A New Social Problem for Reactors: Accurate Missile Attacks

October 20, 2020
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"The Armenian side must not forget that our army's state-of-the-art missile systems allow us to strike the Metsamor nuclear plant with precision, which could lead to a great catastrophe for Armenia," Vagif Dargahli, the Azerbaijani Defense Ministry spokesman, said on July 16,
Fukushima Suggests What’s Possible
These Missiles Shoot within the Lethal Blast Area of their Warheads
Tandem Charge Munitions: Effective Concrete Penetrators
With Accurate Missiles: What Reactor Points Can Be Targeted
# Targeting Distinct Reactor Aim Points Yields Distinct Results

<table>
<thead>
<tr>
<th>Light Damage</th>
<th>To Cause Panic, Evacuations, Electrical Supply Disruptions, You Might Target</th>
<th>To Cause Widespread Contamination AND Panic, Evacuations, Electrical Supply Disruptions You Might Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot</td>
<td>• Grid Connection Supplying Plant Electricity OR Emergency Generators</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>High Damage</th>
<th>• BOTH Grid Connection &amp; Emergency Generators</th>
<th>• BOTH Grid Connection &amp; Emergency Generators</th>
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</thead>
<tbody>
<tr>
<td>Control Room</td>
<td>• BOTH Grid Connection &amp; Emergency Generators</td>
<td>• BOTH Grid Connection &amp; Emergency Generators</td>
</tr>
<tr>
<td>Nuclear Island (Containment)</td>
<td>• BOTH Grid Connection &amp; Emergency Generators</td>
<td>• BOTH Grid Connection &amp; Emergency Generators</td>
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</tbody>
</table>

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<tr>
<th>Extreme Damage</th>
<th>• Spent Fuel Ponds</th>
<th>• Spent Fuel Ponds</th>
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</thead>
</table>
Strikes Can Be Timed with Prevailing Winds to Produce No or Major Casualties
Some Strikes Could Kill a Nation

Hypothetical nuclear accident at the Rokkasho reprocessing plant’s spent fuel pool in Japan

Relocation areas for hypothetical nuclear accident at the Rokkasho reprocessing plant’s spent fuel pool on 1 October and 1 December 2019 (6,470 PBq of Cs-137 release)
Civil Nuclear Plants in East Asia
Civil Nuclear Plants in Southwest Asia
Nuclear Plants in the Middle East
Future Nuclear Sarajevos?

• Israel attacks Iran’s reactor, Russia gets engaged?
• Iran attacks Saudi or Israeli reactor, US gets engaged?
• Pakistan attacks Indian reactor or visa versa, the US or China engages?
• North Korea attacks S. Korean or Japanese reactor, the US engages?
• China strikes Taiwan’s reactors, the US engages?
What Can Be Done for Existing Plants (1)

● Remove older spent fuel to dry cask storage
● Reposition spent fuel to distribute hottest fuel more evenly
● Build spray cooling and monitoring systems for storage ponds
● Construct remote backup nuclear reactor control rooms
What Can Be Done (2)

• Build passive barriers

• Harden spent fuel pond structures and diesel generator control room buildings

• Deploy active air defenses
Additional Slides
Dozens More Mystery Drone Incursions Over U.S. Nuclear Power Plants Revealed
September 7, 2020
Rising Risks, Cheaper Alternatives: Wither New Nuclear Builds?

Normal Accidents
Living with High-Risk Technologies
Charles Perrow

Catastrophic Potential

Simple Complexity Complex

Tight Loose

KEEP OUT!

- Charles Perrow, Normal Accidents
Reactors Attacked 13 Times in the Middle East, But Success Required a First-Rate Air Force

1980 One Iranian strike against Osirak
1981 One Israeli raid against Osirak
1980-1985 Seven Iraqi strikes against Bushehr
1990 One US strike against Osirak
1991 One Iraqi Scud attack attempted against Dimona
2003 One US strike against Osirak
2007 One Israeli strike against Syria’s Reactor
Abqaiq, September 14, 2019: 1st Successful, Precise Missile Strike against a Missile-Defended Site

US Patriots, German Skyguard, French Shahine Never Engaged
India, China, S. Korea, Israel, Iran, Armenia, UAE, S. Arabia, Azerbaijan, Taiwan & Algeria All Have Accurate Missiles
A Cautionary Tale of Self-deterrence: A 2001 “Preemptive” Decision Not to Strike N. Korea’s Yongbyong Reactor

Key Defense Policy Board Members, 2001
Then, DPRK Missiles Could Barely Hit a Farm, Now They Can Knock Off a Barn Door

**2001**

Hwasong-5, 6, Scud-ER
CEP 1,000-3,000 m
~150-300 missiles?

**2020**

KN-18
MaRV
CEP < 200 m?

KN-02
CEP ~100 m

KN-23
CEP 5-30 m or less?
Hit a Civilian Spent Reactor Fuel Pond and You Can Force Millions to Evacuate

(Ref: Dr. Michael Schoepner, Calculations in 2018)

(Note: The contamination threshold for relocation of 1.5 MBq/m² used for the populations around Fukushima and Chernobyl and recommended by the US Environmental Protection Agency.)
Reactor Strikes Can Be Timed with Prevailing Winds to Harm 1 or 2 Countries