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

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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

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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

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Damage Depth vs. EPW Depth and Yield

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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

Maximum feasible penetration depth = 15 meters in "dry rock soil"

Typical depth range for deeply buried targets (500-1000 ft)

- SUB-KILOTON RANGE
- KILOTON RANGE
- TENS OF KILOTONS
- HUNDREDS OF KILOTONS
- ONE MEGATON

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Depth of Burial (DOB) Cutoff for Fallout:
IF DOB < 70.1 x Yield$^{0.294}$ (m), No Fallout
Fallout Area vs. Depth of Burial

Area (sq km) for which 48-hour Dose > 150 Rem (unsheltered)

Depth of Burial (meters)
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

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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

39.1106 N
125.7895 E
5 kt EPW, 3 meters DOB, fixed winds: 370,000 Casualties

Pyongyang, North Korea

Presidential Rail Facility

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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

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