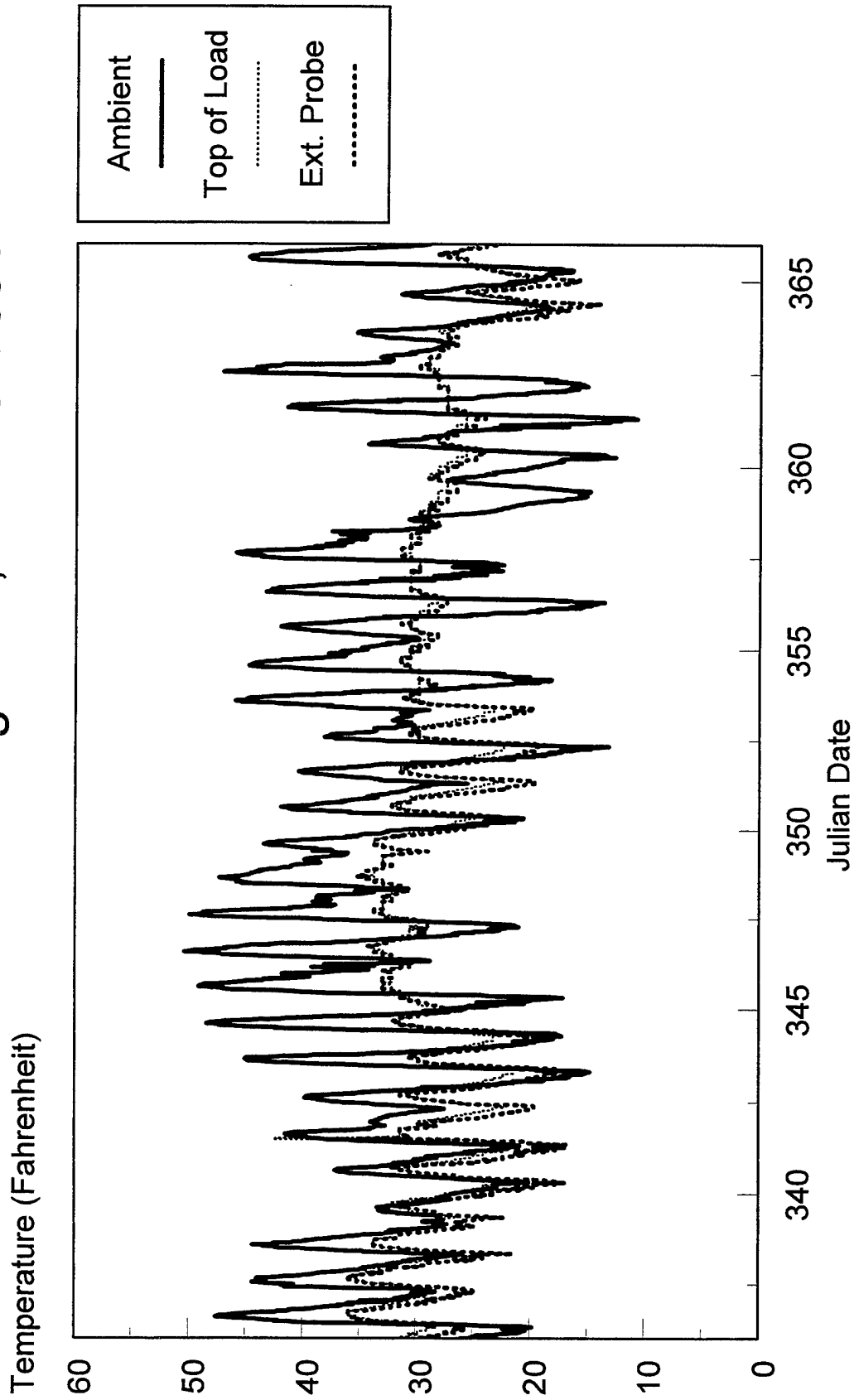


Top of Load
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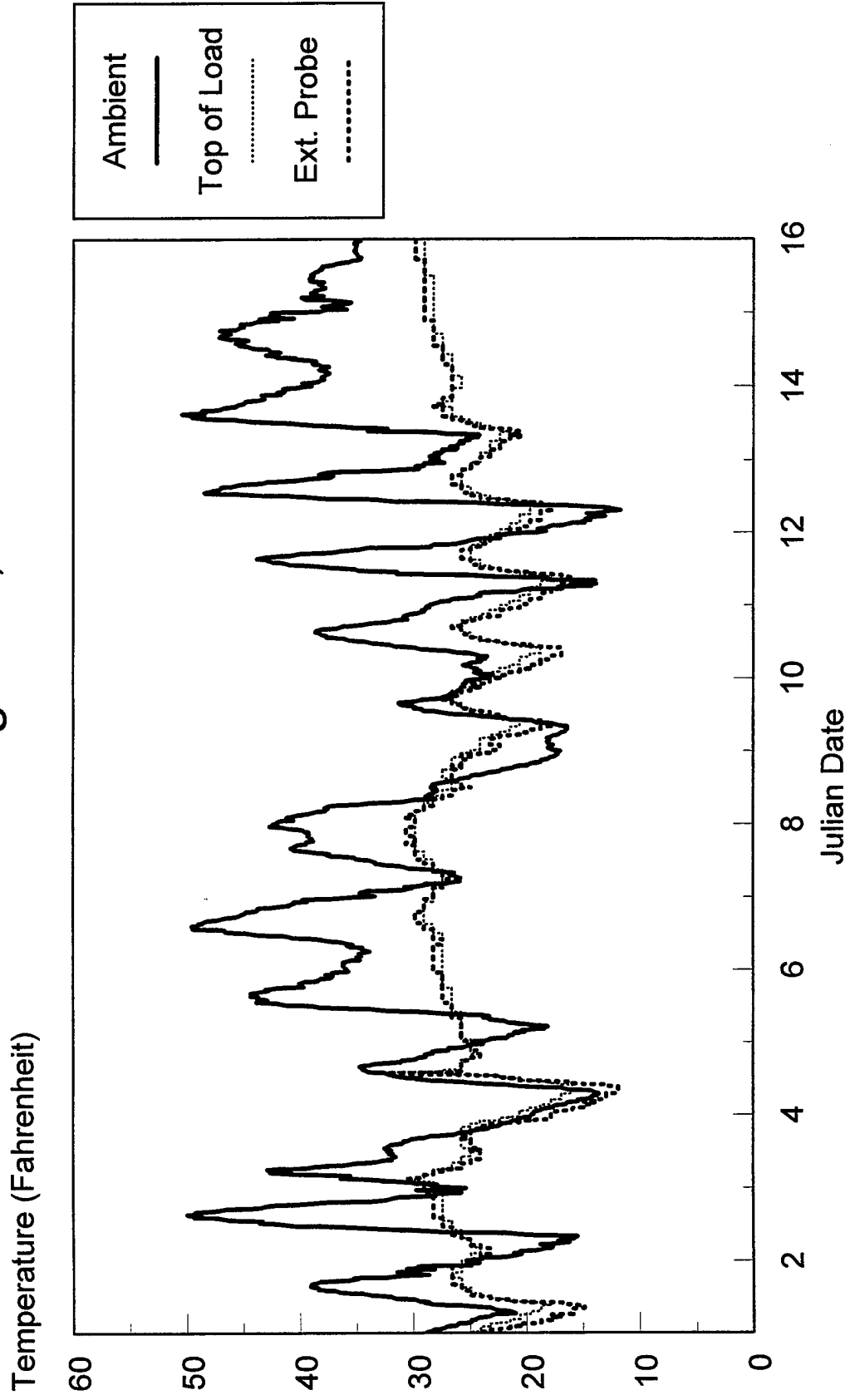
1995 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC D684



1995 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC D684

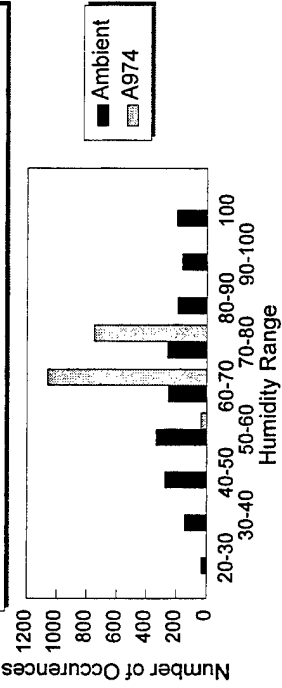


1996 Ammunition Storage Monitoring
2nd ID, South Korea
Above Ground Magazine, DODIC D684



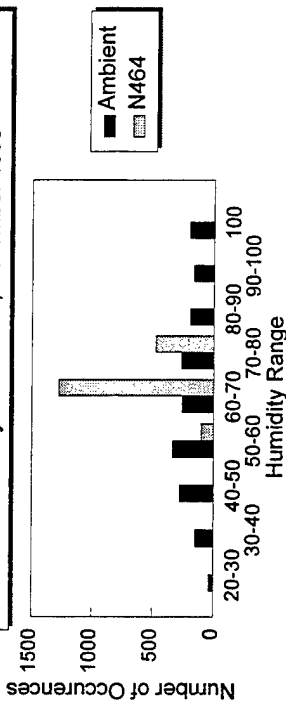
Above Ground Magazine, 2nd ID

Humidity Distribution, November 1995



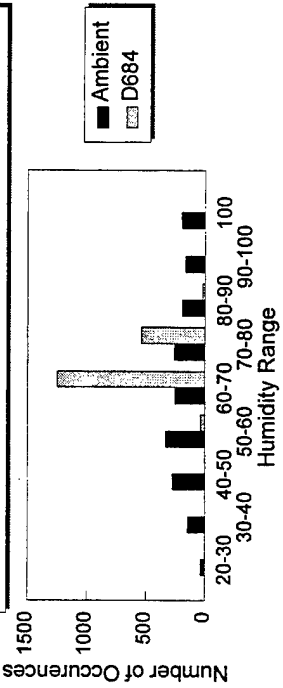
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Humidity Distribution, November 1995



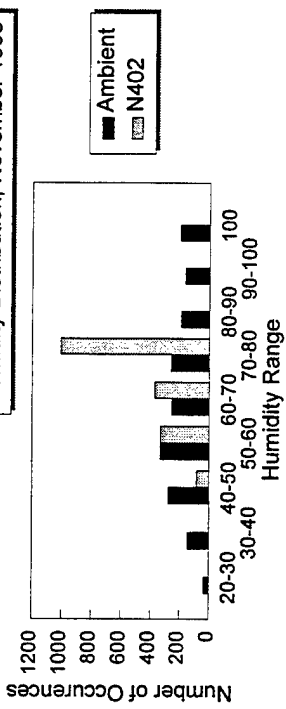
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Humidity Distribution, November 1995



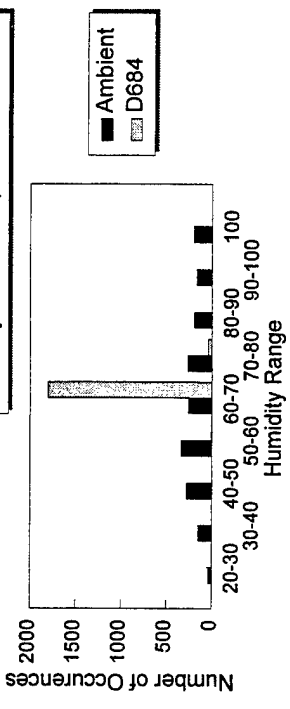
Quonset Hut, 2nd ID

Humidity Distribution, November 1995

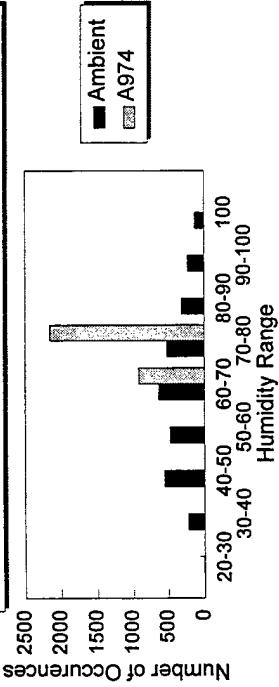


Igloo, 2nd ID

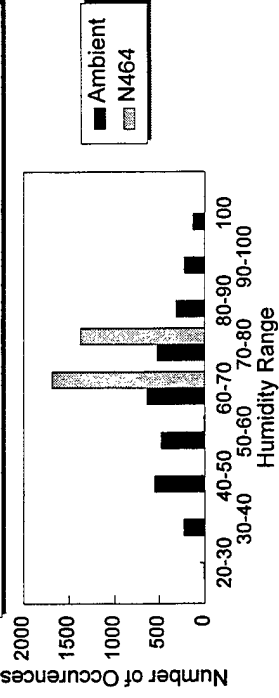
Humidity Distribution, November 1995



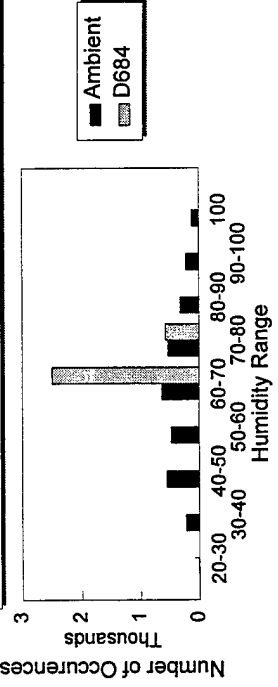
Above Ground Magazine, 2nd ID
Humidity Distribution, December 1995



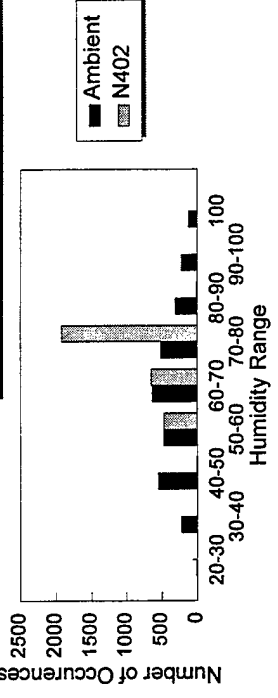
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Humidity Distribution, December 1995



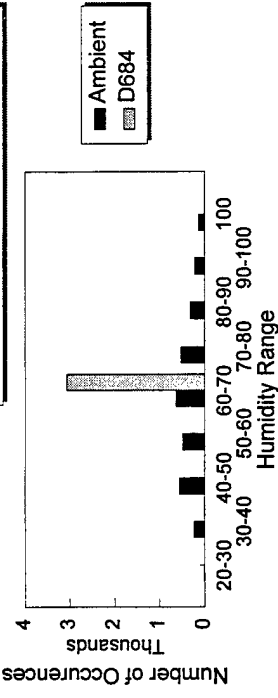
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Humidity Distribution, December 1995



Quonset Hut, 2nd ID
Humidity Distribution, December 1995

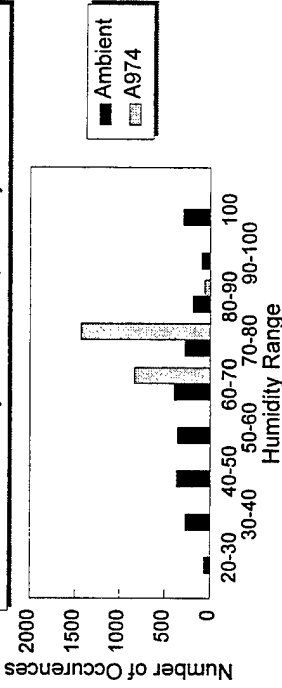


Igloo, 2nd ID
Humidity Distribution, December 1995



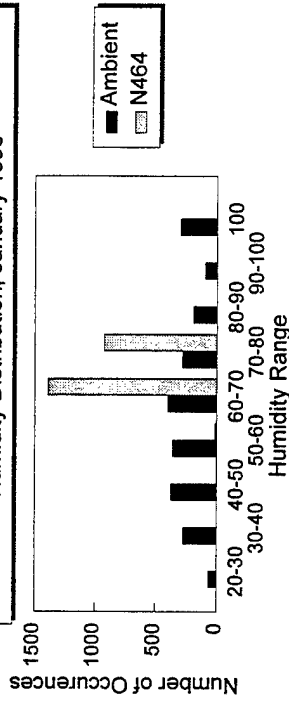
Above Ground Magazine, 2nd ID

Humidity Distribution, January 1996



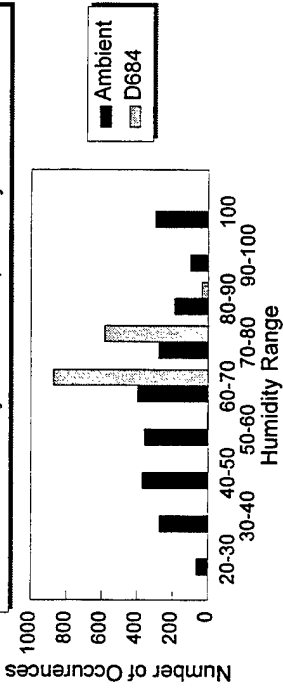
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Humidity Distribution, January 1996



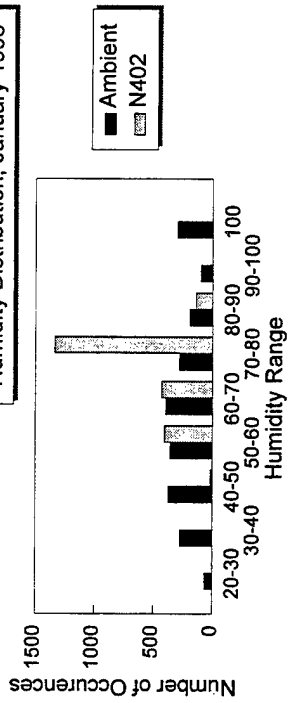
Above Ground Magazine, 2nd ID

Humidity Distribution, January 1996



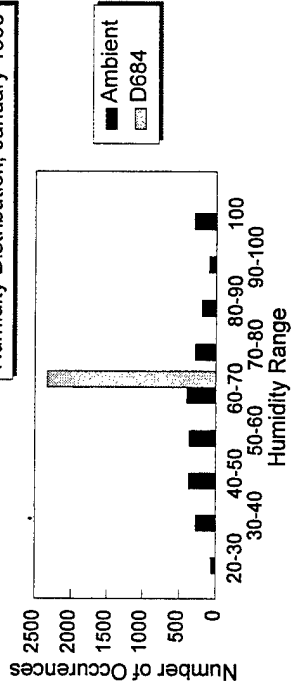
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Humidity Distribution, January 1996



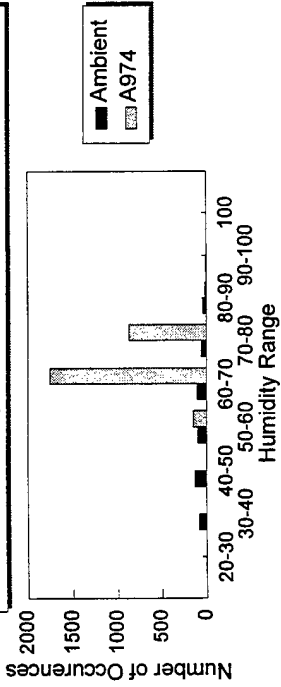
Igloo, 2nd ID

Humidity Distribution, January 1996



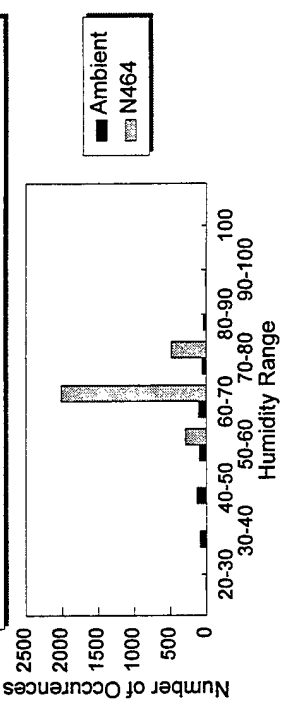
Above Ground Magazine, 2nd ID

Humidity Distribution, February 1996



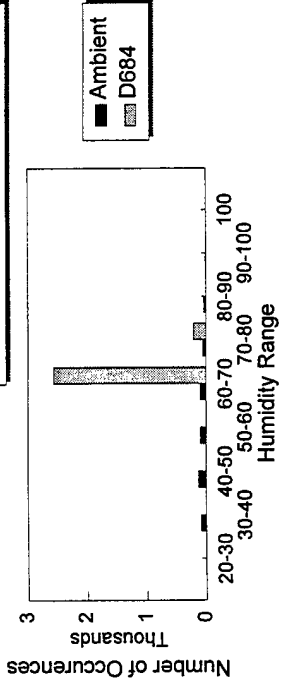
Above Ground Magazine, 2nd ID

Humidity Distribution, February 1996



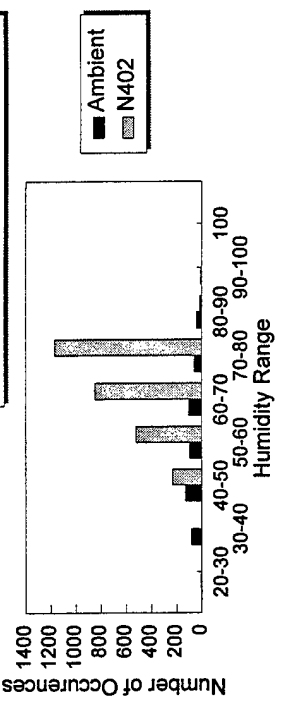
Igloo, 2nd ID

Humidity Distribution, February 1996



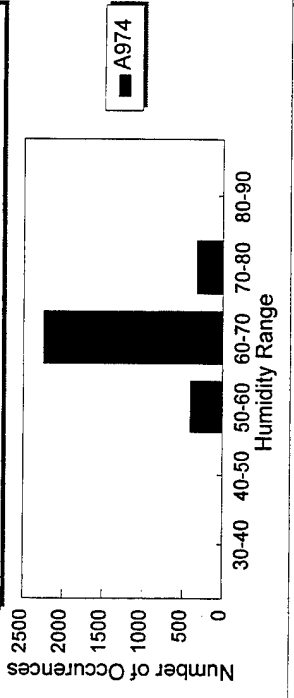
Quonset Hut, 2nd ID

Humidity Distribution, February 1996



Above Ground Magazine, 2nd ID

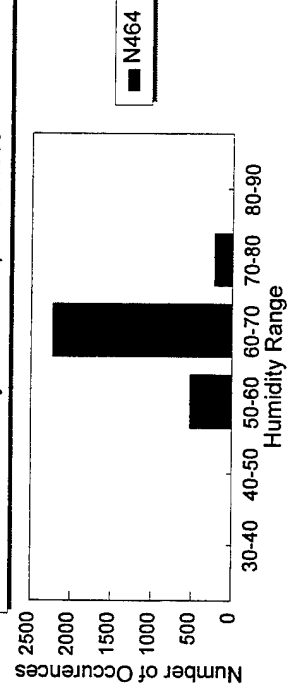
Humidity Distribution, March 1996



■ A974

Above Ground Magazine, 2nd ID

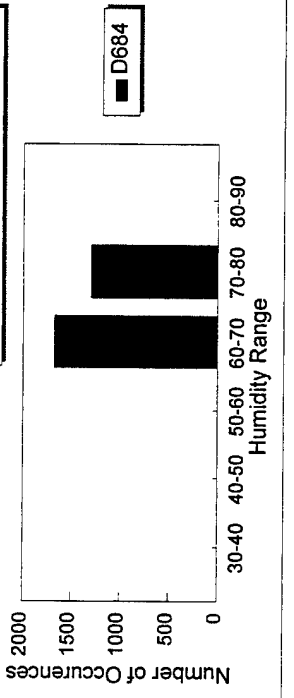
Humidity Distribution, March 1996



■ N464

Igloo, 2nd ID

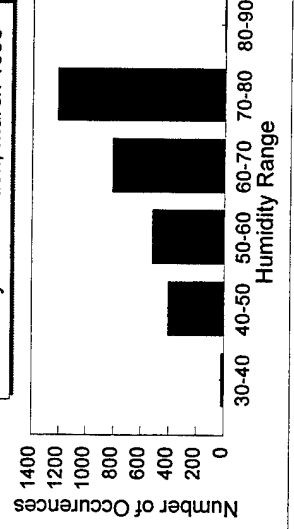
Humidity Distribution, March 1996



■ D684

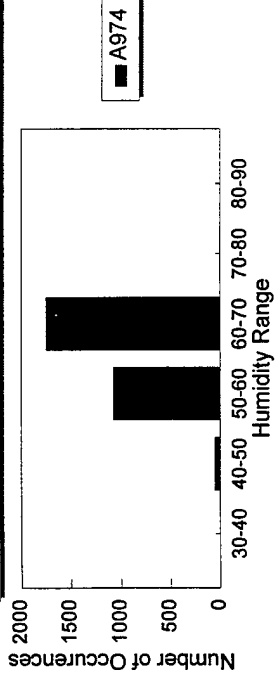
Quonset Hut, 2nd ID

Humidity Distribution, March 1996

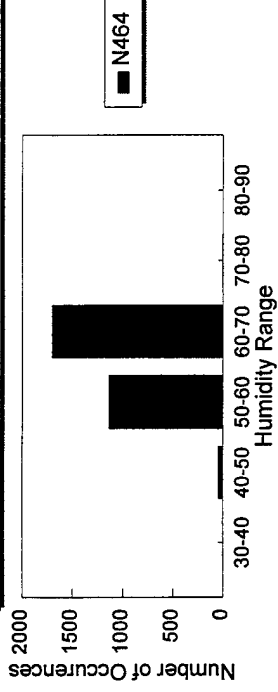


■ N402

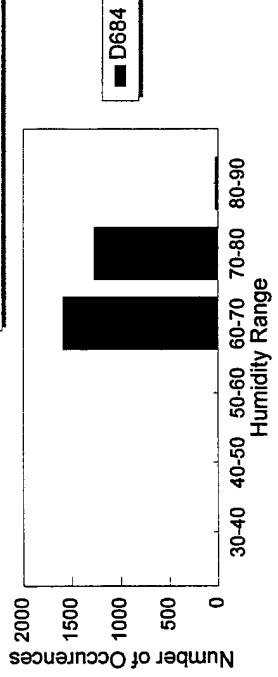
Above Ground Magazine, 2nd ID
Humidity Distribution, April 1996



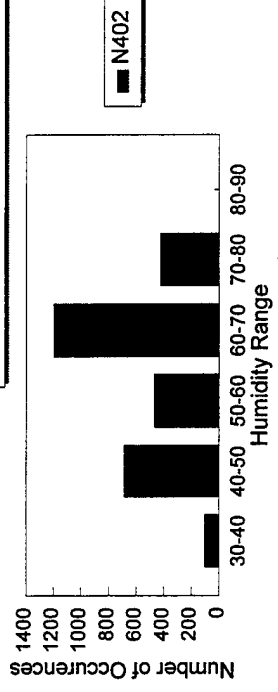
Above Ground Magazine, 2nd ID
Humidity Distribution, April 1996



Igloo, 2nd ID
Humidity Distribution, April 1996

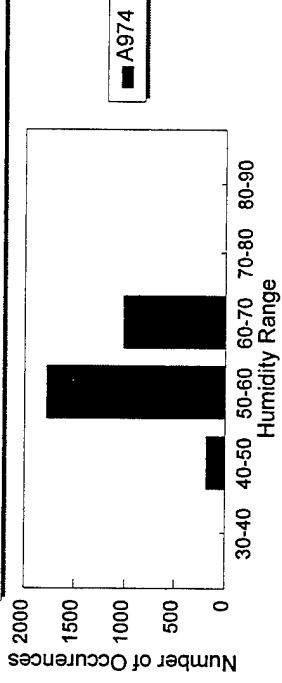


Quonset Hut, 2nd ID
Humidity Distribution, April 1996



Above Ground Magazine, 2nd ID

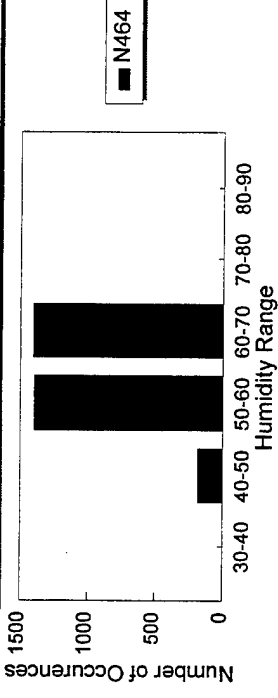
Humidity Distribution, May 1996



■ N464

Above Ground Magazine, 2nd ID

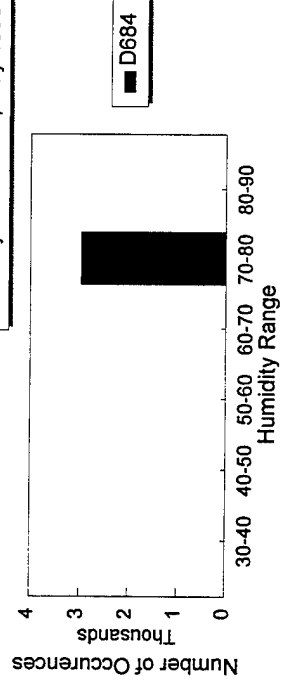
Humidity Distribution, May 1996



■ N464

Igloo, 2nd ID

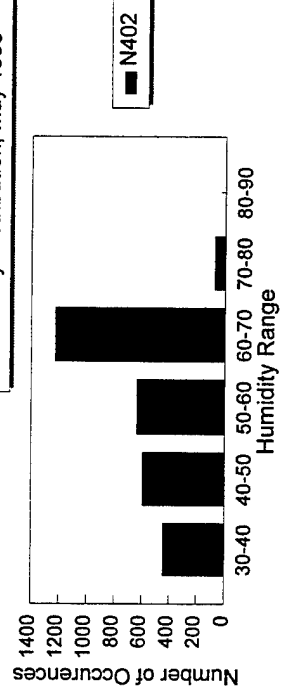
Humidity Distribution, May 1996



■ D684

Quonset Hut, 2nd ID

Humidity Distribution, May 1996



■ N402

PART 7

APPENDIX

AD #2

Temperature Distribution Feb '96

	Ambient	AG Mag	Igloo
10-20	22.099	2.0873	0.1308
20-30	51.667	38.738	15.701
30-40	18.785	47.594	82.468
40-50	7.7348	10.864	1.7
50-60	0	0.6916	0
60-70	0	0.0251	0

Temperature Distribution Mar '96

	Ambient		
20-30	No Data	3.1782	0.0941
30-40		37.046	50.427
40-50		55.063	49.479
50-60		4.6149	0
60-70		0.0982	0

Temperature Distribution Apr '96

	Ambient		
30-40	No Data	8.5489	1.5184
40-50		41.582	72.473
50-60		32.293	24.15
60-70		15.34	1.8583
70-80		2.0746	0
80-90		0.1613	0

Temperature Distribution for May '96

	Ambient		
30-40	0.0658	0	0
40-50	6.9124	0.2401	0
50-60	36.076	30.466	61.958
60-70	33.706	54.114	38.042
70-80	18.631	13.847	0
80-90	4.6083	1.2784	0
90-100	0	0.054	0

Temperature Distribution for Jun '96

	Ambient		
40-50	0.1398	0	0
50-60	4.8917	0.1525	0
60-70	58.001	50.416	91.568
70-80	27.324	43.796	8.4323
80-90	9.3641	4.9298	0
90-100	0.2795	0.7052	0

Temperature Distribution for Jul '96

	Ambient		
50-60	4.2339	0	0
60-70	32.93	30.26	47.043
70-80	31.989	32.576	47.513
80-90	21.909	31.219	5.4435
90-100	8.9382	5.0037	0
100-110	0	0.9409	0

Temperature Distribution for Aug '96

	Ambient		
60-70	23.79	4.5213	2.1057
70-80	45.228	44.089	89.718
80-90	21.169	44.755	8.1765
90-100	9.8118	5.6333	0
100-110	0	1.002	0

Temperature Distribution for Sep '96

	Ambient		
50-60	10.643	1.3944	0.0463
60-70	57.428	48.994	65.14
70-80	24.612	44.672	34.814
80-90	7.3171	4.6312	0
90-100	0	0.3092	0

Temperature Distribution for Oct '96

40-50	No Data	0.0855	0
50-60		9.6957	3.7436
60-70		44.813	46.918
70-80		40.634	49.339
80-90		4.5332	0.0672
90-100		0.2383	0

Temperature Distribution for Nov '96

	Ambient		
30-40	12.246	1.0946	0.0887
40-50	40.143	28.007	8.2956
50-60	35.544	47.543	68.778
60-70	12.067	22.391	22.837
70-80	0	0.9653	0

Temperature Distribution for Dec '96

	Ambient		
20-30	4.7043	0.2315	0
30-40	37.097	35.951	8.8239
40-50	32.527	54.193	77.144
50-60	19.456	9.4459	14.032
60-70	6.2164	0.1792	0

AD #2

Temperature Distribution for Jan '97

	Ambient		
10-20	0.504	0	0
20-30	8.703	2.3297	0.2957
30-40	49.16	65.177	20.356
40-50	33.938	30.388	78.945
50-60	7.1909	2.1057	0.4032
60-70	0.504	0	0

Temperature Distribution for Feb '97

	Ambient		
20-30	5.3943	0.0413	0
30-40	32.664	38.323	12.269
40-50	33.185	43.953	83.854
50-60	21.466	16.08	3.8765
60-70	5.9152	1.5708	0
70-80	1.3765	0.0331	0

Temperature Distribution for Mar '97

	Ambient		
20-30	0.2017	0	0
30-40	6.1849	0.4258	0
40-50	29.378	22.476	16.289
50-60	37.076	64.93	83.711
60-70	21.916	11.145	0
70-80	5.2437	1.0233	0

Temperature Distribution for Apr '97

	Ambient		
40-50	5.9354	1.2921	0.1389
50-60	36.723	35.619	51.746
60-70	27.768	42.5	47.115
70-80	22.631	17.673	0.9998
80-90	6.5602	2.8426	0
90-100	0.3818	0.0733	0

Temperature Distribution for May '97

	Ambient		
50-60	6.4539	0.2232	0
60-70	24.774	21.283	63.659
70-80	39.348	55.336	34.037
80-90	23.872	20.271	1.3604
90-100	5.5517	2.4706	0.5275
100-110	0	0.4167	0.4164

AD #2

Temperature Distribution for Feb '97

Ambient	B-105	B-133	B-135	B-163	B-177	B-335	B-437	B-239	B-184	B-555	Ext. Pro	Ext. Pro
20-30	145	0	4	0	0	0	0	0	0	0	0	0
30-40	878	744	940	900	866	932	1207	1551	1649	0	0	0
40-50	892	1400	768	1227	1411	1026	1218	948	870	2458	2670	2643
50-60	577	502	808	507	403	636	263	189	169	230	18	59
60-70	159	42	160	54	8	94	0	0	0	0	0	0
70-80	37	0	8	0	0	0	0	0	0	0	0	0

Temperature Distribution for Mar '97

Ambient	B-105	B-133	B-135	B-163	B-177	B-335	B-437	B-239	B-184	B-555	Ext. Pro	Ext. Pro
20-30	6	0	0	0	0	0	0	0	0	0	0	0
30-40	184	0	48	0	0	6	6	0	0	0	0	0
40-50	874	554	660	570	538	548	788	954	992	120	433	362
50-60	1103	1951	1389	1845	2267	1673	2041	2021	1983	2855	2542	2613
60-70	652	470	690	550	170	672	140	0	0	0	0	0
70-80	156	0	188	10	0	76	0	0	0	0	0	0

Temperature Distribution for Apr '97

Ambient	B-105	B-133	B-135	B-163	B-177	B-335	B-437	B-239	B-184	B-555	Ext. Pro	Ext. Pro
40-50	171	171	28	18	14	20	24	20	20	0	0	0
50-60	1058	1058	797	911	922	737	1140	1434	1570	1123	1854	1304
60-70	800	800	1054	1162	1375	1182	1407	1289	1159	1758	1027	1563
70-80	652	652	724	732	562	752	310	136	130	0	0	14
80-90	189	189	270	58	8	190	0	0	0	0	0	0
90-100	11	11	8	0	0	0	0	0	0	0	0	0

Temperature Distribution for May '97

Ambient	B-105	B-133	B-135	B-163	B-177	B-335	B-437	B-239	B-184	B-555	Ext. Pro	Ext. Pro
50-60	93	0	12	0	0	0	0	0	0	0	0	0
60-70	357	294	268	304	279	212	313	580	644	777	1143	957
70-80	567	842	612	734	978	644	1000	790	742	608	242	484
80-90	344	296	402	350	274	496	242	46	32	32	34	0
90-100	80	10	136	42	16	90	4	12	12	14	12	0
100-110	0	0	12	10	10	0	0	12	10	10	10	0