BNL-28939

Thyroid Absorbed Dose Assessment for Rongelap and Utirik Residents

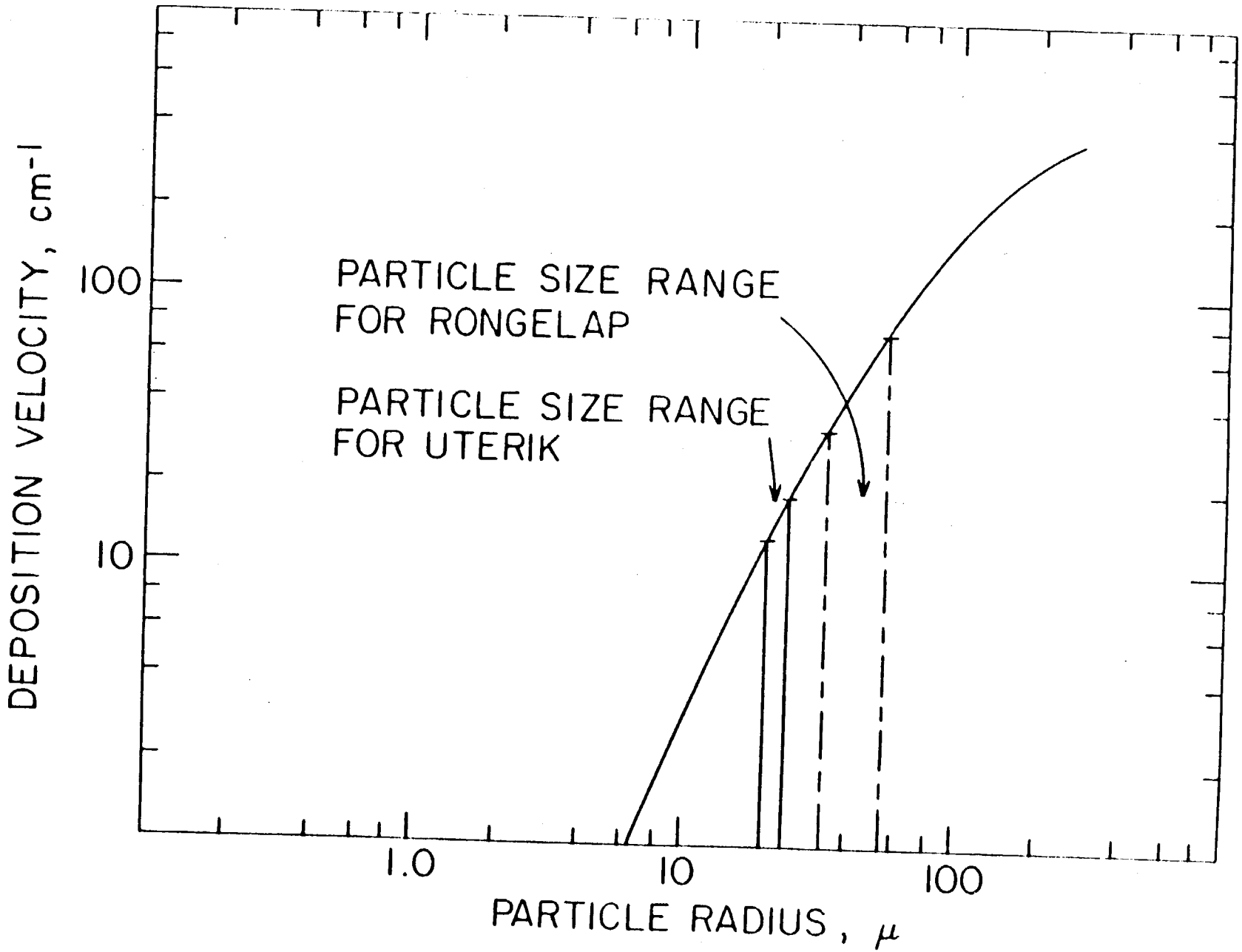
E.T. Lessard, J.R. Naidu, R.P. Miltenberger
Brookhaven National Laboratory
Safety and Environmental Protection Division
Upton, New York 11973
&
N.A. Greenhouse
University of California
Lawrence Berkeley Laboratory
Berkeley, California 94720
&
L.V. Kaplan
Brookhaven Summer Student Program
Brookhaven National Laboratory
and Yale University

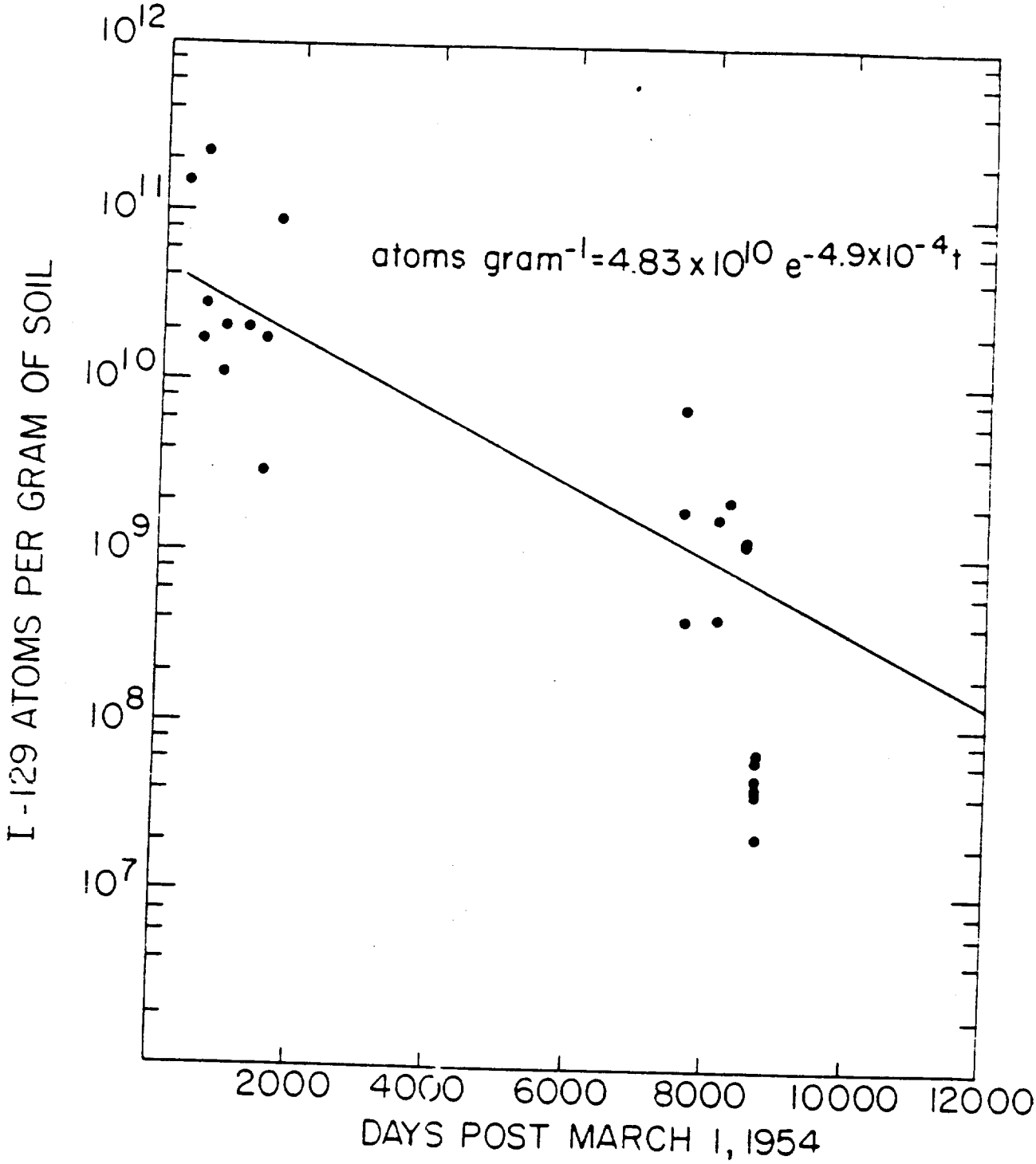
403090

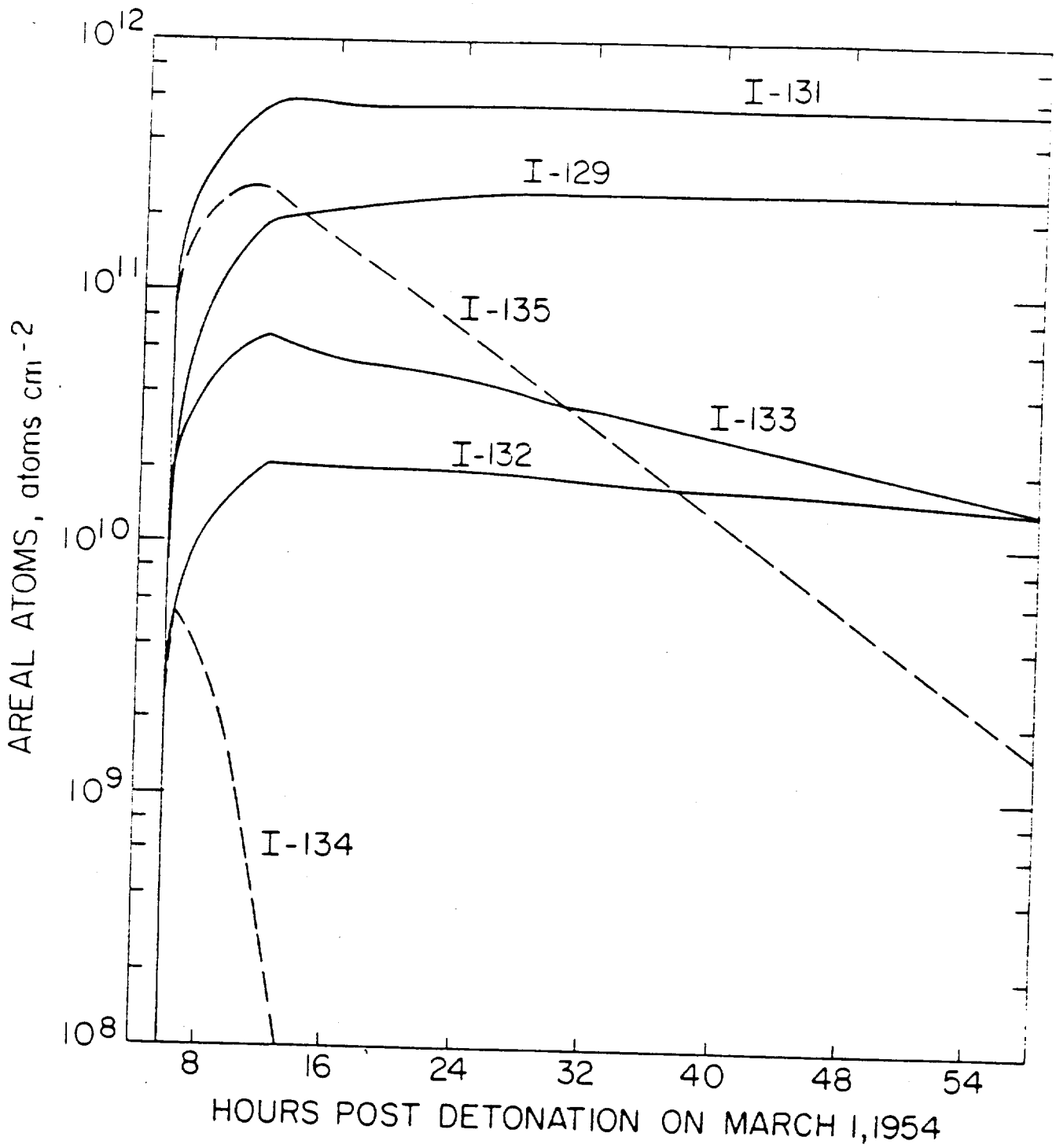
ABSTRACT

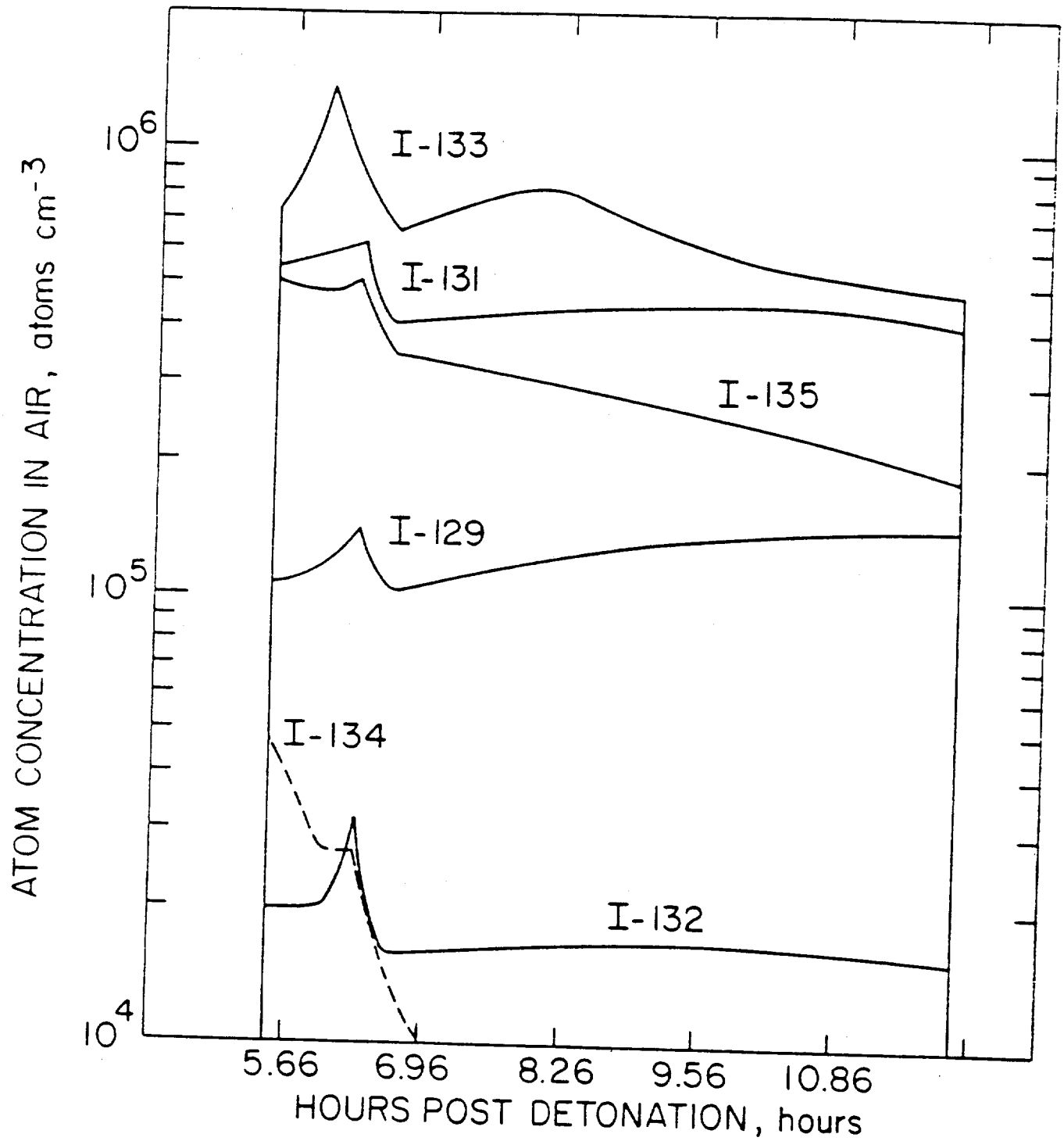
The internal thyroid absorbed dose from Castle Bravo fallout affecting Rongelap and Utirik Atolls, Marshall Islands, is reassessed using independent approaches encompassing 1) the single pooled urine radiochemical analysis of March 1954 and current uptake, retention and excretion models, 2) airborne concentrations and areal activities of the iodine isotopes derived from historic soil samples and, 3) airborne concentrations and areal activities of the iodine isotopes derived from weather data obtained during the thermonuclear test experiment at Bikini Atoll and current fallout deposition models. Factors such as solubility of iodine isotopes, the possible contribution from neutron induced activity, the impact of thyroid seekers other than iodine isotopes on dose, and confidence levels for values of derived quantities such as airborne activity concentrations are also considered. Additionally, these thyroid absorbed dose estimates are compared to the incidence of thyroid nodules reported for the accidentally exposed people.

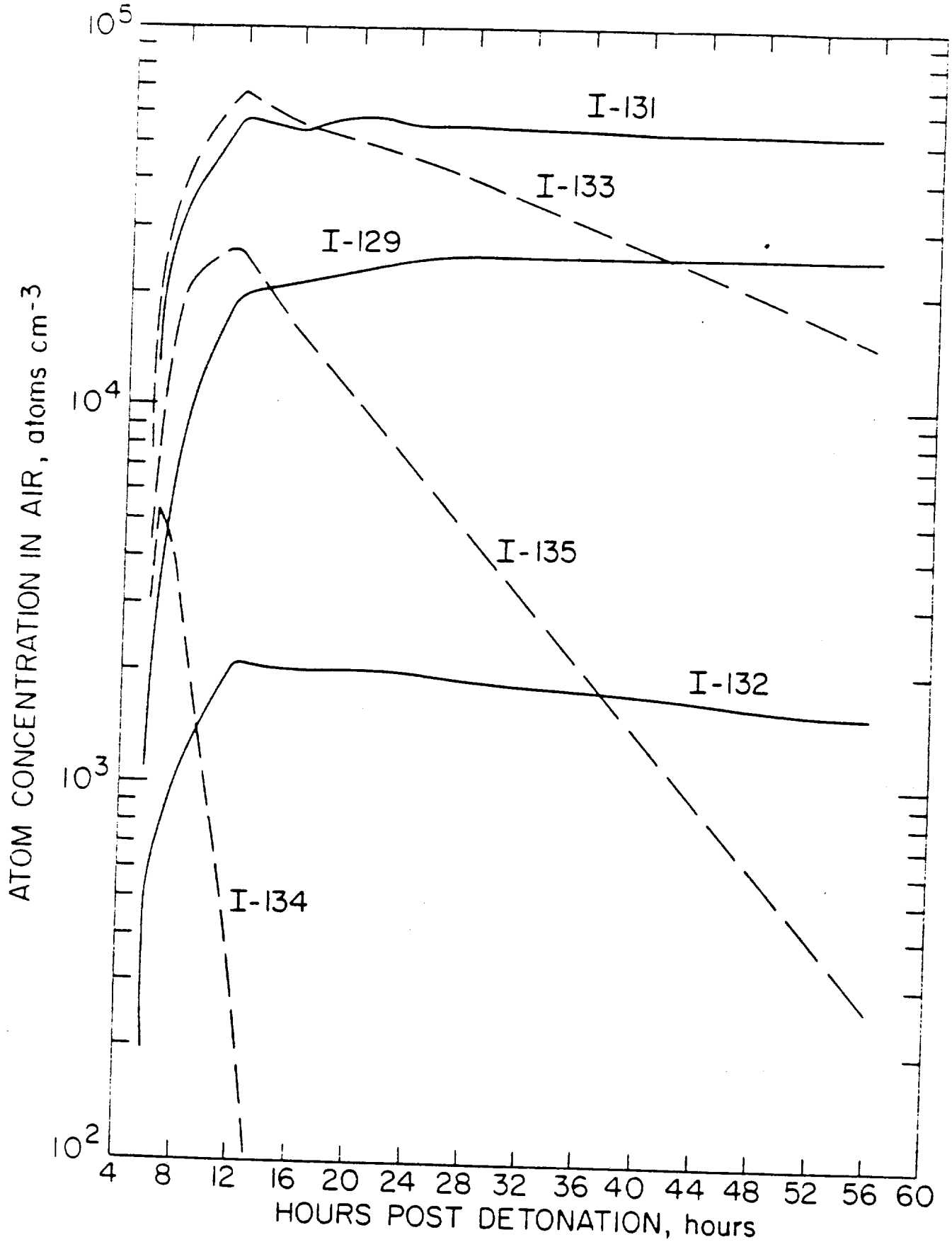
Research carried out under the auspice of the U. S. Department of Energy under Contract No. DE-AC02-76CH00016.

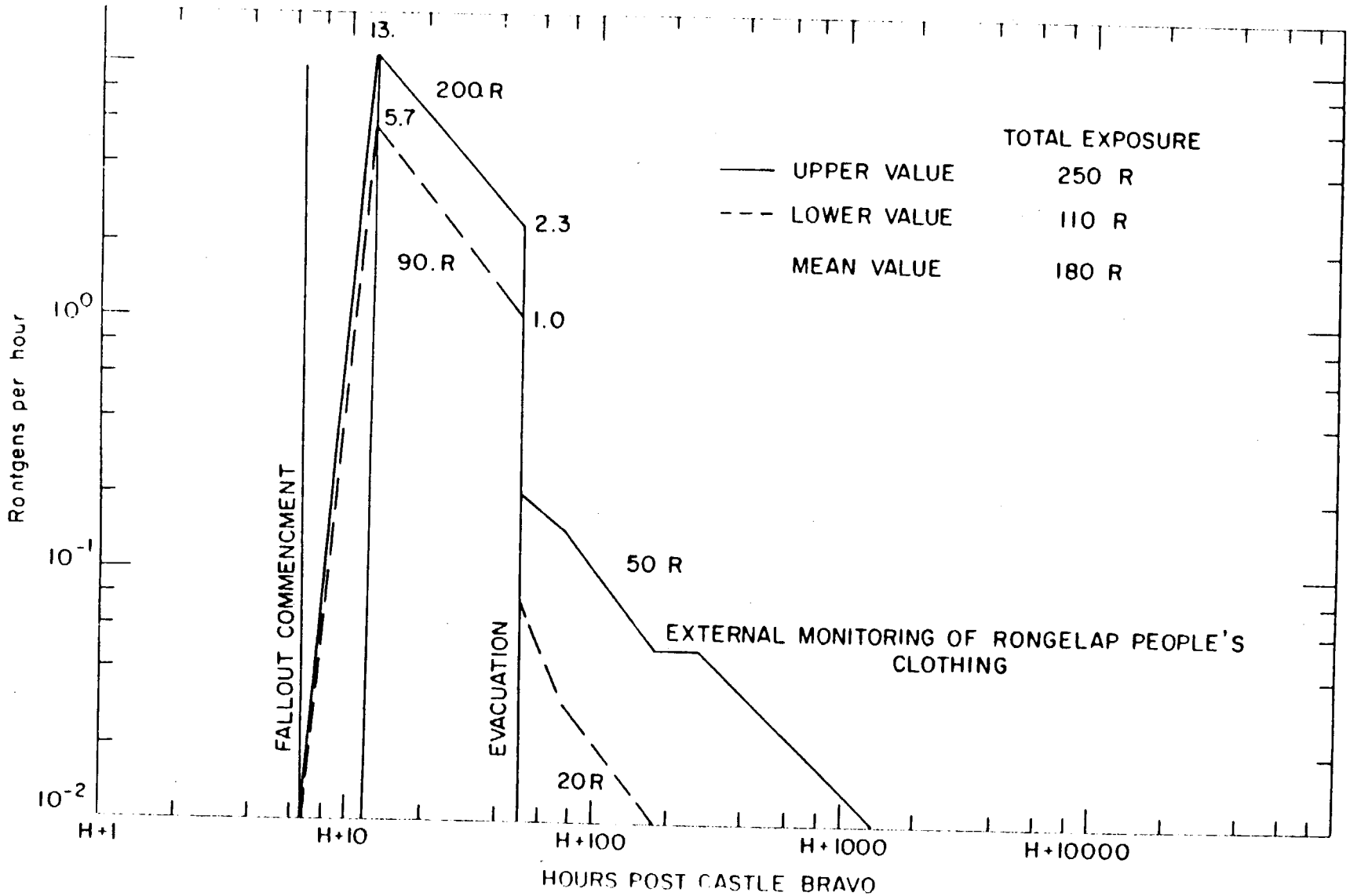

DEPOSITION VELOCITY, cm-1
100
10
PARTICLE SIZE RANGE
FOR RONGELAP
PARTICLE SIZE RANGE
FOR UTERIK
1.0
10
100
PARTICLE RADIUS, μ

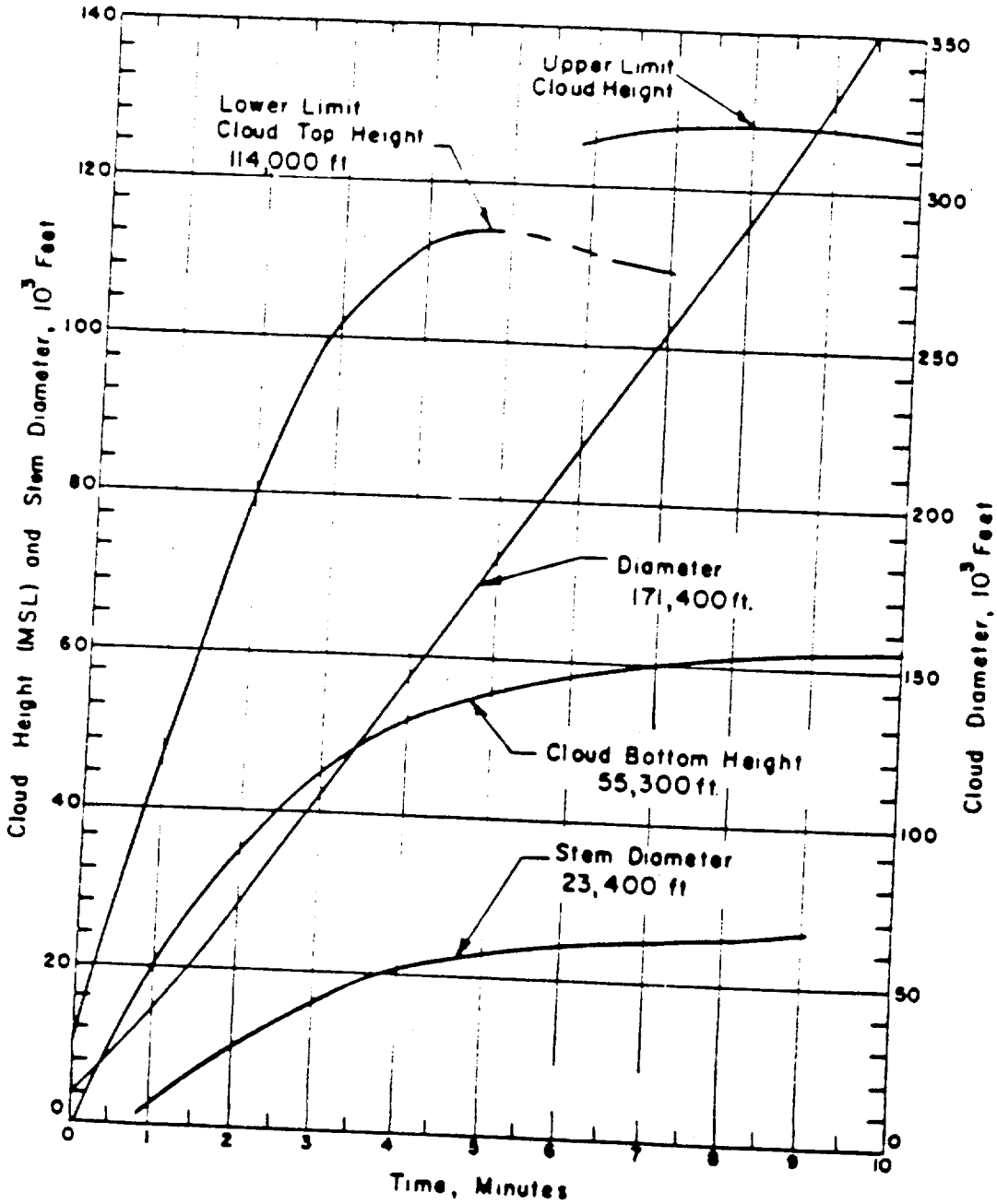

10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
I-129 ATOMS PER GRAM OF SOIL
atoms gram^{-1}=4.83 x 10^{10} $e^{-4.9 \times 10^{-4} t}$
2000
4000
6000
8000
10000
12000
DAYS POST MARCH 1, 1954


10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
AREAL ATOMS, atoms cm^{-2}
I-131
I-129
I-135
I-133
I-132
I-134
8
16
24
32
40
48
54
HOURS POST DETONATION ON MARCH 1, 1954

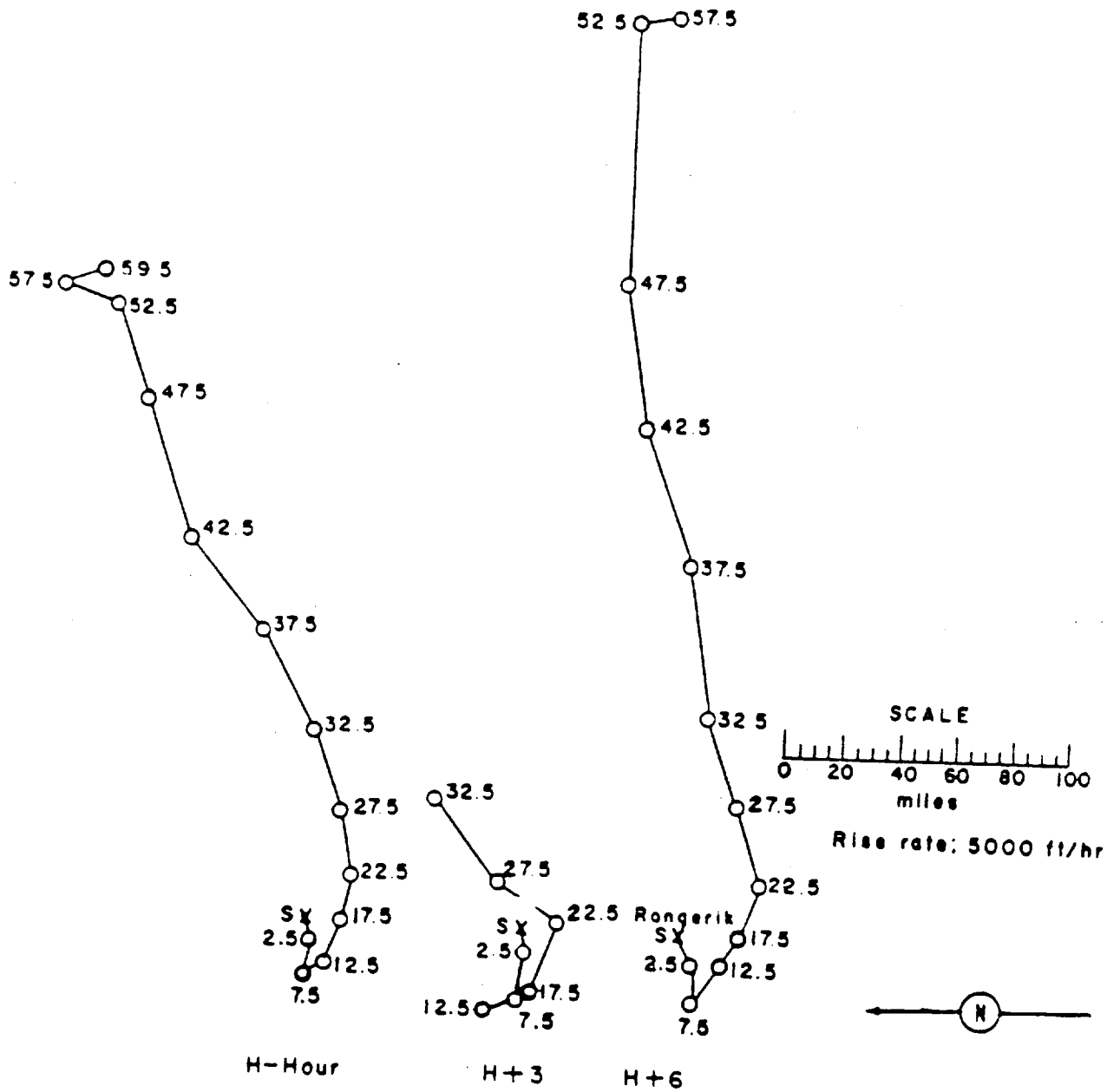

ATOM CONCENTRATION IN AIR, atoms cm^{-3}
10^6
10^5
10^4
I-133
I-131
I-135
I-129
I-134
I-132
5.66
6.96
8.26
9.56
10.86
HOURS POST DETONATION, hours


ATOM CONCENTRATION IN AIR, atoms cm-3
HOURS POST DETONATION, hours
I-131
I-133
I-129
I-135
I-132
I-134
10^5
10^4
10^3
10^2
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60

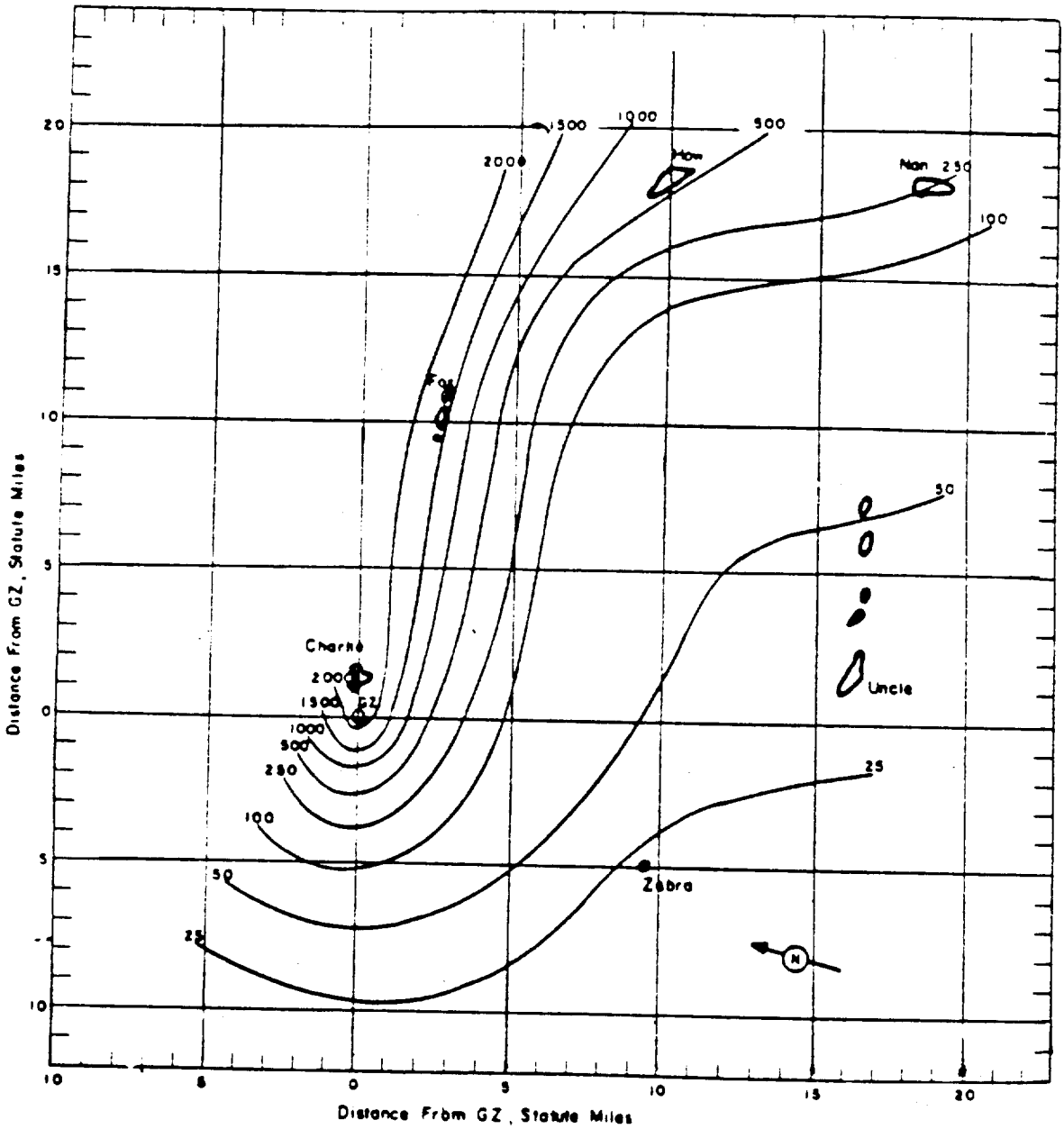

13.
200 R
5.7
2.3
90. R
1.0
50 R
20 R
TOTAL EXPOSURE
UPPER VALUE 250 R
LOWER VALUE 110 R
MEAN VALUE 180 R
EXTERNAL MONITORING OF RONGELAP PEOPLE'S CLOTHING
FALLOUT COMMENCMENT
EVACUATION
Rontgens per hour
10^0
10^{-1}
10^{-2}
H+1
H+10
H+100
H+1000
H+10000
HOURS POST CASTLE BRAVO



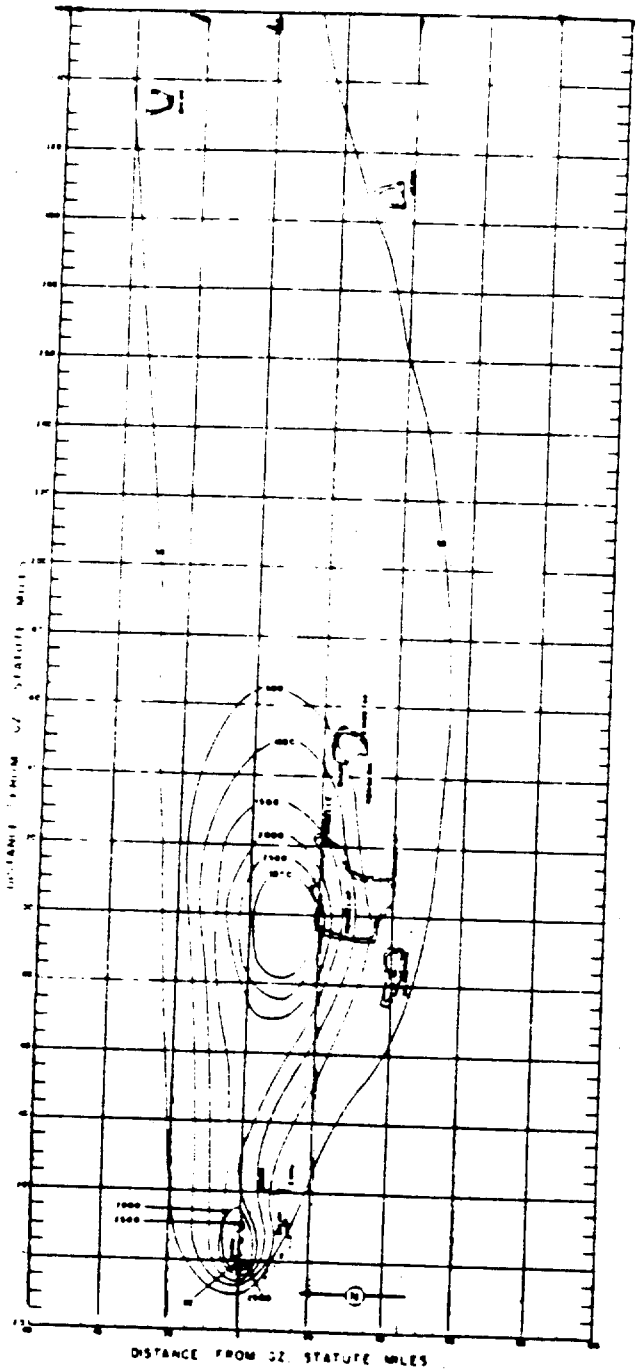
Cloud Dimensions: Operation CASTLE - Shot 1 - Bravo.



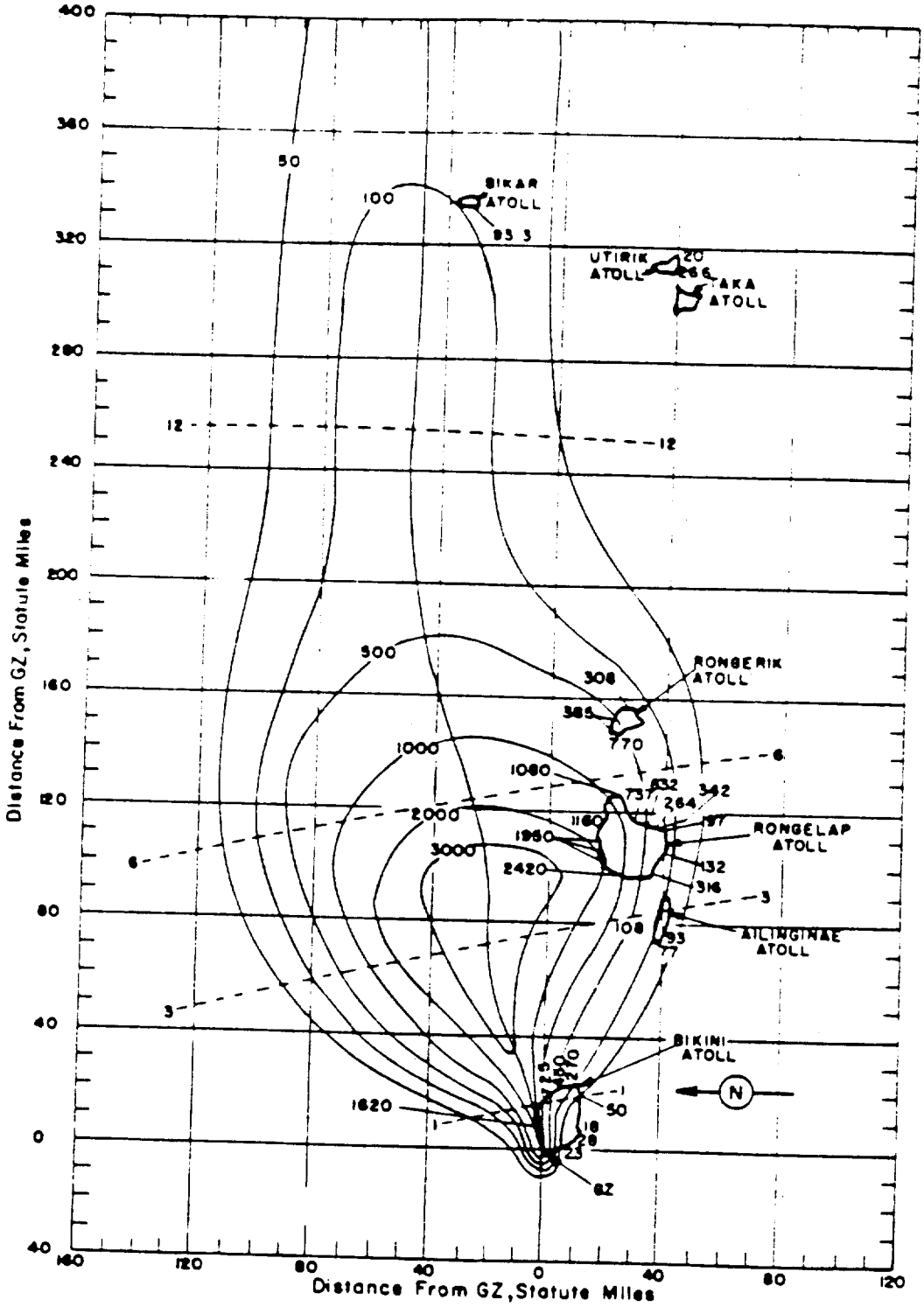
Hodographs for Operation CASTLE - Shot 1 - Bravo.



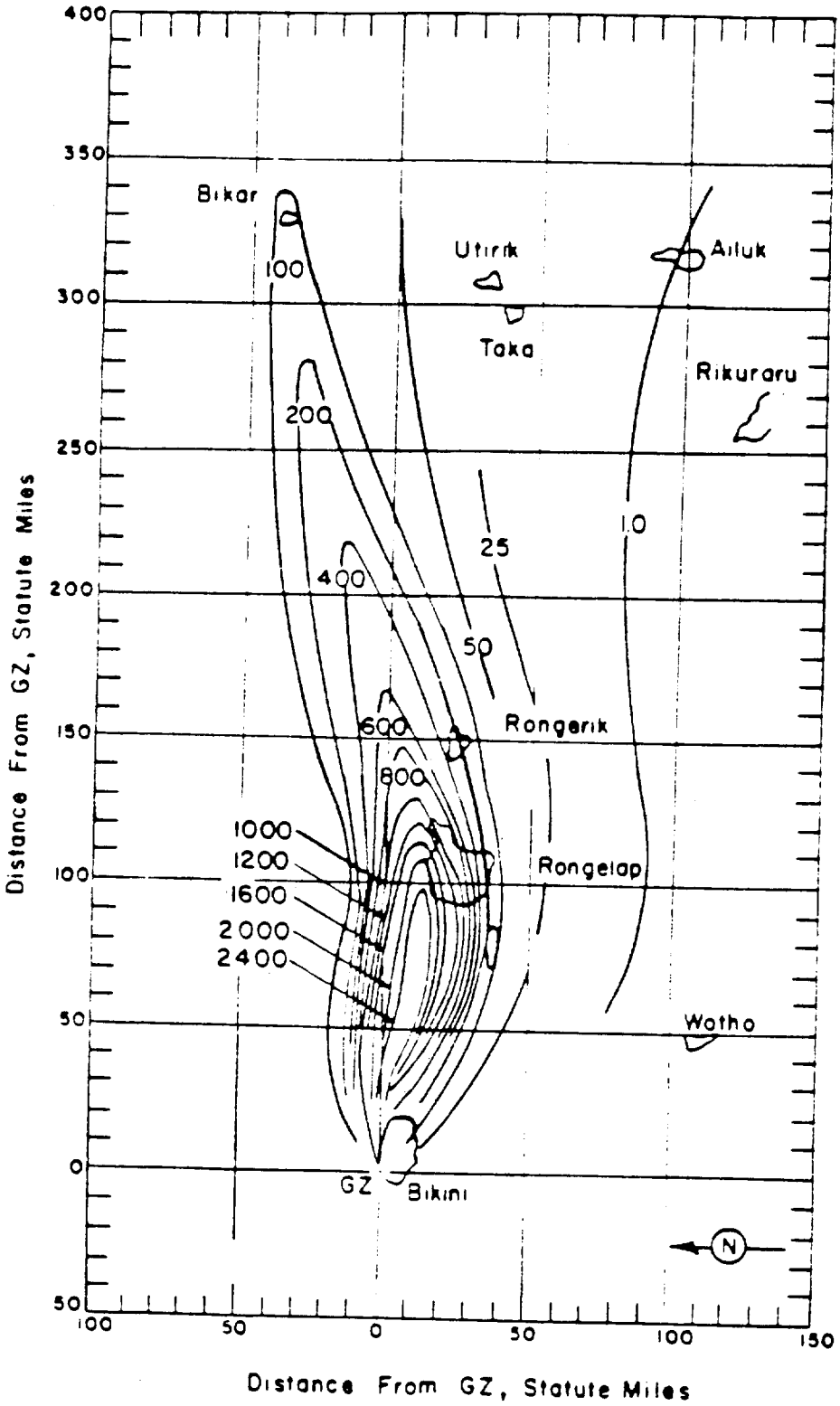
Operation CASTLE - Shot 1 - Bravo.
On-site dose rate contours in r/hr at H+1 hour.



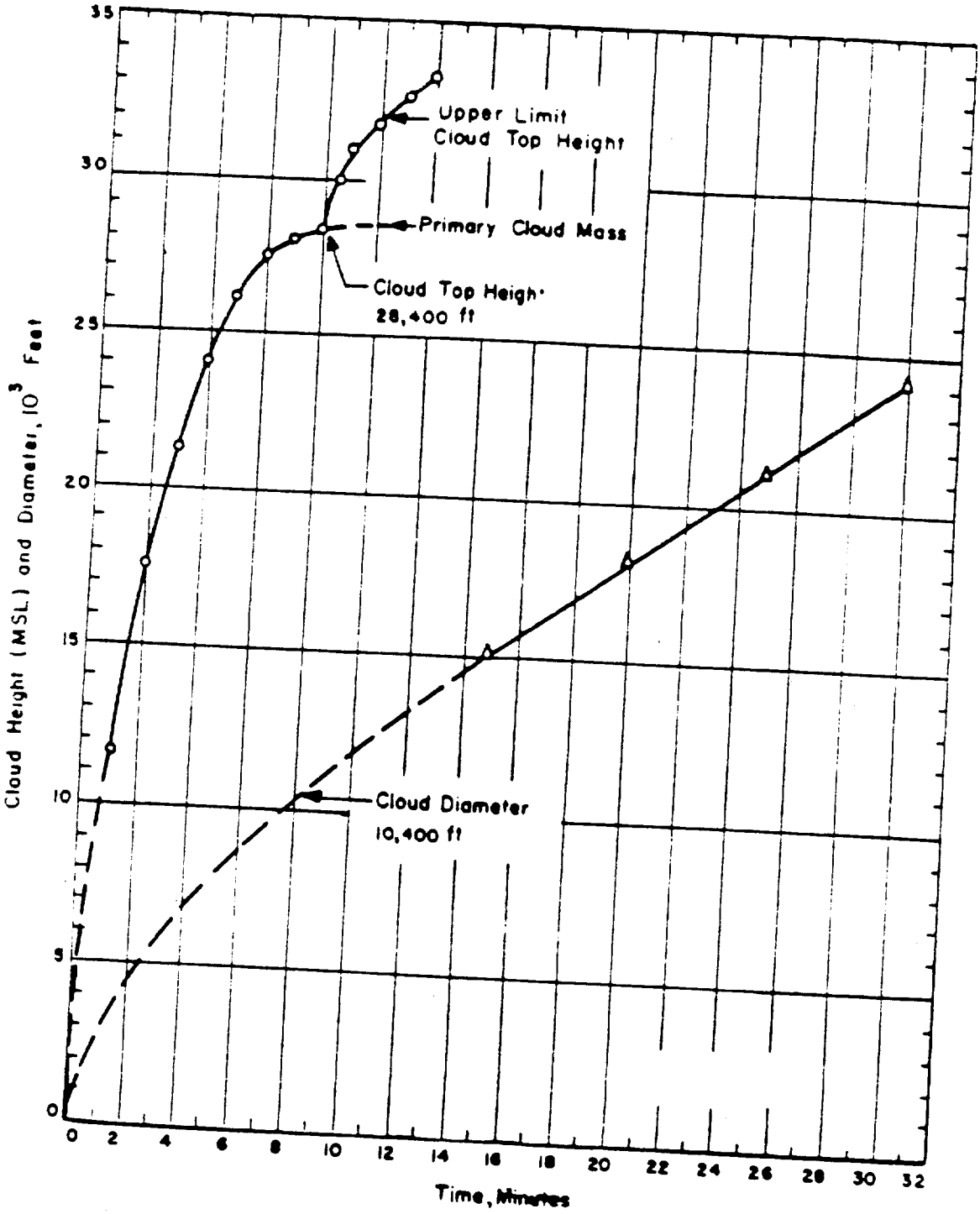
Operation CASTLE - Shot 1 - Bravo.
Off-site dose rate contours in r/hr at H+1 hour (RAND).



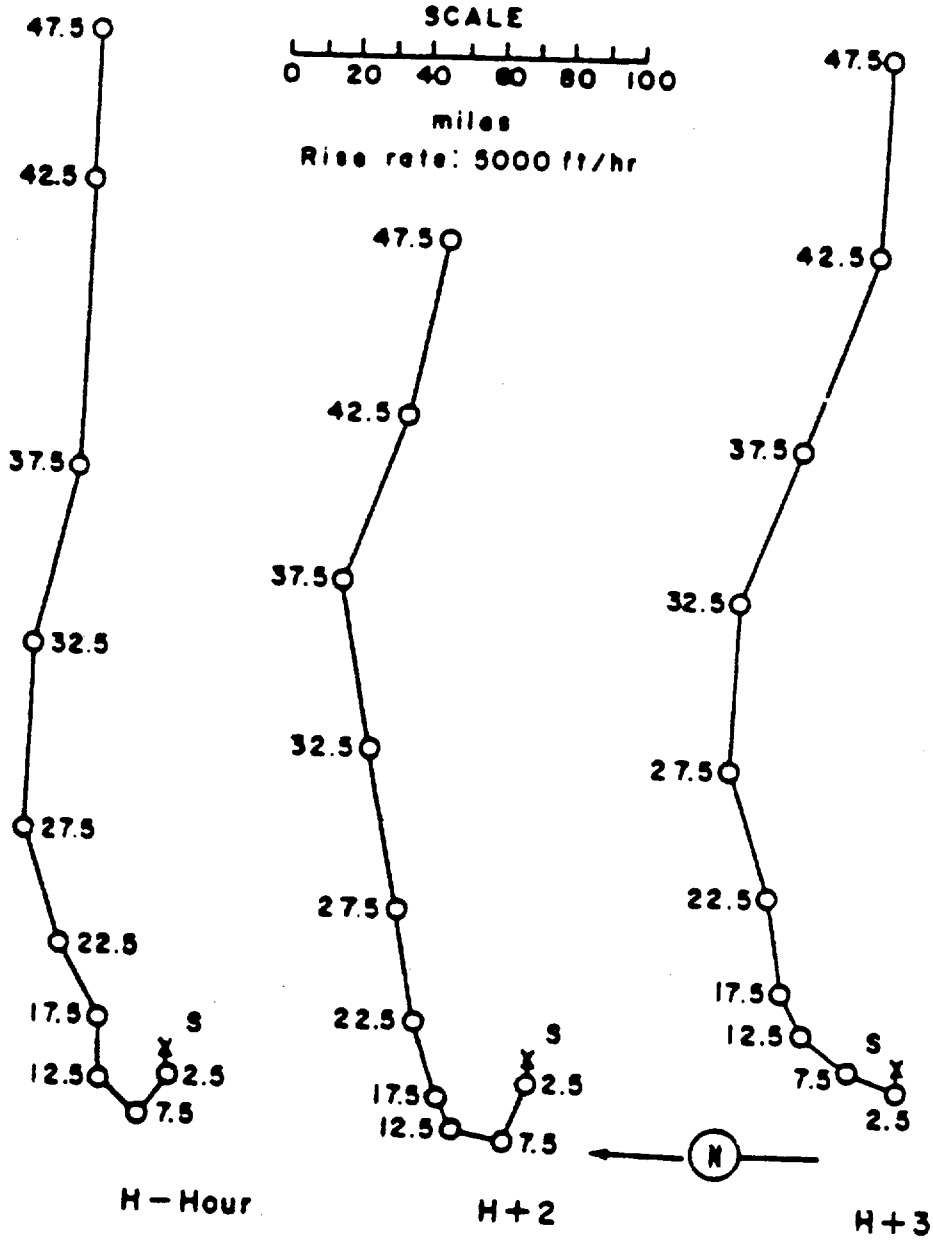
Operation CASTLE - Shot 1 - Bravo.
Off-site dose rate contours in r/hr at H+1 hour (NRDL).



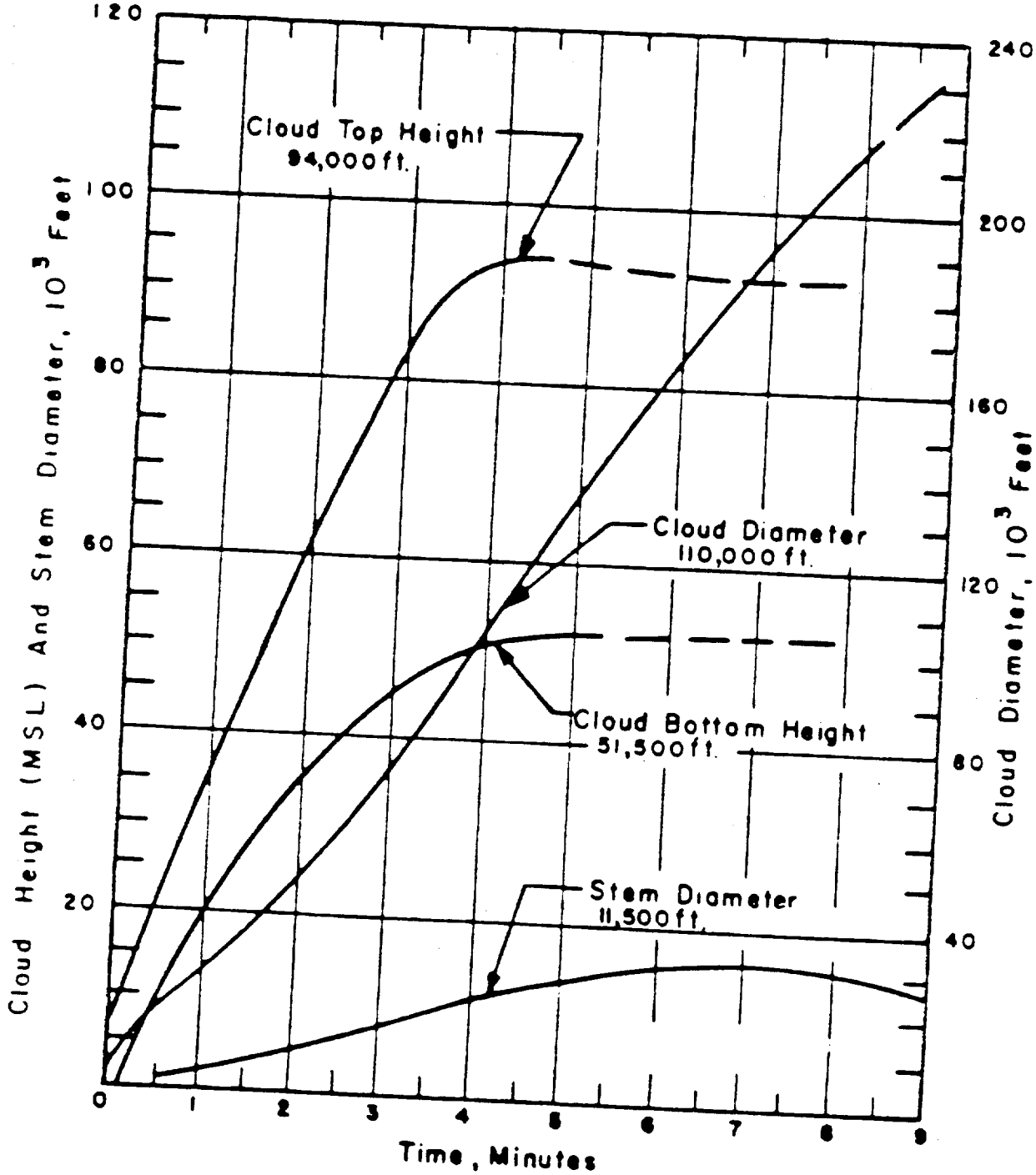
Operation CASTLE - Shot 1 - Bravo.
Off-site dose rate contours in r/hr at H+1 hour (AFSWP).



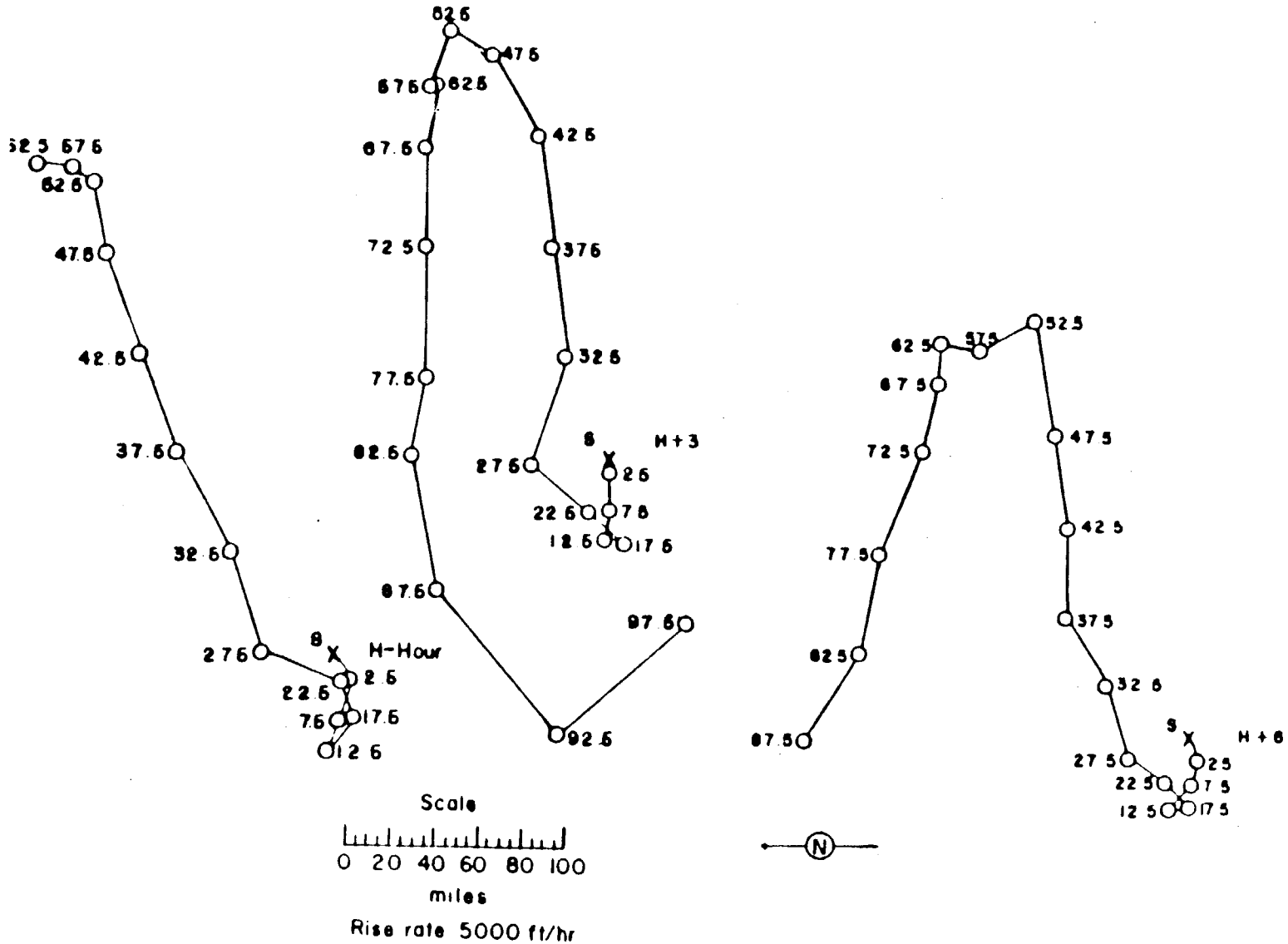
Cloud Dimensions: Operation SANDSTONE - Shot 3 - Zebra.



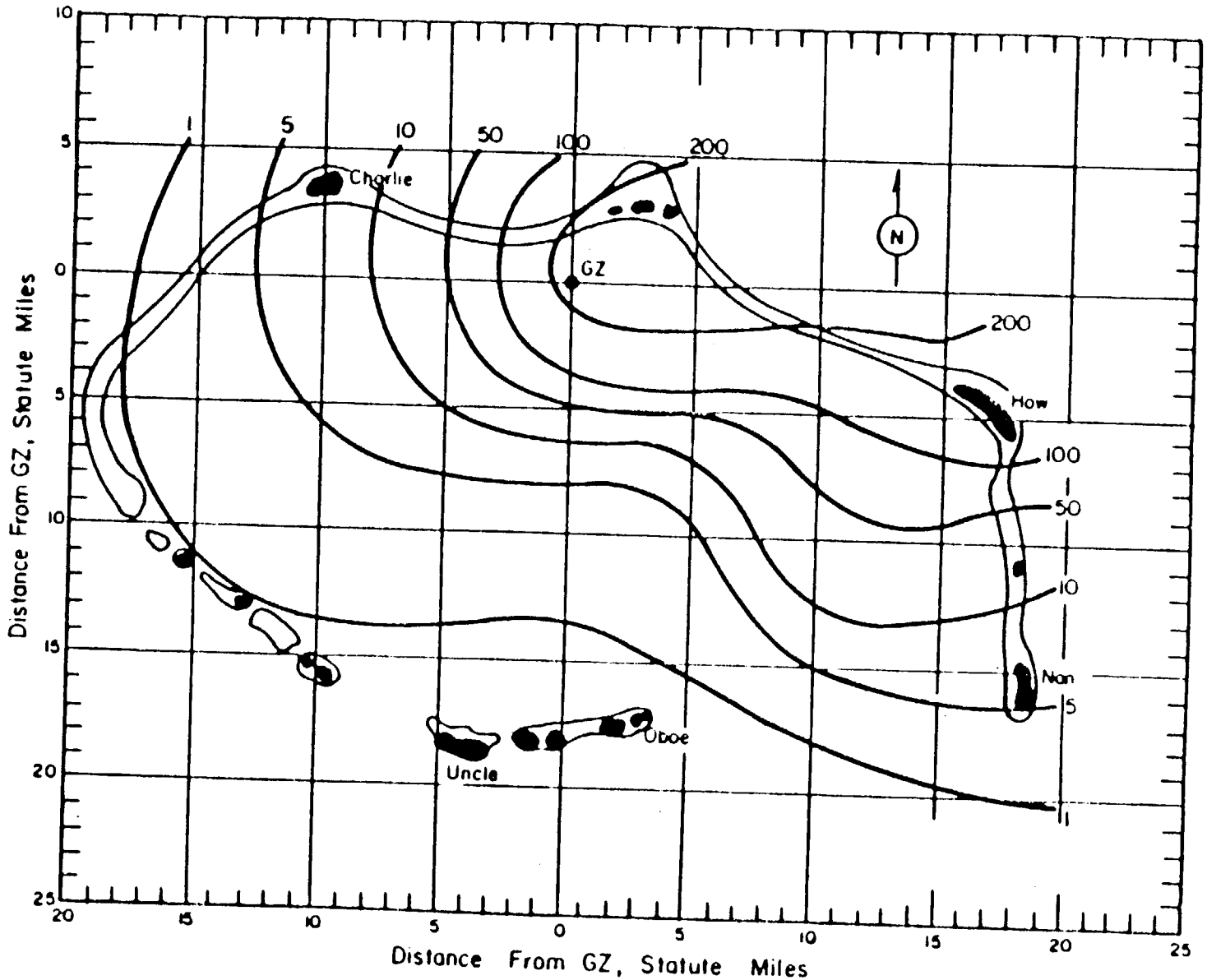
Hodographs for Operation SANDSTONE - Shot 3 - Zebra



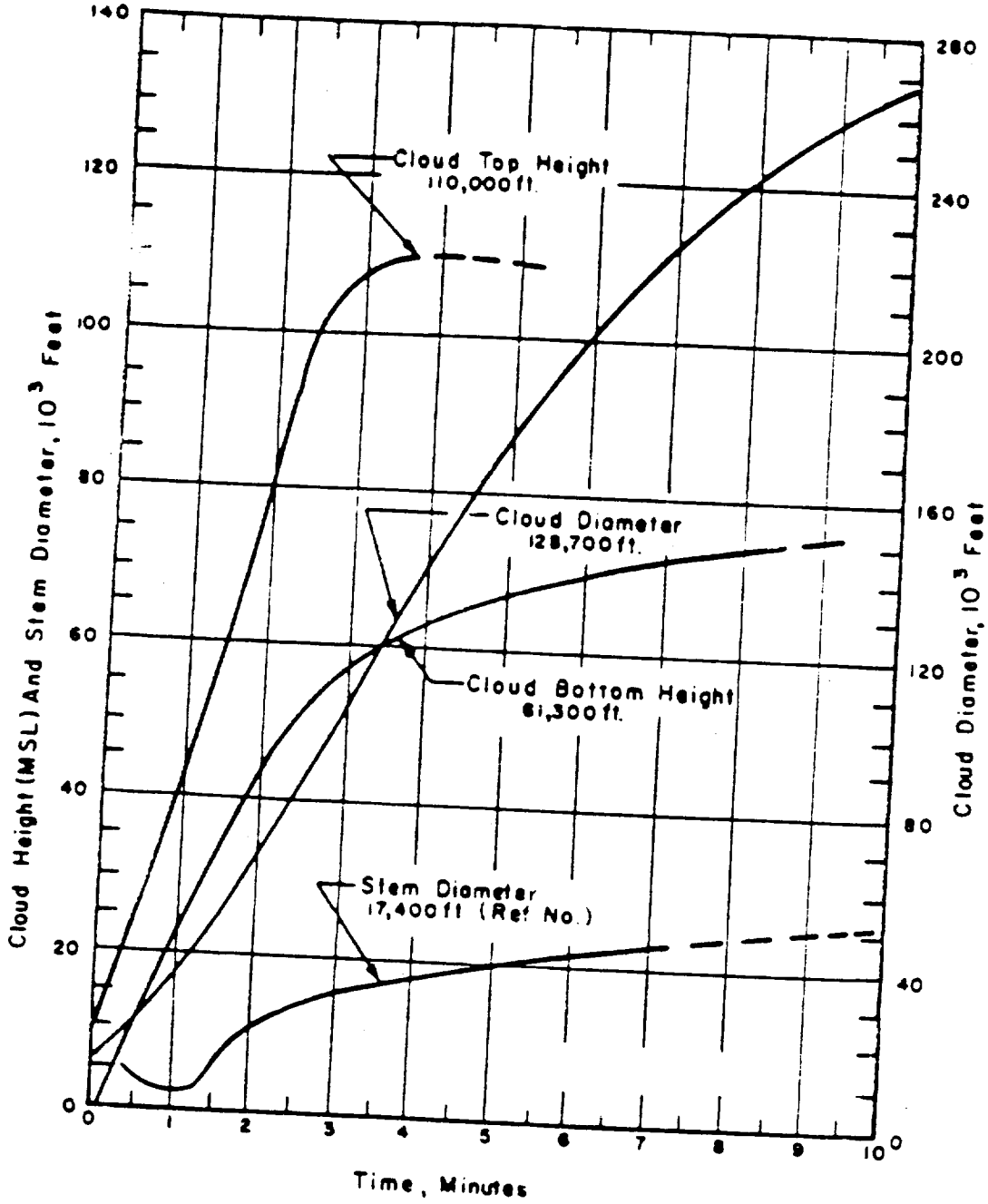
Cloud Dimensions: Operation CASTLE - Shot 4 - Union.



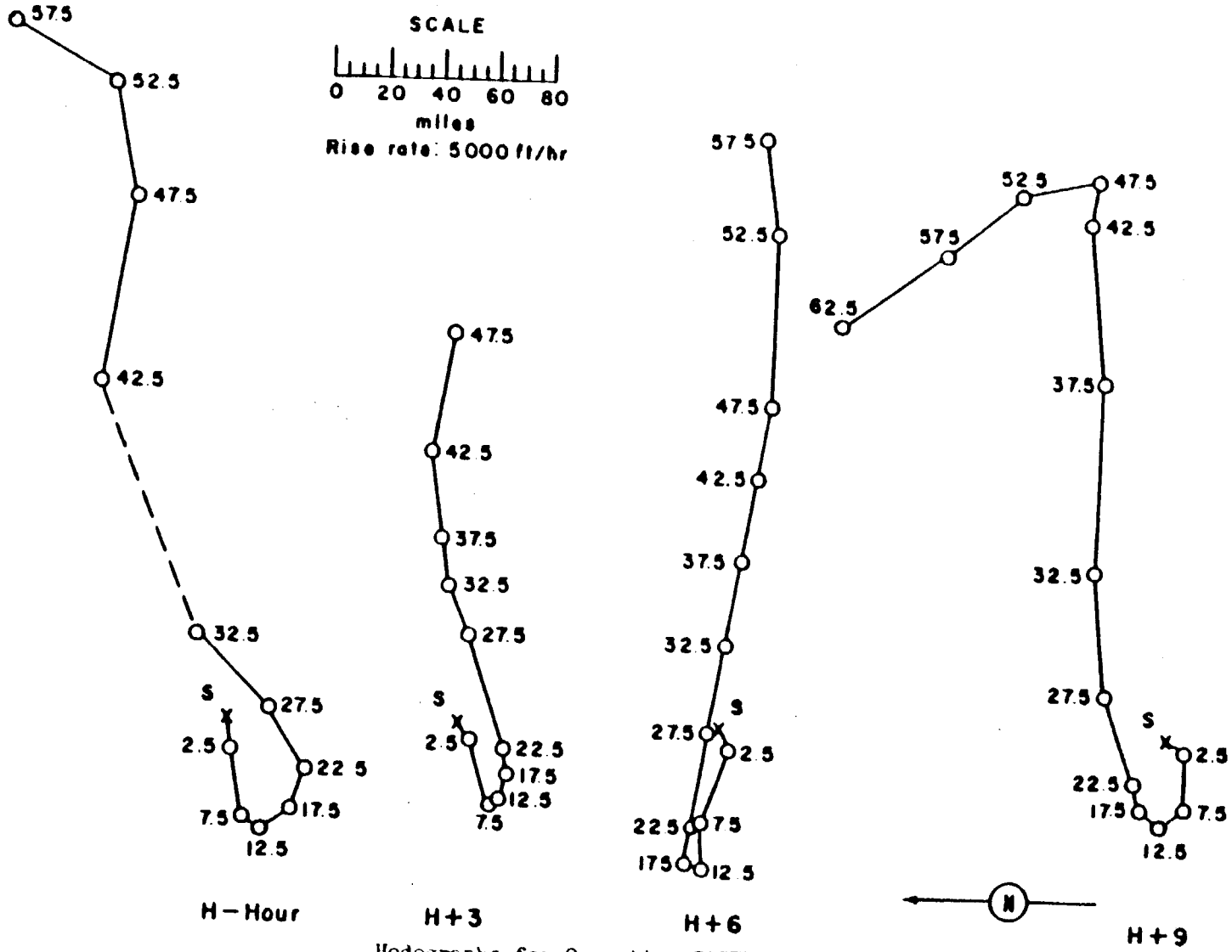
Holographs for Operation CASTLE - Shot 4 - Union.



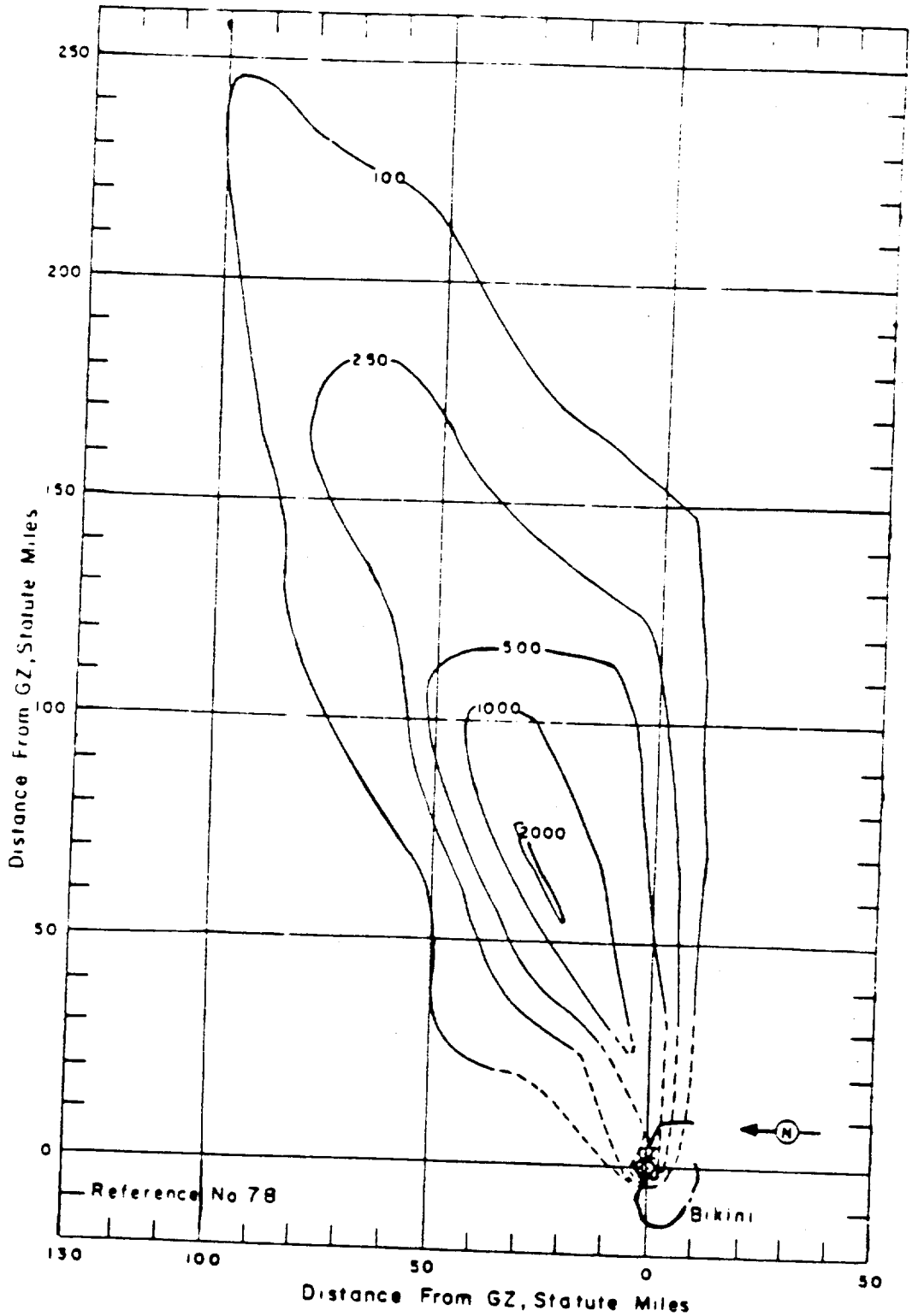
Operation CASTLE - Shot 4 - Union. On-site dose rate contours in r/hr at H+1 hour.



Cloud Dimensions: Operation CASTLE - Shot 5 - Yankee.



Hodographs for Operation CASTLE - Shot 5 - Yankee.



Operation CASTLE - Shot 5 - Yankee.
Off-site dose rate contours in r/hr at H+1 hour.