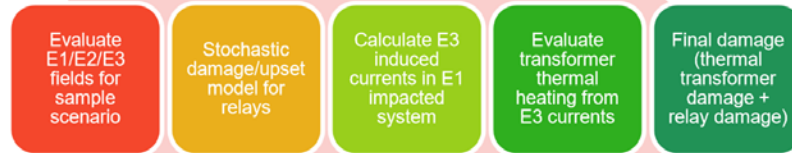# FERC: 2017 Reliability Technical Conference

Michael K. Rivera

A-1: Information Systems and Modeling

Los Alamos National Laboratory

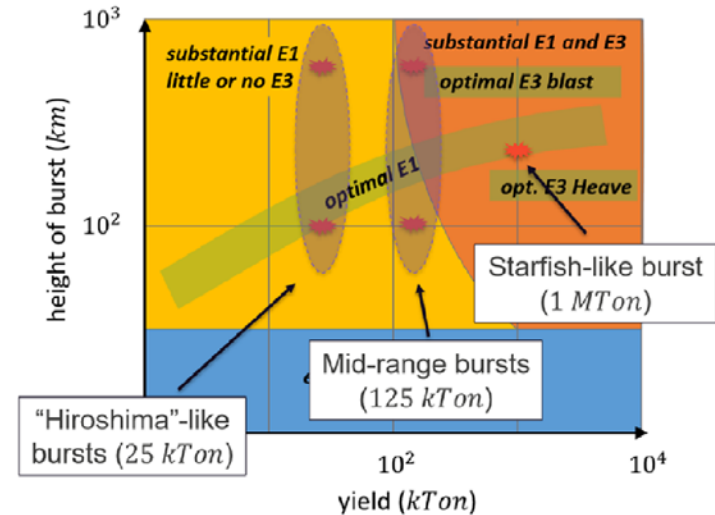LA-UR-17-24988 and LA-UR-17-24992

UNCLASSIFIED

| Yield (kTon)	Height of Burst (km)	E1	E3 Blast @ Edge of E1	E3 Heave Centered on E1
25	100	Regional—high	Low	Low
25	400	CONUS—low	Low	Low
125	100	Regional—high	Low	Med/High
125	400	CONUS—low	Med/High	Low/Med
1000	200	Interconnect—med	Med	High
10	endo	City	none	none

- No workflow comparable to TPL-007-1
- Working with DOE/OE, DHS, and EPRI (Horton) to develop a scientifically-based workflow

Possible EMP workflow:

Evaluate E1/E2/E3 fields for sample scenario → Stochastic damage/upset model for relays → Calculate E3 induced currents in E1 impacted system → Evaluate transformer thermal heating from E3 currents → Final damage (thermal transformer damage + relay damage)

Note: Tri-lab effort is currently on schedule to deliver end-end capability in Sept. 17

LA-UR-17-24988
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Gamma Source: 0.3% Yield, 0.2/sh rise, 2/sh fall
IGRF12 Magnetic Field
Radiated Hazard (CHAP): Peak Electric Field

Contour Levels every 1 kV/m
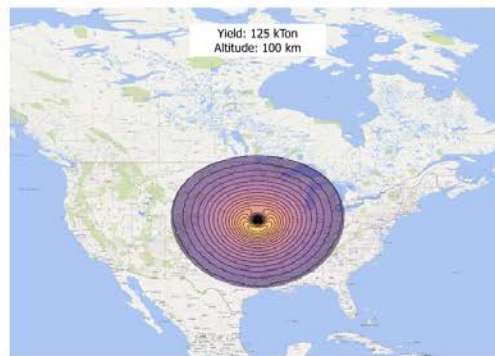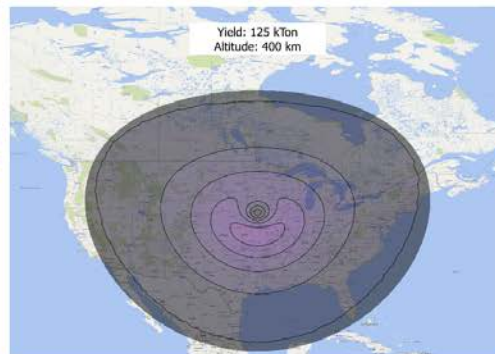
Maximum Field Values

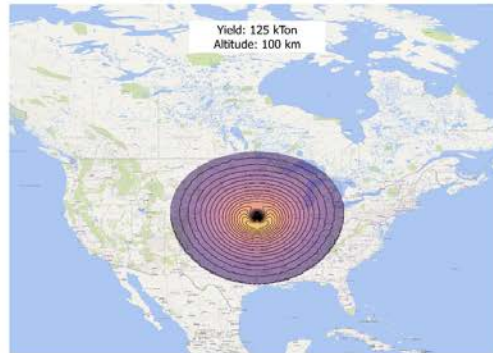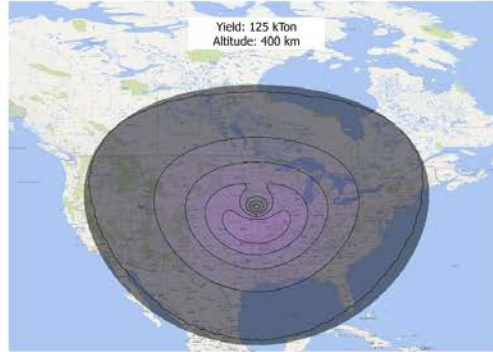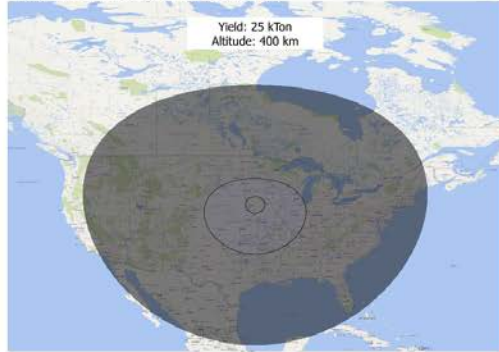| Yield (kTon)	H.O.B. (km)	Maximum Peak Electric Field (kV/m)
25	100	11.8
25	400	1.7
125	100	20.7
125	400	5.6
1000	200	25.3

LA-UR-17-24992

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50 meter High Aerial Line (10 km long)
End Impedance: 1 GΩ
Worst Case Peak Voltage (Not Realizable)

Contour Levels every 100 kV

Maximum Field Values

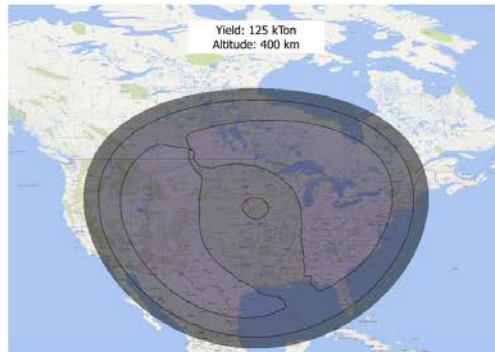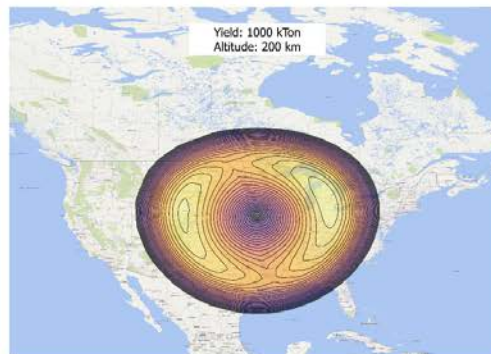| Yield (kTon)	H.O.B. (km)	Worst Case Peak Voltage (kV)
25	100	1264
25	400	181
125	100	2199
125	400	591
1000	200	2694

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UNCLASSIFIED

50 meter High Aerial Line (10 km long)
End Impedance: 1 GΩ
Maximum Peak Voltage

Contour Levels every 40 kV

Maximum Field Values

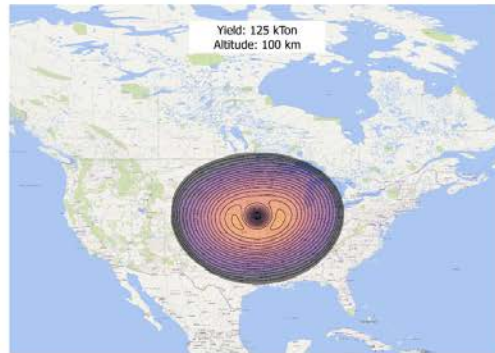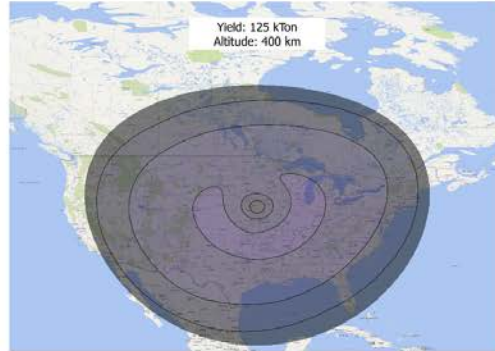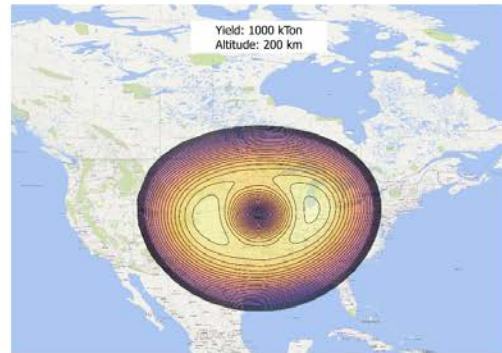| Yield (kTon)	H.O.B. (km)	Maximum Peak Voltage (kV)
25	100	223
25	400	21.6
125	100	606
125	400	98.3
1000	200	954

LA-UR-17-24992

UNCLASSIFIED

50 meter High Aerial Line (10 km long)
End Impedance: 1 GΩ
Expected Peak Voltage

Contour Levels every 17 kV

Maximum Field Values

Yield (kTon)	H.O.B. (km)	Expected Peak Voltage (kV)
25	100	134
25	400	15.1
125	100	295
125	400	55.3
1000	200	413

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