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Extrapolating radionuclide observables from the Platte underground nuclear explosive test

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CTBT Science and Technology 2017

PNNL-SA-126273

Platte UNE

- 14 April 1962 – part of a series of underground nuclear explosive tests after the end of the 1958-1961 moratorium
- Early days of U.S. efforts to conduct and contain nuclear explosions underground
- Horizontal (tunnel) emplacement into the side of a mesa at the Nevada Test Site (now known as the Nevada National Security Site)
- 170.7 m depth of burial
- 1.85 kT yield

Same location – same result:
Des Moines UNE

Platte Site

Platte Release

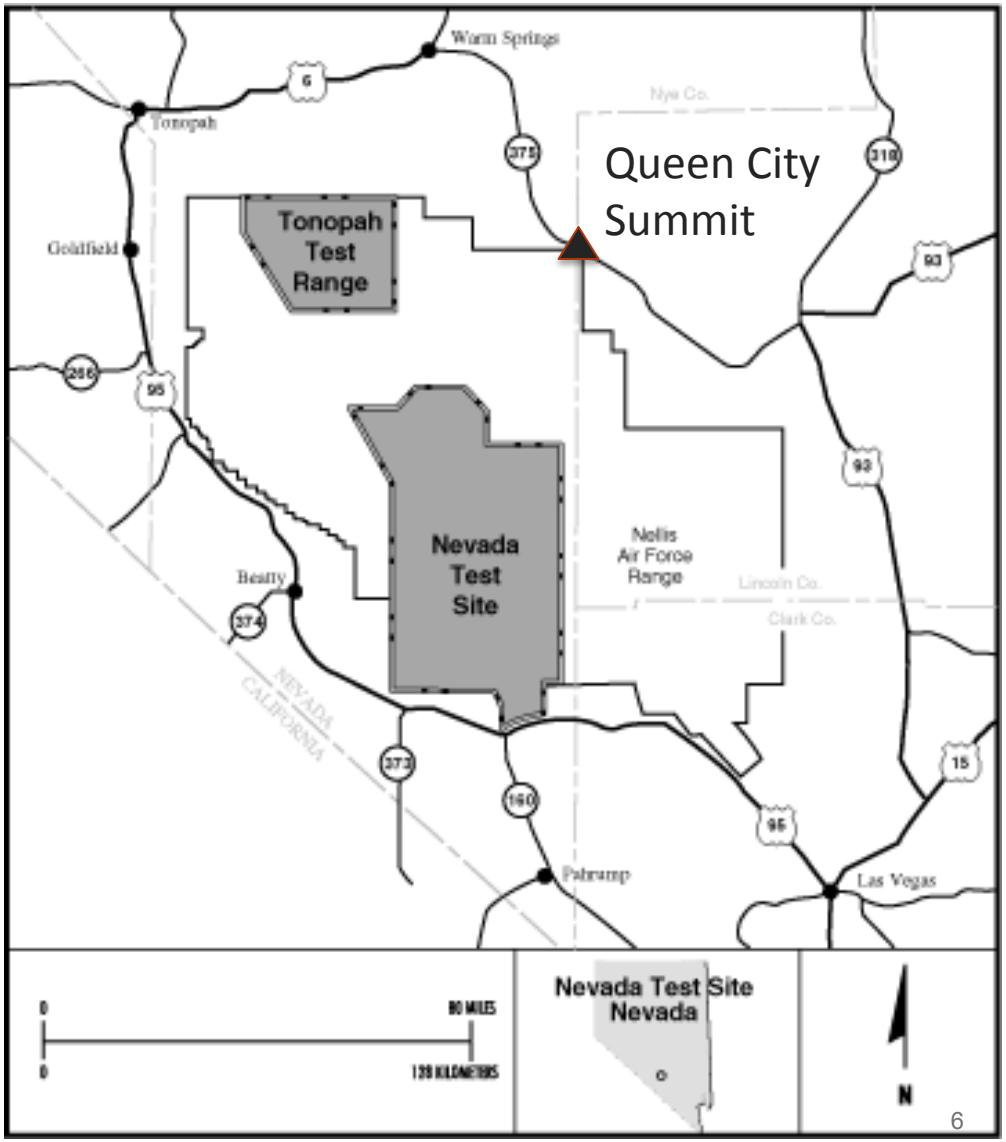
- Prompt venting within 1.5 seconds from tunnel portal, fissures on hillside, and tunnel ventilation hole
- Cloud of radionuclide particulates formed that included: $^{95}Zr/^{95}Nb$, ^{103}Ru, ^{105}Ru, ^{131}I, ^{133}I, ^{135}I, ^{132}Te, $^{140}Ba/^{140}La$, ^{141}Ce, and ^{144}Ce
- Release cloud height of ~2400 m
- Cloud drifted north at 29 km/hour
- Detected up to 200 km away
- Test release at 12 hours: 7×10^{17} Bq

Modeling Platte Release

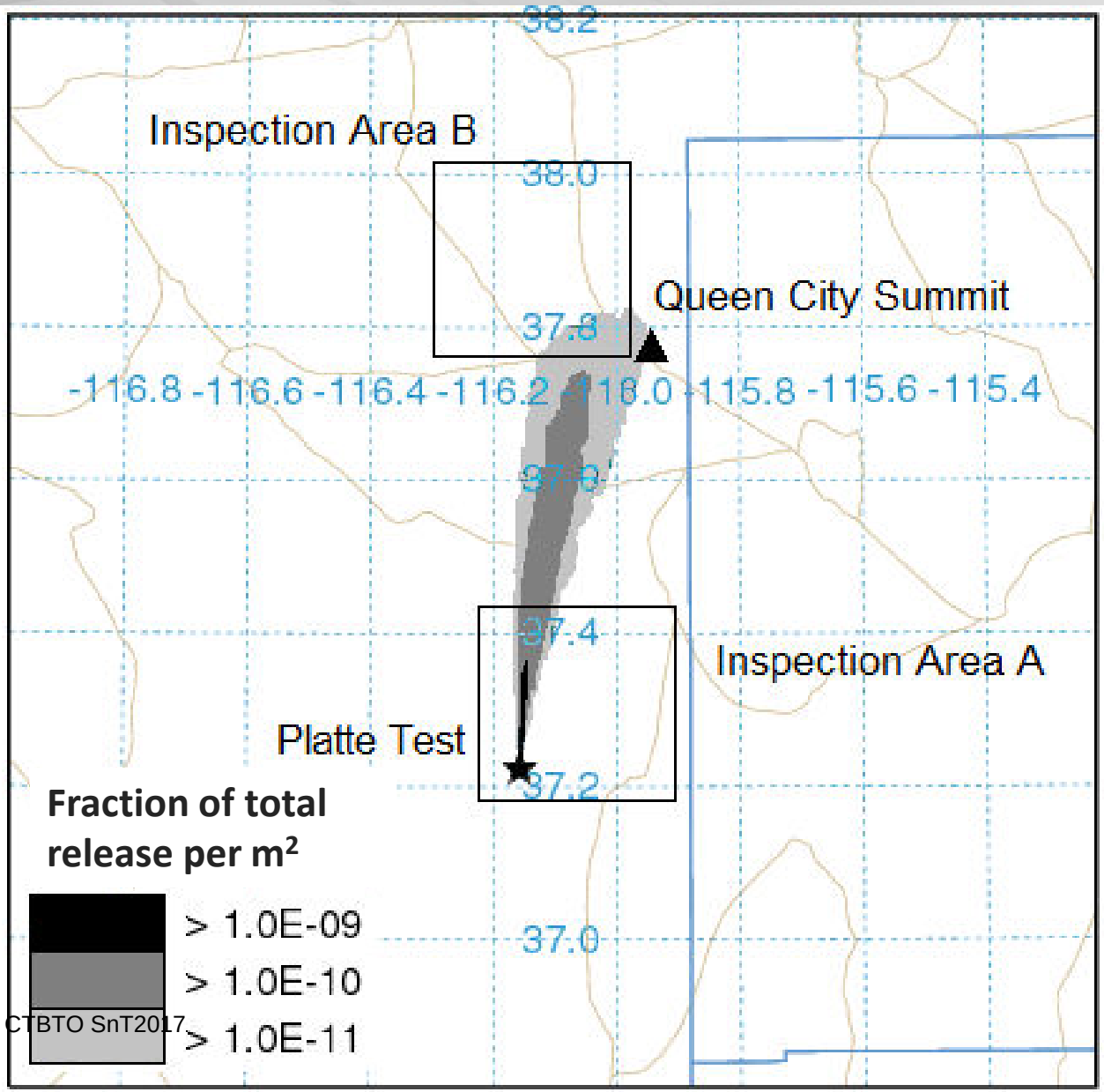
- Isotope Inventory: Fission product yield data from England and Rider
- Prompt release means no need for decay-chain considerations before release
- Percentage release: Will use measurements to constrain
- Fractionation: This can vary much for different releases. However, given the number of radioisotopes detected and the promptness of the release, the amount of fractionation prior to release for this UNE will be at the minimal end of the scale.
- Dispersion and deposition: HYSPLIT using actual meteorological data

Platte Release Detection

- High iodine and tellurium concentrations in the range of 100 – 1000 Bq/m^3 were measured at Queen City Summit 63 km away
- HYSPLIT model shows a dilution factor from UNE site to Queen City Summit of 1 x 10^{-12}
- Results in a release percentage calculation of about 0.36% of produced radioactivity
- Using this, we can make a plume map of Platte for an "OSI"



Platte Deposition Plume



Nuclide	Bq m^{-2}
^{95}Zr	48.8
^{95}Nb	89.3
^{99}Mo	1393.9
^{99m}Tc	9109.2
^{103}Ru	116.2
^{106}Rh	7.9
^{131}I	319.0
^{132}Te	1036.5
^{132}I	11107.4
^{137}Cs	0.4
^{140}Ba	276.8
^{140}La	1997.2
^{141}Ce	105.7
^{144}Ce	8.6
^{144}Pr	16.0
^{147}Nd	120.1

Detecting a Platte Plume

- Using Minimum Detectable Activities (MDAs) from IFE14 for soil samples analyzed in the laboratory, we calculated how long each OSI Relevant Radionuclide would have been detectable for two "inspection areas".
- Only the well-chosen Inspection Area has measureable radioisotopes at two years.

Nuclide	MDA	Days	
	($Bq\ m^{-2}$)	A	B
^{95}Zr	4.7	642	217
^{95}Nb	3.5	>	316
^{99}Mo	26.5	35	16
^{99m}Tc	9.9	38	20
^{103}Ru	3.0	468	208
^{106}Rh	24.9	>	--
^{131}I	3.6	106	53
^{132}Te	4.3	47	26
^{132}I	3.2	49	28
^{137}Cs	3.3	>	--
^{140}Ba	11.4	144	59
^{140}La	2.6	174	89
^{141}Ce	7.2	343	127
^{144}Ce	31.9	>	--
^{144}Pr	189.6	623	--
^{147}Nd	17.5	104	31

Conclusion

- Using measurement data from a U.S. low-yield UNE release, and coupled with meteorological data, we have generated a deposition plume model for the UNE
- This model can inform the kinds of particulate radioisotope activities that might be present in an OSI and how long they might be detectable via soil samples
- Although the percent release is larger than most releases from the U.S. underground nuclear explosive testing, it is not large for full (many radioisotope particulates escape), prompt releases
- Study did not attempt to describe noble gas releases or depositions very near the release location

Platte Today

Thank You!

- You can watch a video of the Platte release, as well as read our journal article on radionuclide observables at:

http://dx.doi.org/10.1016/j.jenvrad.2016.08.002

"Radionuclide Observables for the Platte Underground Nuclear Explosive Test on 14 April 1962", J.L. Burnett and B.D. Milbrath, Jou. Env. Rad. **164**, 232-8 (2016).

The authors wish to thank the U.S. Department of Energy, National Nuclear Security Administration, Office of Nonproliferation and Arms Control for their support of this presentation.