Earth-Penetrating Nuclear Weapons

Target Damage and Fallout

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Earth-Penetrating Nuclear Weapons

Target Damage and Fallout

1. Employment Policy
2. Targeting, Damage and Fallout
3. Hypothetical Use
4. A Summary of NRDC's Main Objections to Development of New Earth-Penetrating Nuclear Weapons

Earth-Penetrating Nuclear Weapons: Two Contexts

Regional/Tactical

- Targets in Countries with Regional or Emergent WMD Capabilities (e.g., North Korea, Iran and Syria)
- Target Destruction Criteria for Weapons Design Balanced against Minimizing Collateral Effects—Lower Yields

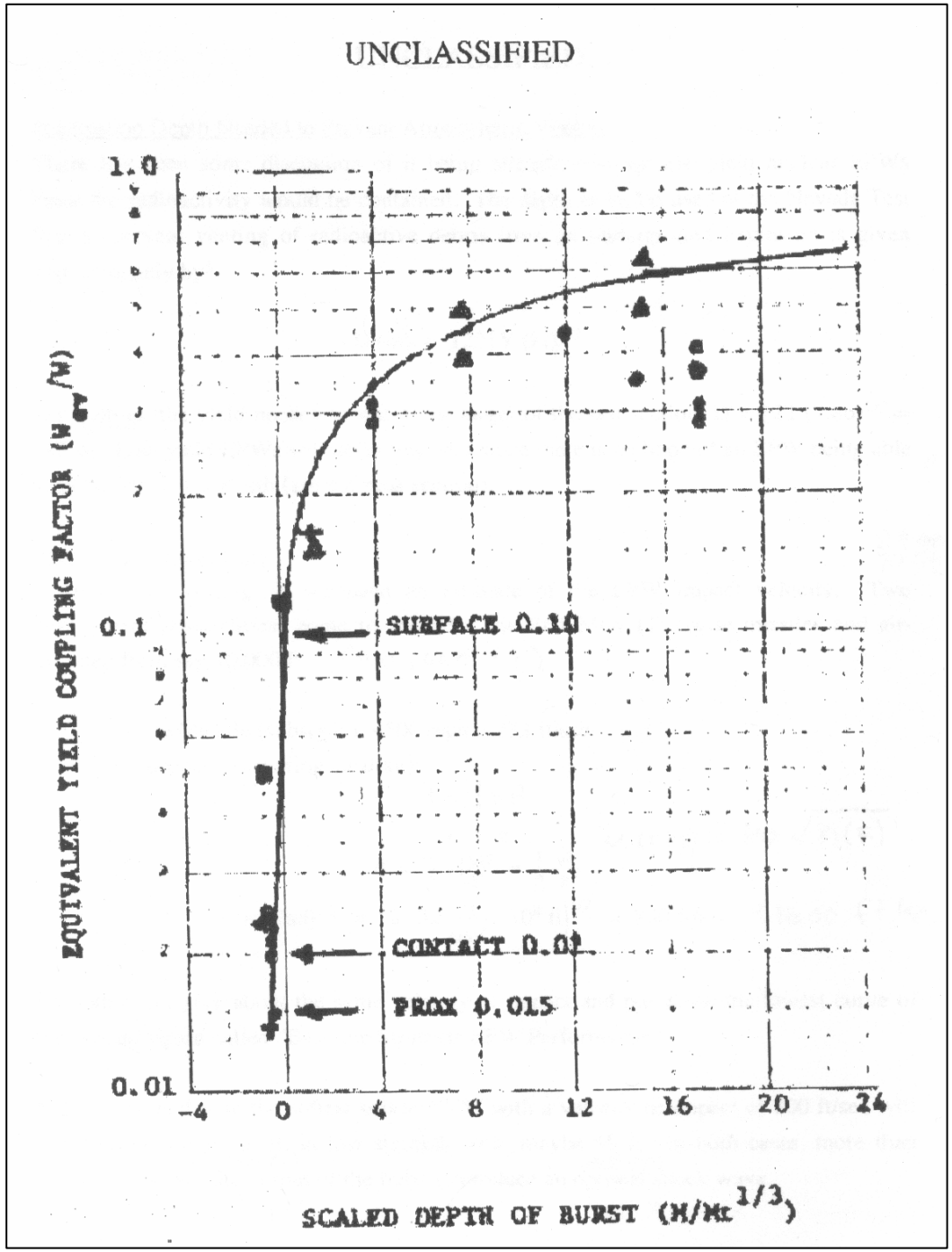
Strategic

- Targets in Russia and China (countries with which the U.S. has a deterrent relationship)
- Part of the SIOP
- Target Destruction the Overriding Criteria for Weapons Design—Higher Yields

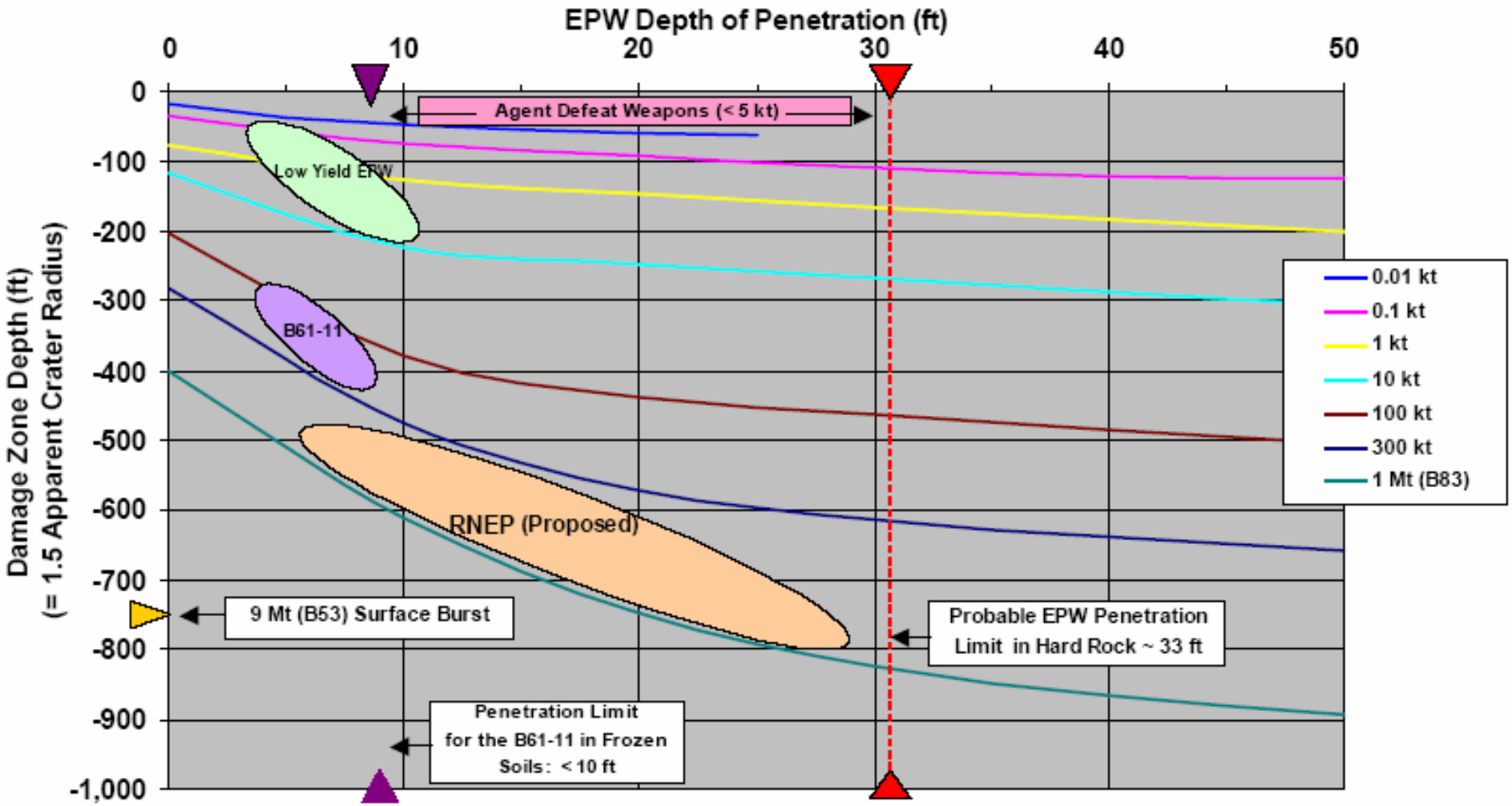
Earth-Penetrating Nuclear Weapons: Technical Issues

- Coupling the Energy from the Nuclear Explosion to the Earth to Destroy Underground Structures
- Fallout from the Nuclear Explosion—How Does it Change for a Buried Burst?

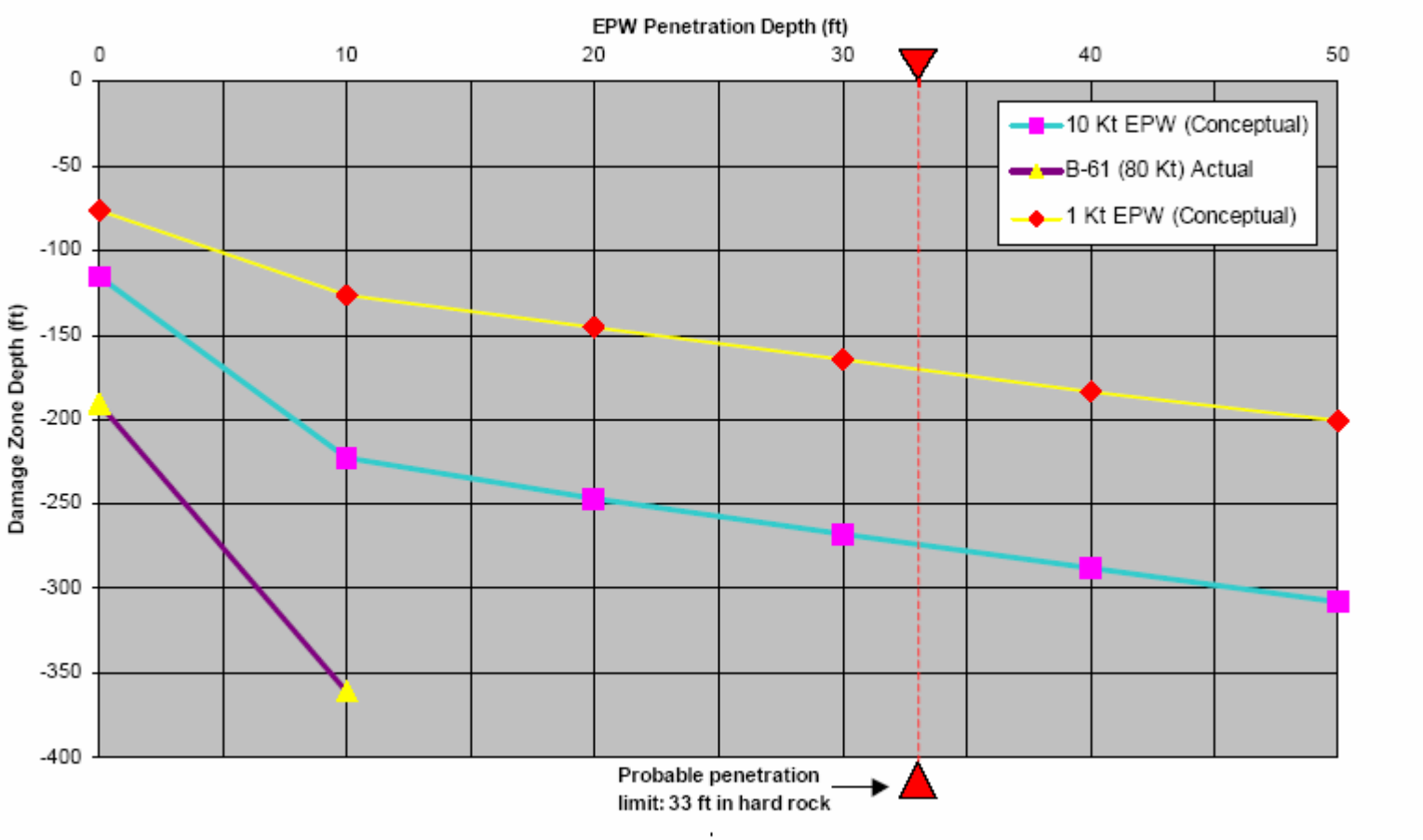
Coupling the Nuclear Explosive Energy to the Earth



Damage Depth vs. EPW Depth and Yield

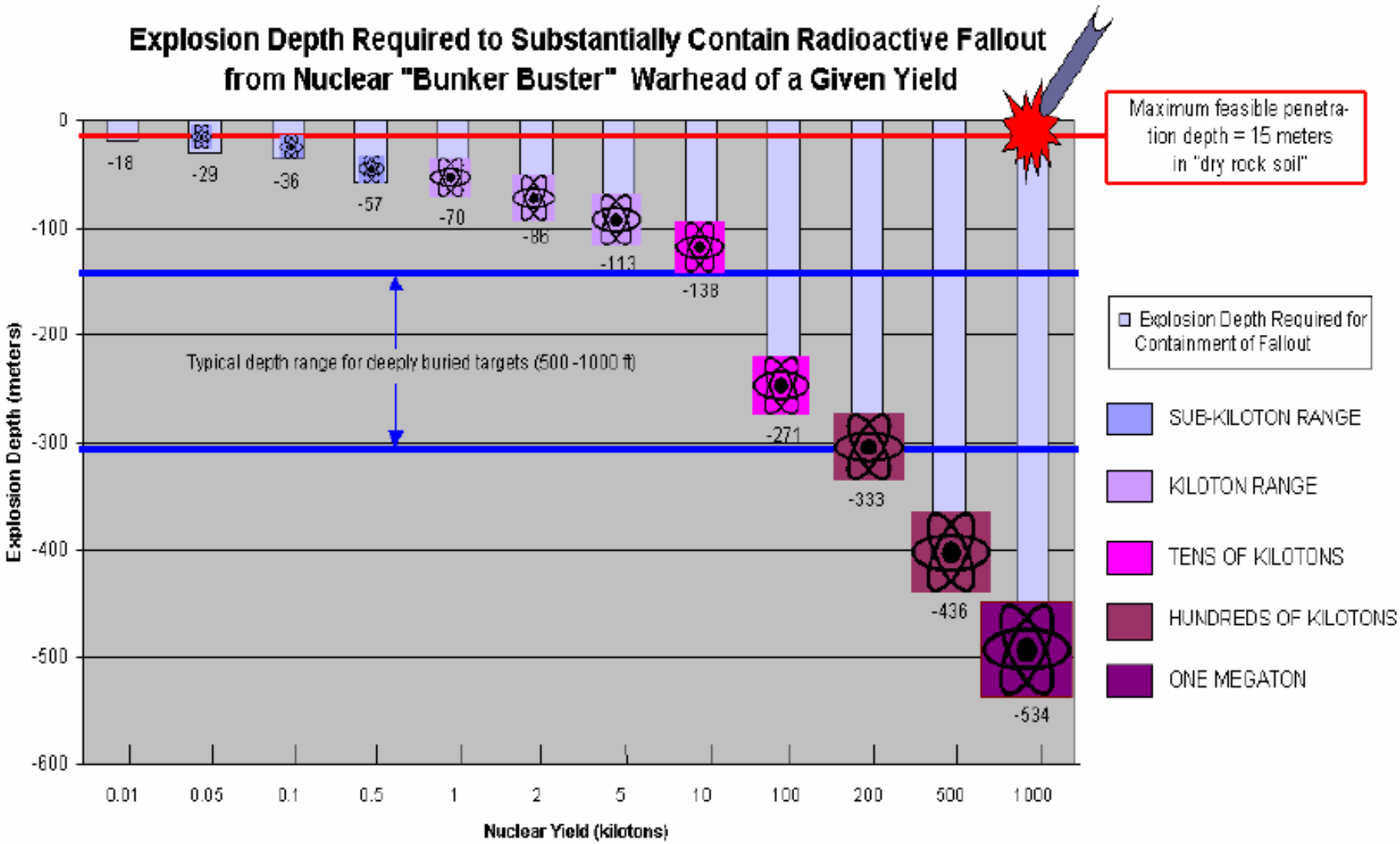


Damage Depth vs. EPW Depth and Yield



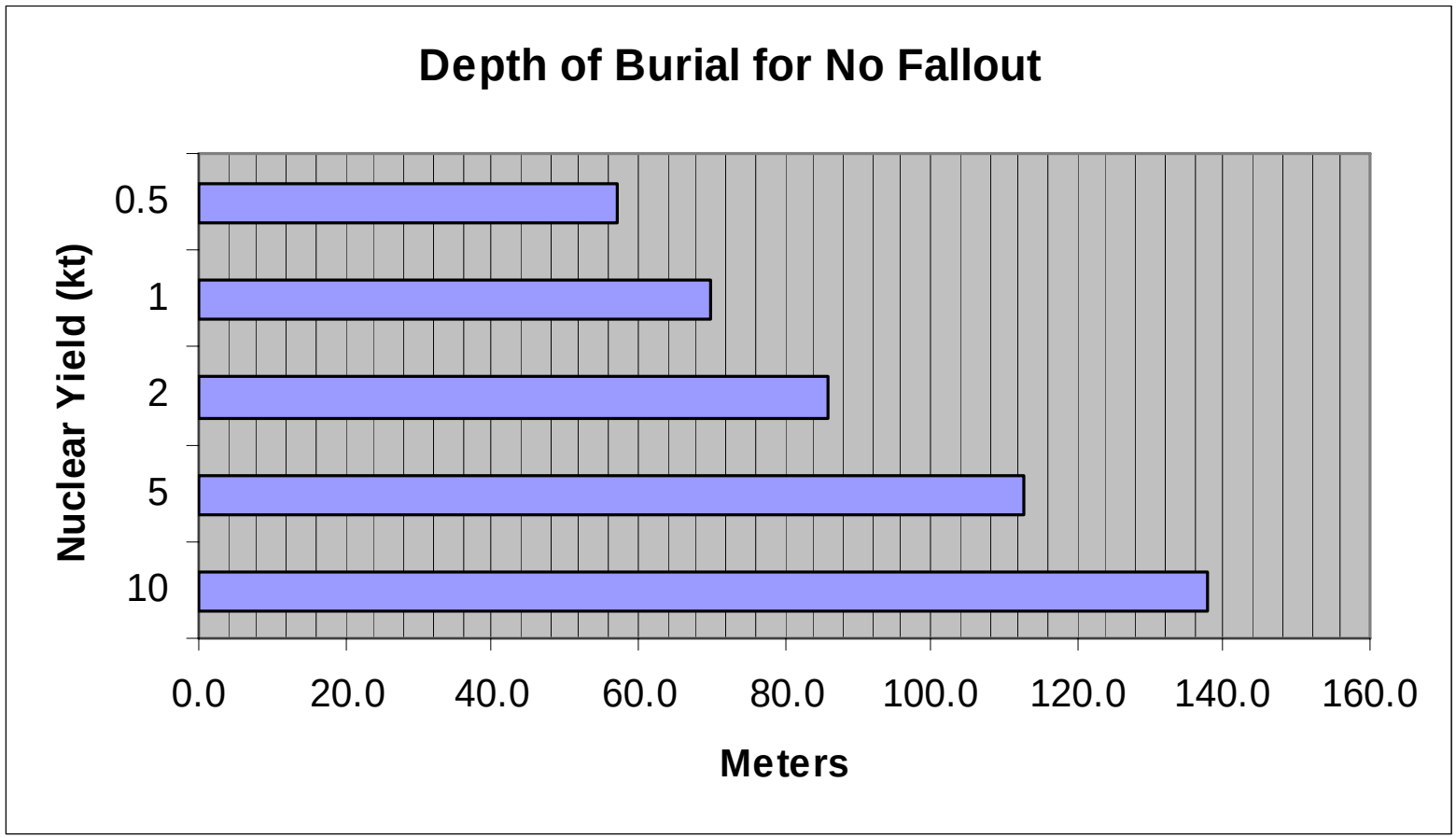
Nuclear Fallout: Intensity and Extent of Radioactive Contamination Depends on:

- Explosive Yield of the Nuclear Weapon (higher yield, more fallout);
- Depth of Burial (fallout increases with depth within the limits of penetration of existing EPWs)
- Type of Nuclear Weapon (fission or thermonuclear)
- Ambient Winds (wind speed and direction up to tens of miles above the ground zero)
- Weather (rain) and Terrain (mountains)

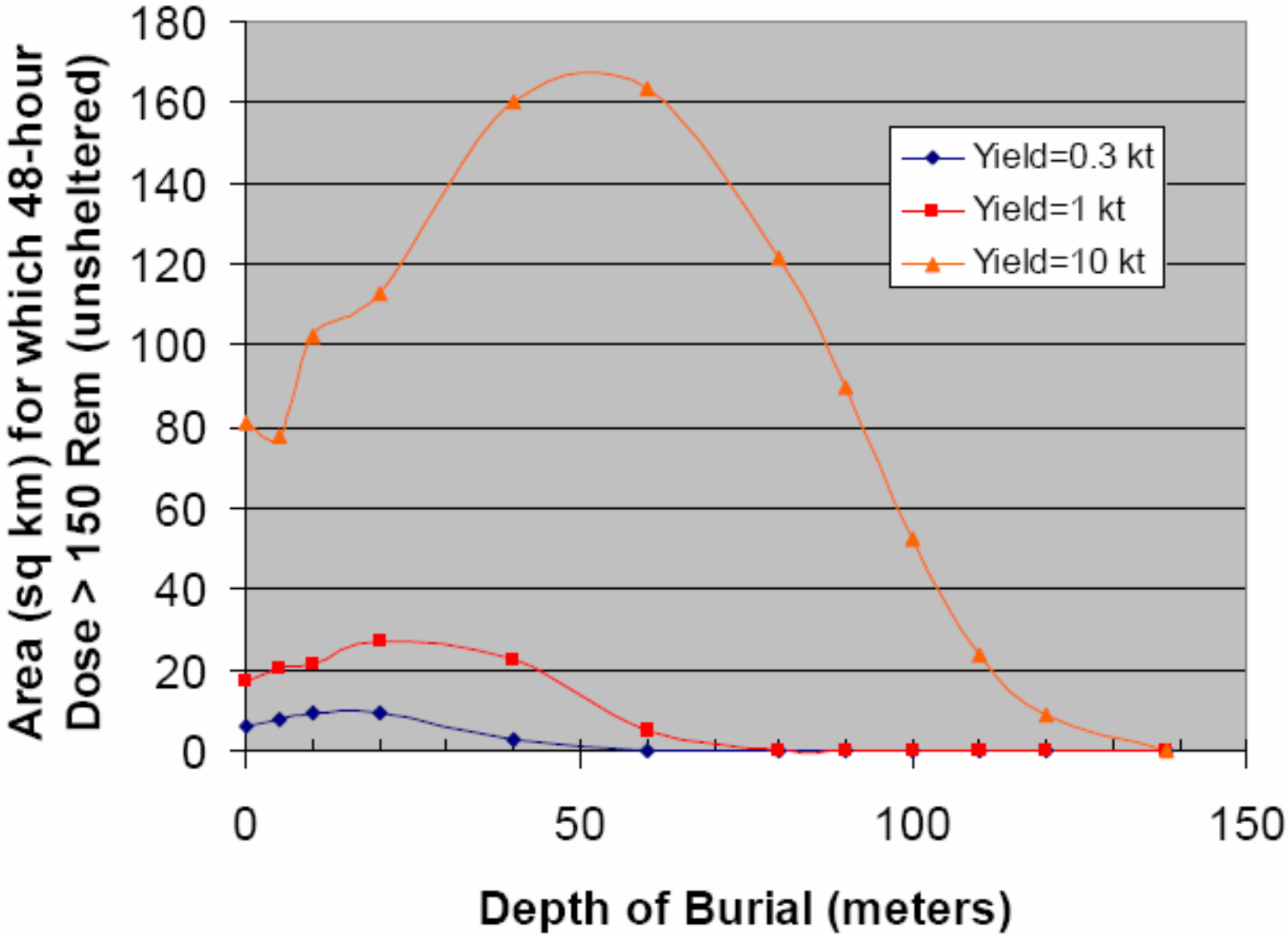

Explosion Depth Required to Substantially Contain Radioactive Fallout from Nuclear "Bunker Buster" Warhead of a Given Yield
Explosion Depth (meters)
0
-100
-200
-300
-400
-500
-600
-18
-29
-36
-57
-70
-86
-113
-138
-271
-333
-436
-534
Typical depth range for deeply buried targets (500 -1000 ft)
Maximum feasible penetration depth = 15 meters in "dry rock soil"
Explosion Depth Required for Containment of Fallout
SUB-KILOTON RANGE
KILOTON RANGE
TENS OF KILOTONS
HUNDREDS OF KILOTONS
ONE MEGATON
0.01
0.05
0.1
0.5
1
2
5
10
100
200
500
1000
Nuclear Yield (kilotons)

Depth of Burial (DOB) Cutoff for Fallout:

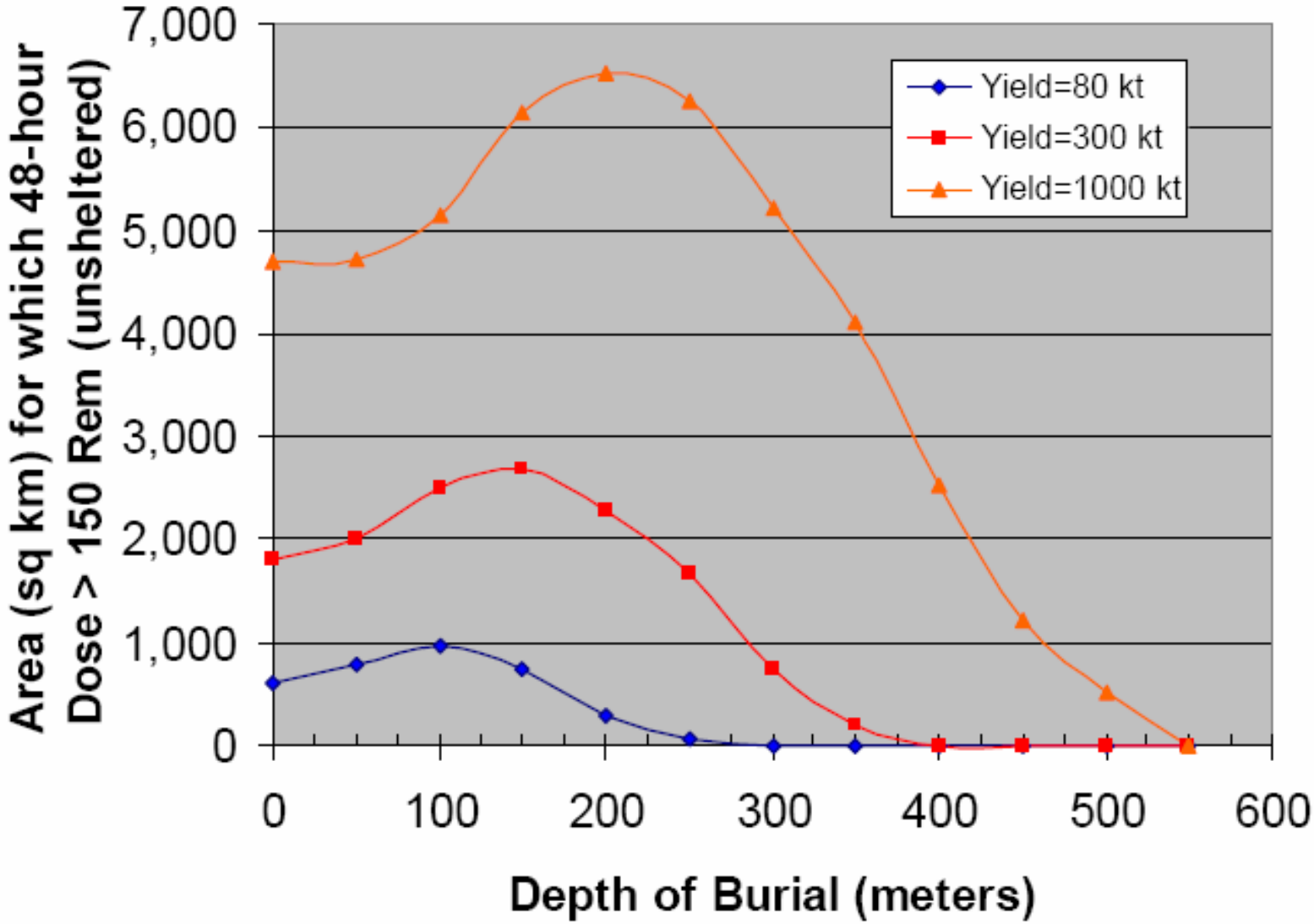
IF DOB < 70.1 x Yield$^{0.294}$ (m), No Fallout



Fallout Area vs. Depth of Burial



Fallout Area vs. Depth of Burial



Earth-Penetrating Nuclear Weapons

Hypothetical Use

1. 5-kilotons EPW in an Urban Area
2. Regional/Tactical: North Korean Leadership Target in Pyong'yang
3. Strategic: Russian Command Bunker in Moscow

5-kilotons EPW in an Urban Area (Washington, DC)

Ground Zero:

500 5th Street, NW

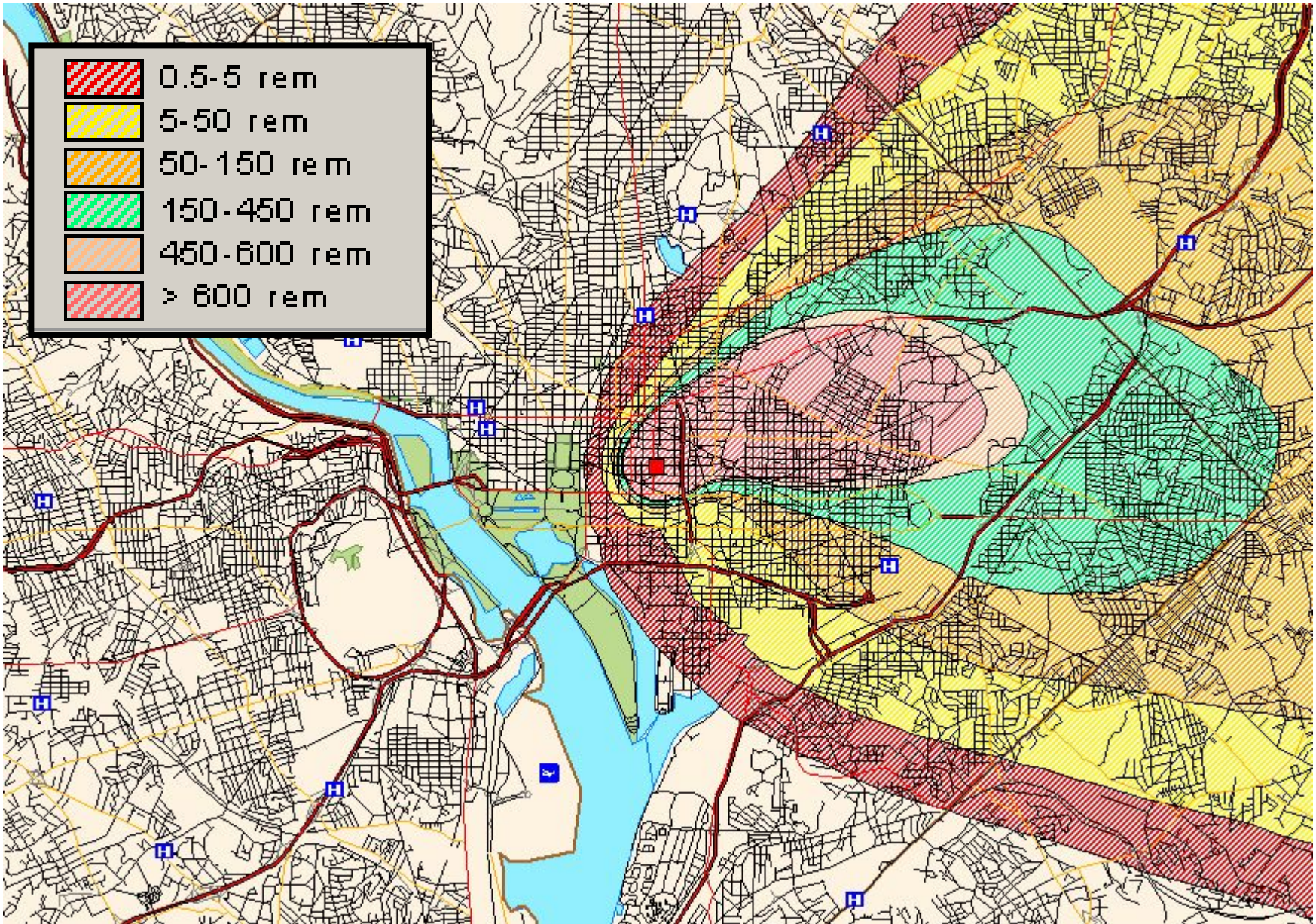
3 meters DOB (today's EPW technology): **140,000 casualties**

50 meters DOB (~ maximum fallout): **350,000 casualties**

100 meters DOB (substantial containment): **15,000 casualties**

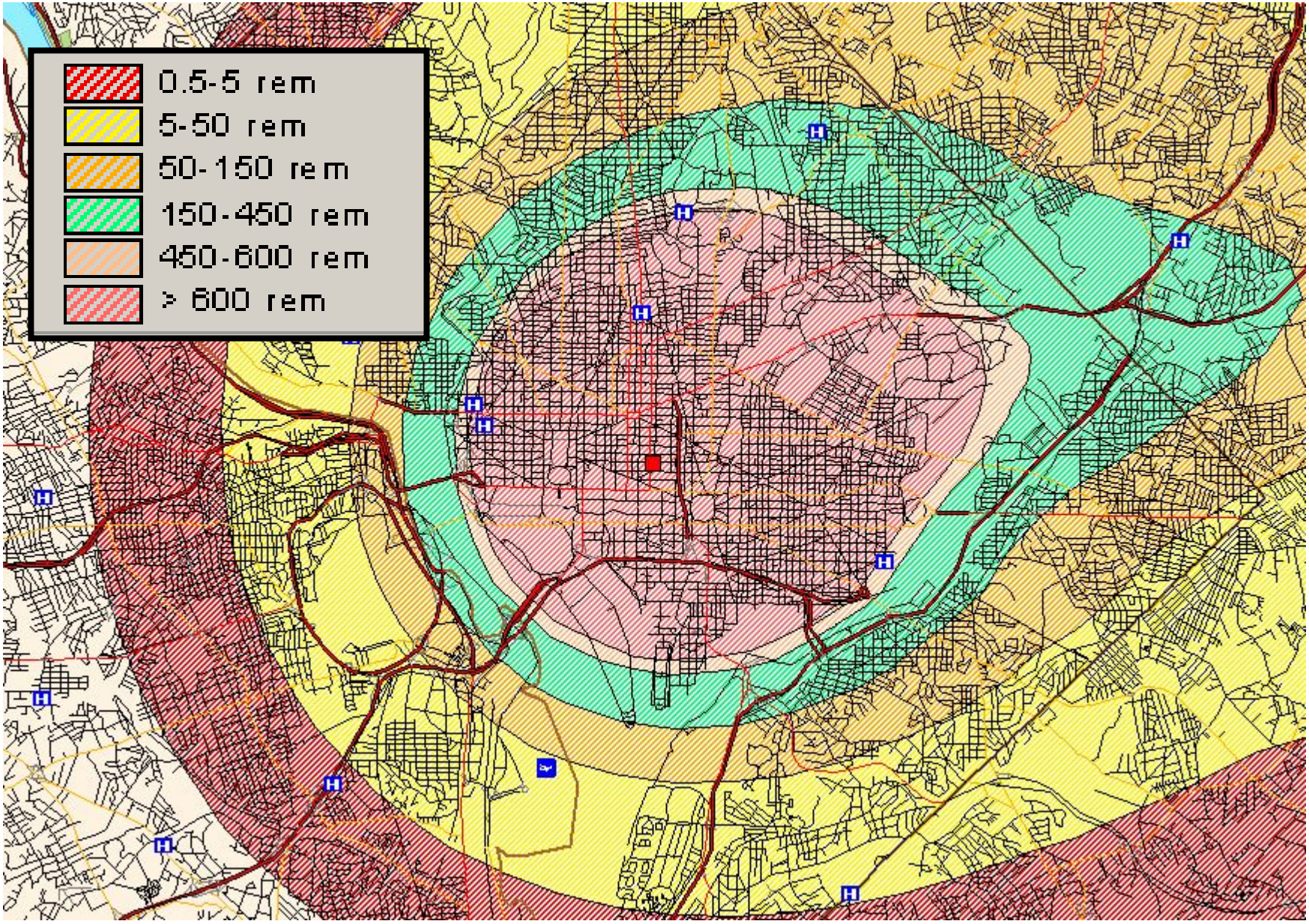
5-kilotons EPW in an Urban Area (Washington, DC)

3 meters DOB



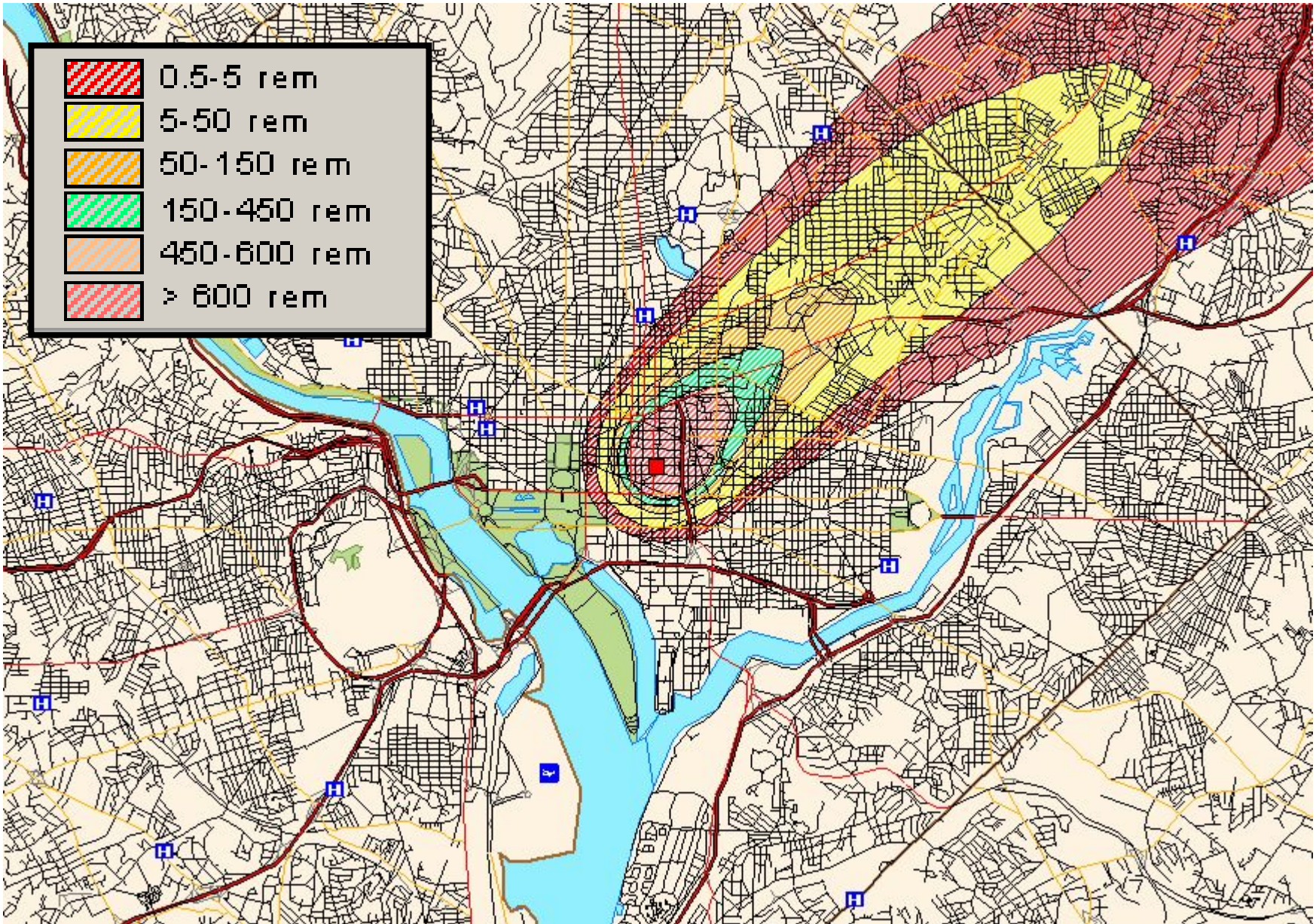
5-kilotons EPW in an Urban Area (Washington, DC)

50 meters DOB



5-kilotons EPW in an Urban Area (Washington, DC)

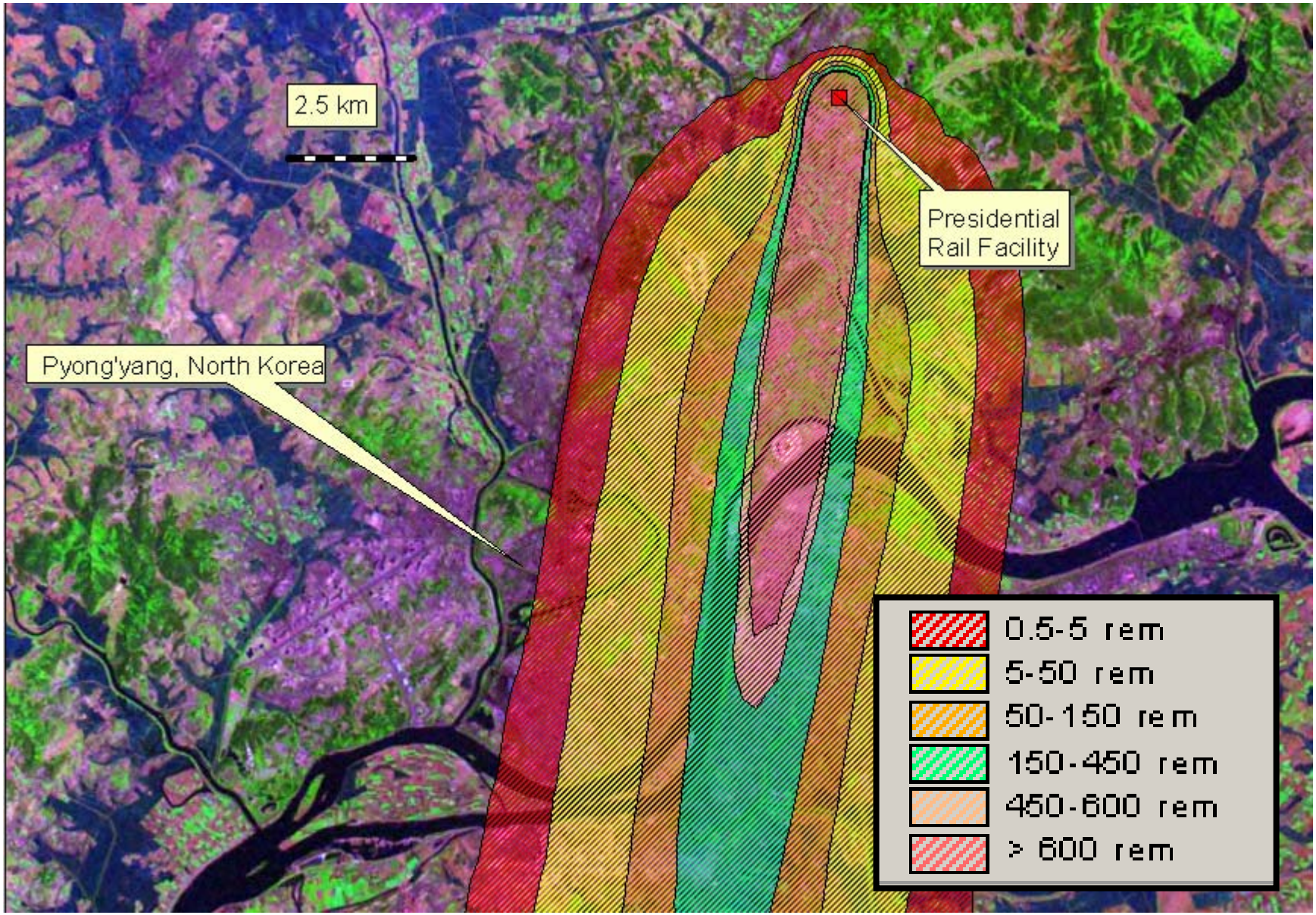
100 meters DOB



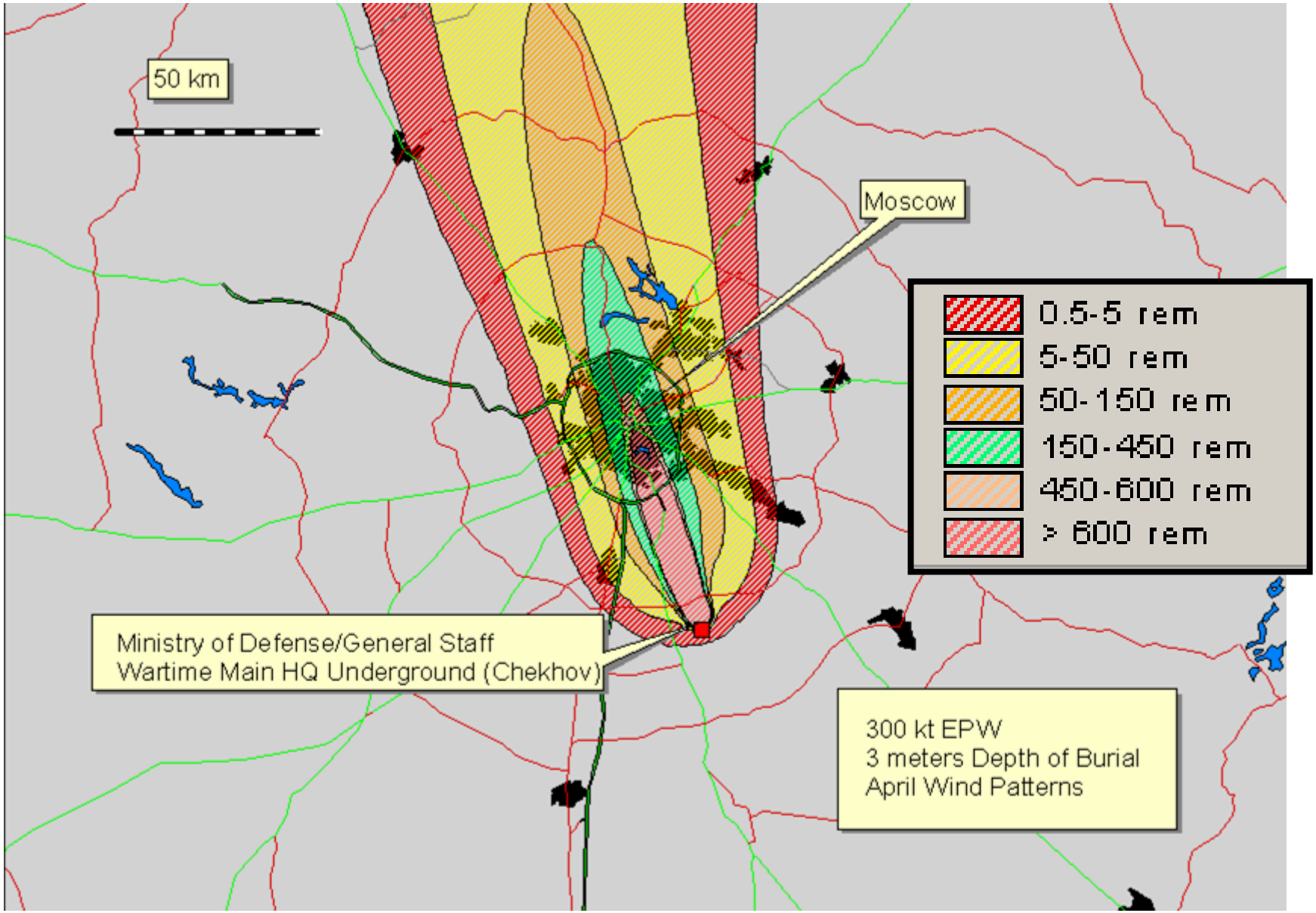
Earth-Penetrating Nuclear Weapons: Hypothetical Use

Presidential Rail Facility, Pyong'yang, North Korea

5 kt EPW, 3 meters DOB, fixed winds: 370,000 Casualties

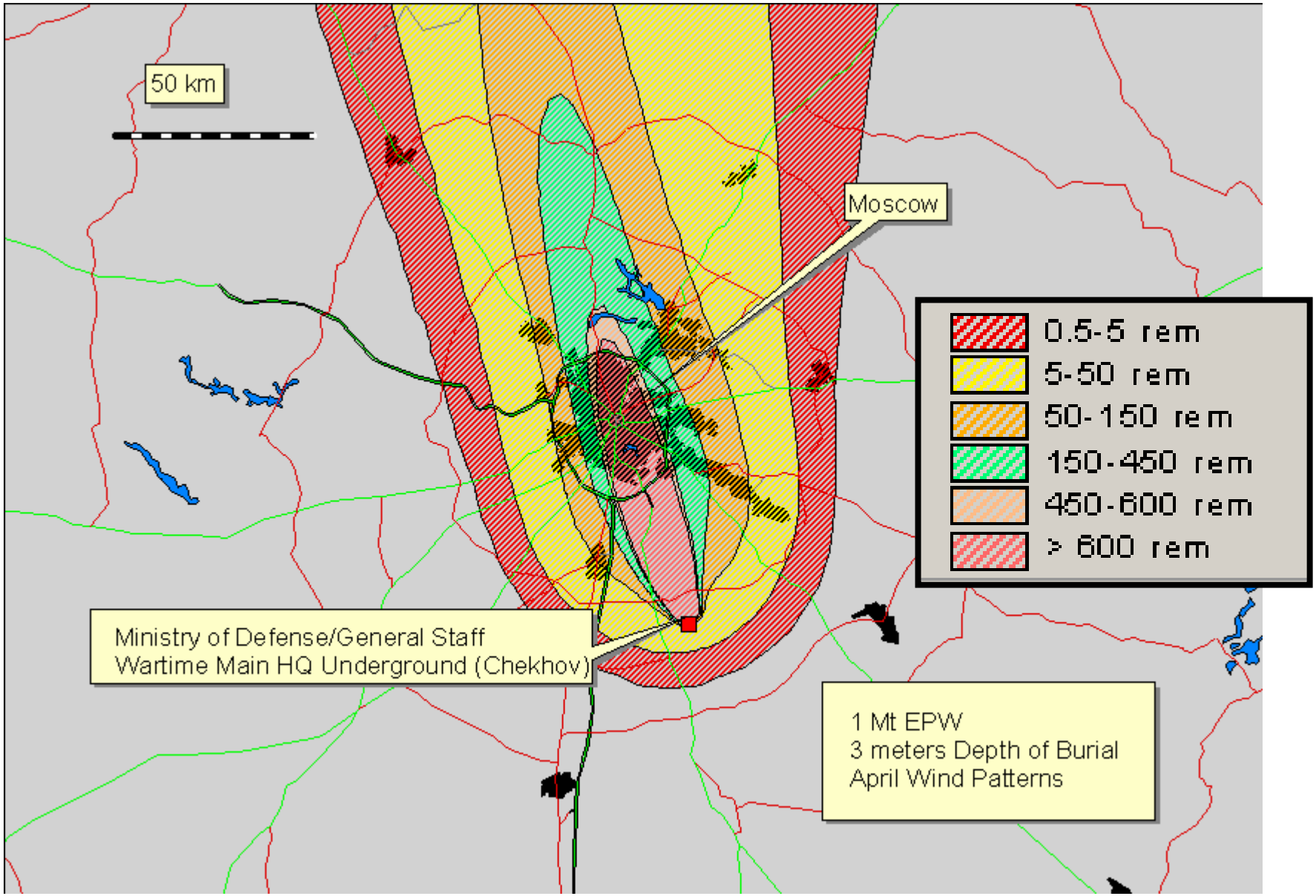


HPAC Calculation: B-61 Mod 11 near Moscow



Upwards of 4.6 Million Casualties

HPAC Calculation: 1-Mt EPW near Moscow



Upwards of 8 Million Casualties

NRDC Opposes Further Development of the EPW

I. New Nuclear Weapons Development in the United States—Particularly in a Regional Context against Non-Nuclear Weapon States—Interferes with the Critical U.S. Foreign Policy Objectives of Non-Proliferation and Nuclear Disarmament

II. EPW Program would Exacerbate Potential for a Return to Testing in the U.S., Even with the Current Absence of Military Requirements for New Nuclear Weapons

III. Low-yield EPW's are not Effective Agent Defeat Weapons; Have Minimal Depth of Destruction; Result in Excessive Fallout and the Intelligence Requirements for their Use are Unreliable.

IV. High-yield EPW's Have No Regional Use and No Added Strategic Deterrent Value.

V. Unnecessary to Deter Emerging Threats or to Maintain Weapon Designer Competency or to Avoid Design Surprises