

# Report: USSR Nuclear EMP Upper Atmosphere Kazakhstan Test 184

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**Test Description:** *In recent years, Russia provided very limited data on the 1962 USSR Nuclear EMP tests over Kazakhstan, the “K Project,” almost all from Test 184. The missiles in the **K Project** were all launched from Kapustin Yar toward the Saryshagan ABM test range just west of the town of Saryshagan. Test 184’s Estimated Detonation Point, 47.78 N, 65.329 E, was above a point 180 kilometers west of Zhezqazghan. The nuclear detonation caused an electromagnetic pulse that covered all of Kazakhstan, with the strongest effects near the south central region.*

## 1. Executive Summary

### **SCALABILITY of Test 184 to 2012**

The impact from Test 184 is considered to be much lower than from an EMP attack today on a small region or country. The test caused serious damage, *in spite of* 3 factors limiting the impact:

1. A low intensity (huge area) EMP E1 Field due to very high altitude (290 km) detonation
2. Low EMP field strengths from a warhead design with lower EMP efficiency than a conventional fission bomb.
3. Virtually all equipment in the region was pre-digital age, using highly EMP-resistant vacuum tubes in place of today’s extremely sensitive digital technology.

### **IMPACT of Test 184<sup>1</sup>**

- **Generating Power Stations:** Burned out (and in one case apparently burned down)
- **Underground power lines:** Fused
- **Above ground power lines:** Insulators burned out
- **Long distance telephone lines:** Shut down (spark gap devices break down).
- **1962-era electronics:** Destroyed

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<sup>1</sup> U.S. Congress Commission to Assess the United States from Electromagnetic Pulse (EMP) Attack; <http://www.empcommission.org/>

One of the most important goals of the K Project was to test the effects of nuclear EMP on the ABM radar and radio communication systems. The results of the test: they were destroyed, even though – in 1962 – Russian military equipment typically used vacuum tubes, which are highly EMP resistant, in place of today/s highly sensitive digital electronics.

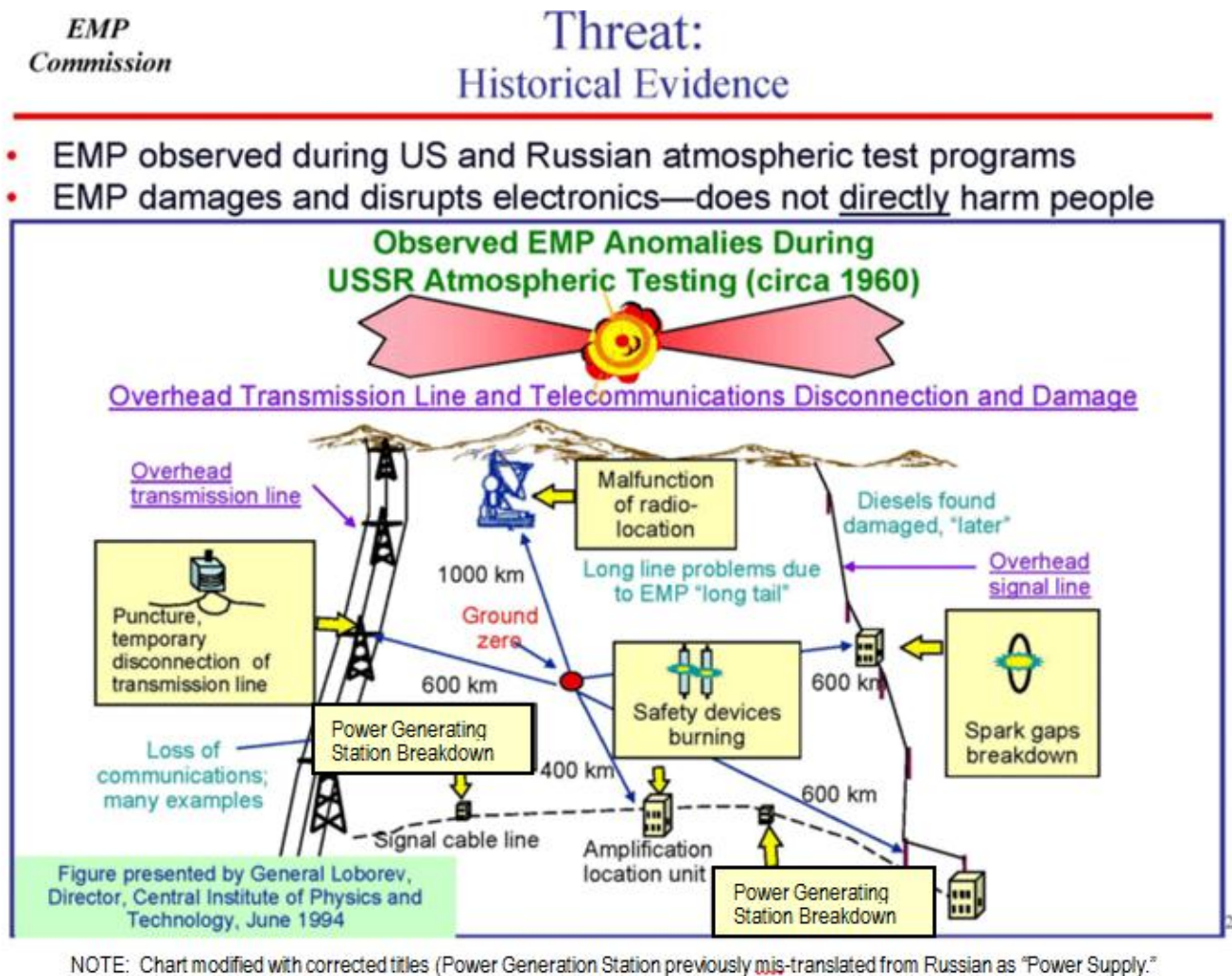
**Note: USSR provided only limited data.** Although the USSR performed multiple HEMP tests in 1962, accumulating “vast facts on the damage levels from HEMP illuminating both military and civil systems,”<sup>2</sup> very limited data was provided to the U.S. on only one test – Test 184. Russia, presumably for security reasons, has published no data on the damage that occurred during those “K Series” tests where the EMP field strengths were highest (these tests affected areas of Kazakhstan where Russia still leases very large tracts of land).

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<sup>2</sup> Greetsai, Vasily N., et al. "Response of Long Lines to Nuclear High-Altitude Electromagnetic Pulse (HEMP)" IEEE Transactions on Electromagnetic Compatibility, Vol. 40, No. 4, November 1998.

## 2. Summary of test results

To introduce the test results, a one-chart summary is reproduced here (Source: Courtesy of U.S. EMP Commission and the 1994 EUROEM Conference paper by Vladimir M. Loberev. Note minor translation enhancements in figure).<sup>3</sup>



<sup>3</sup> **EMP Summary Chart for USSR EMP Test:** United States EMP Commission summary of some of the damage from test 184 (also consistent with Figure 2 from the 1994 EUROEM Conference: Vladimir M. Loberev, "Up to Date State of the NEMP Problems and Topical Research Directions," Conference Proceedings, **Electromagnetic Environments and Consequences: Proceedings of the European International Symposium on Electromagnetic Environments** Vol. 1, pages 15-21. May 30-June 3, 1994, Bordeaux, France.

## Summary of specific conclusions

From information communicated by the Russian science team to U.S. Lawrence Livermore National Laboratory, and in related venues (*see references in end-notes*):

- **Underground power Line Failure:** Major 1000-kilometer shielded, underground (~ 1 meter depth) power line running from the capital of Kazakhstan to Almaty.
- **Overhead Power Line Failures:** Power line ceramic insulator flash over / burn out, resulting in a short circuit on the line, with some lines detaching from poles and falling to the ground.<sup>4</sup>
- **Telephone Line Failures:** Example -- All over-voltage protectors and fuses blew out in 570 kilometer telephone line: Two effects -- E1- induced current of 1500 to 3400 amp for ~ 15 microseconds, E3- induced 4 amp current for >20 seconds. [See Greetsai, Vasily N., et.al. "Response of Long Lines to Nuclear High-Altitude Electromagnetic Pulse (HEMP)" *IEEE Transactions on Electromagnetic Compatibility*, Vol. 40, No. 4, November 1998].
- **Power (Generation) Substations Failed:** Due to transformer burn out and, in some cases, fires.<sup>5</sup>
- **Fires reported:** The EMP started a fire in the city's power substation, which was connected to the long underground power line The Russian description of the fire's impact, in Lawrence Livermore National Lab meeting: "Destruction of the Power Generating Station ["power supply"] at Karaganda."
- **Military Diesel generators damaged:** Causing later burn-out
- **Electronics Failures:** In 1962 Russia, radars used highly EMP-resistant Vacuum Tube, not today's extremely sensitive digital electronics.
  - Radar Failure: At 1000 km from detonation
  - Radio Failures: At ranges of about 600 kilometers

**E3 Field Strength:** 1300 nT/min in the Karagandy region during the first 20 seconds after the detonation. For comparison, the solar storm that shut down the entire power grid of Quebec on March 13, 1989 had a magnitude of 480 nT/min, and caused the Quebec power grid to go from normal operation to complete collapse in 92 seconds.

*NOTE: According to the recent Oak Ridge Laboratory DOE / FERC / DHS Study, comparable GIC would likely damage about 365 large transformers in the U.S. power grid, leaving about 40 percent of the U.S. population without electrical power for 4 to 10 years during acquisition of replacement transformers.*

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<sup>4</sup> Referenced in Oak Ridge National Laboratory E-Threat Study for DOE, FERC, and DHS.

<sup>5</sup> Effect summarized by Russian Scientist Loborev, (translated from the Russian): "The matter of this phenomenon is that the electrical breakdown ["puncture"] occurs at the weak point of a system. Next, the heat-induced breakdown ["puncture"] is developed at that point, under the action of the power voltage; as a result, the electrical power substation ["source"] is put out of action very often."

<sup>i</sup> NOTE: A number of references were used in compiling this report, in addition to those cited in the text. The additional references are listed below:

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References (in Russian):

- i. [The Kapustin Yar Reference](#)
- ii. The Bear Book: [The Nuclear Tests of the U.S.S.R.](#), Volume 2, Section on High-Altitude Tests. (V.N. Mikhailov, Editor-in-Chief, Institute of Strategic Stability, Rosatom.)
- iii. [Novosti Kosmonavtiki, No. 236, \(2002\)](#), (News of cosmonautics).

References in English:

- iv. Soviet Test 184; Jerry Emanuelson, B.S.E.E., Futurescience, LLC
- v. Greetsai, Vasily N., et al. "Response of Long Lines to Nuclear High-Altitude Electromagnetic Pulse (HEMP)" *IEEE Transactions on Electromagnetic Compatibility*, Vol. 40, No. 4, November 1998.
- vi. Pfeffer, Robert and Shaeffer, D.Lynn. [A Russian Assessment of Several U.S.S.R. and U.S. HEMP Tests](#). *Combating WMD Journal*. U.S. Army Nuclear and CWMD Agency. Issue 3. January, 2009. pp. 33-38.
- vii. Report Meta-R-320: [The Early-Time \(E1\) High-Altitude Electromagnetic Pulse \(HEMP\) and Its Impact on the U.S. Power Grid](#). Section 3 – E1 HEMP History. January 2010. Written by Metatech Corporation for Oak Ridge National Laboratory.
- viii. Other references on E3 (slow electromagnetic) damage to power grids:
- ix. [Severe Space Weather Events](#) by the National Research Council of the United States National Academies.
- x. *Electric Power Generation, Transmission, and Distribution* edited by Leonard L. Grigsby. Chapter 16. *Geomagnetic Disturbances and Impacts on Power System Operation* by John G. Kappenman. 2007: CRC Press.
- xi. Metatech: The Early-Time (E1) High-Altitude Electromagnetic Pulse (HEMP) and Its Impact on the U.S. Power Grid; [http://www.ornl.gov/sci/ees/etsd/pes/pubs/ferc\\_Meta-R-320.pdf](http://www.ornl.gov/sci/ees/etsd/pes/pubs/ferc_Meta-R-320.pdf)
- xii. Metatech, The Late-Time (E3) High-Altitude Electromagnetic Pulse (HEMP) and Its Impact on the U.S. Power Grid; [http://www.ornl.gov/sci/ees/etsd/pes/pubs/ferc\\_Meta-R-321.pdf](http://www.ornl.gov/sci/ees/etsd/pes/pubs/ferc_Meta-R-321.pdf)
- xiii. U.K. Defence Select Committee e-threat Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10404>
- xiv. U.S. Congressional EMP Commission Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10325>
- xv. U.S. Strategic Posture Commission Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10327>
- xvi. U.S. Department of Energy (DOE) / NERC HILF Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10383>
- xvii. U.S. FERC / DOE / DHS e-threat Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10369>
- xviii. NASA / NAS Severe Space Weather Study Report, <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10328>
- xix. US Army Corps of Engineers: <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10353>
- xx. Electric Infrastructure Security Summit Reports: <http://www.eisummit.com/>
- xxi. Lloyd's Space Weather Report: <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10400>
- xxii. NERC GMDTF Report, <http://www.nerc.com> ; <http://www.eiscouncil.org/English/Resources/ResouceInside.asp?itemId=10409>
- xxiii. Federation of American Scientists, EMP Source Material, <http://www.fas.org/nuke/intro/nuke/emp/toc.htm>