

# POTENTIALLY DANGEROUS TECHNOGENIC OBJECTS AT SEMIPALATINSK TEST SITE



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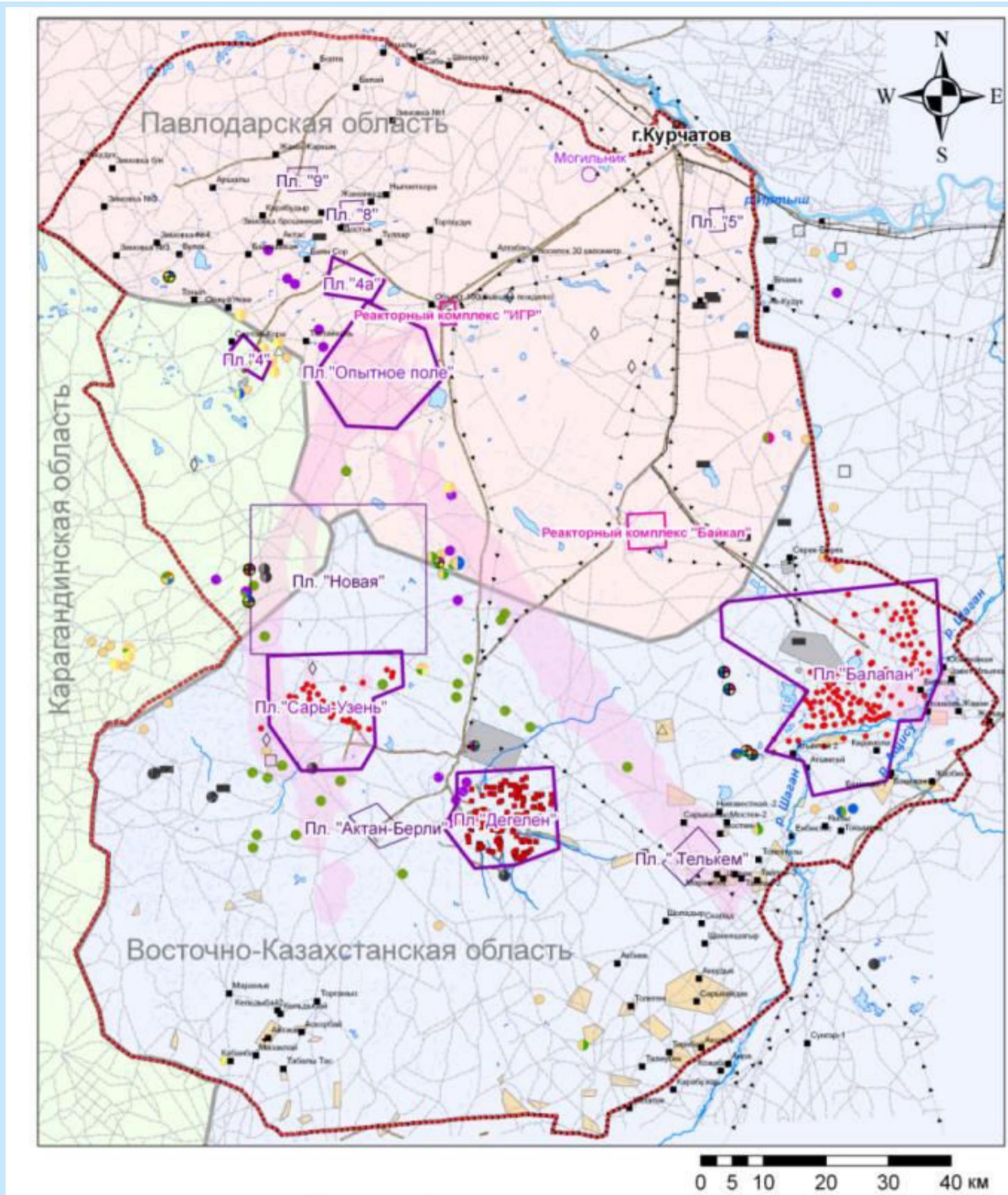
## INTRODUCTION

Forty years (29.08.1949 – 19.10.1989) nuclear tests were conducted at the territory of Semipalatinsk Test Site (STS) including more than three hundred underground nuclear explosions (UNE).

Now there is a huge amount of UNE central zones, where radioactive products concentrated in a small areas. The UNEs were conducted at three test sites: “Degelen” (209 tests), “Balapan” (108 tests) and “Sary-Uzen” (23 tests).

On some of UNE central zones were observed emissions of gases, ground water temperature anomaly, which were the reason to consider it potentially dangerous technogenic objects.

Some results of one of major task of the Institute, which is determination of potentially dangerous technogenic objects, are presented below.



Map of Semipalatinsk Test Site (STS)

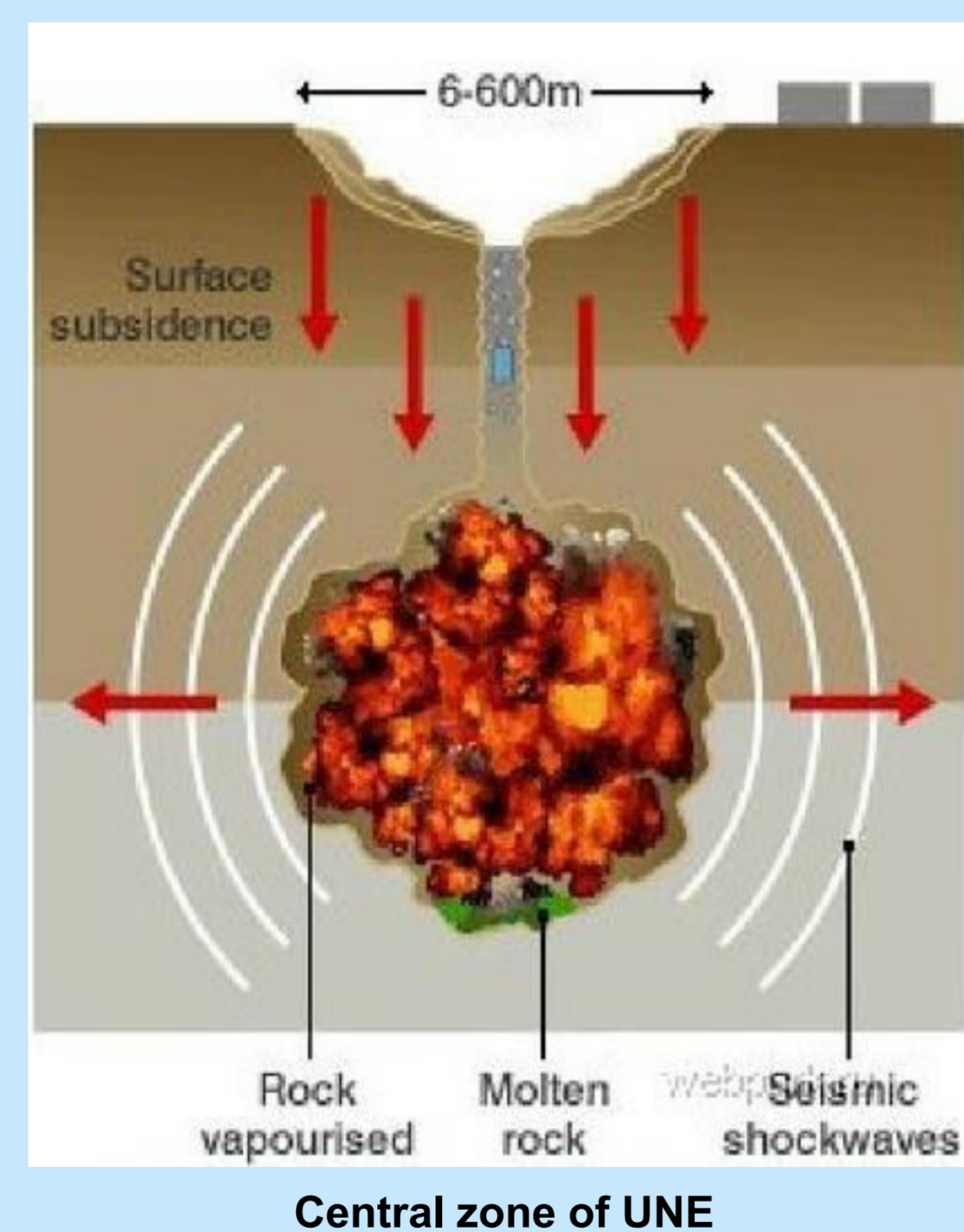
## Underground tests and its consequences

Local contamination of an epicentral area and a destruction zone occurs in result of a UNE. As a result of a evaporation of a rock, a significant amount of gas is formed at the epicenter of an UNE, so the epicentral zone is a site of radioactive contamination with a high temperature and pressure of the gases formed.

Studies of the environmental situation in places where nuclear tests were conducted are characterized by long-term processes initiated by UNE. These processes are associated with the interaction of groundwater with the boiler cavity through weakened rock structures that facilitate the transfer of gases, contaminated groundwater, residual heat of UNE fuel and products.

The most part of “warfare” borehole (WB) has no signs of surface subsidence, and remains to our time in quasi-stable state. At the same time in a number of epicentral areas of WB structural failures are observed, formed at different times - some partly during UNE, others – much later, for example structural failure at the UNE “Glubokaya” happened after 15 years from test conduction.

The presence of technogenic effects, intense fracturing zones, collapsed pillars and other tectonic destruction make UNE-cavities susceptible to air passage. Increased gas emissions in these areas are expected because of the large number of cracks.



Central zone of UNE



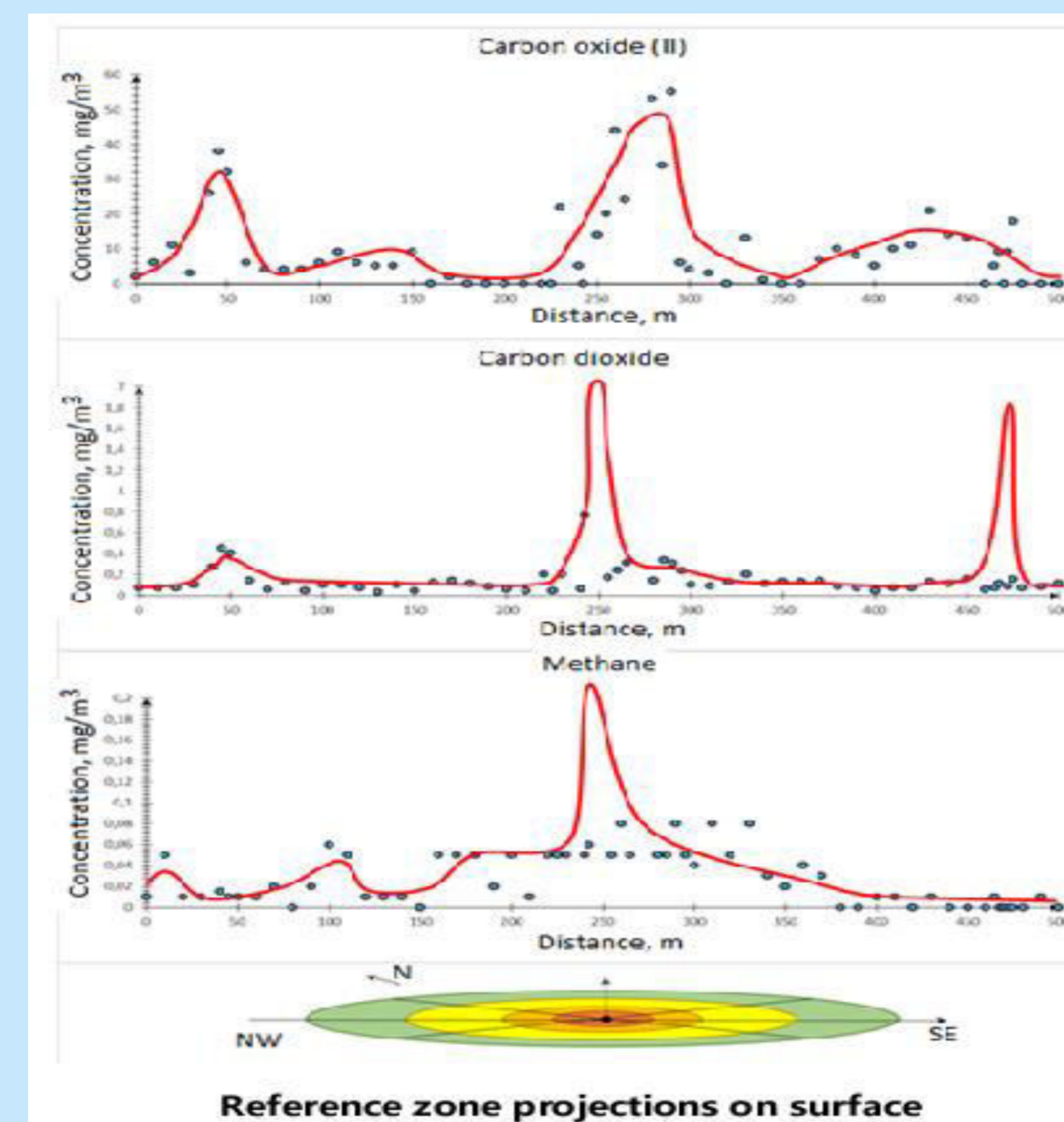
“Warfare” boreholes (WB) with surface subsidence



Epicentric zone of the UNE “Glubokaya”

## Gas emission from soil around head of WB, and from the head of WB

Gas emission in the near-well areas of WB in most cases is observed near the head of WB, there are anomalies in the soil air near WB.



Gas concentrations in soil in central zone of 1315 WB

Figure with gases concentrations shows a path from 250 m at northwest (pointed as 0) to 250 m at southeast (pointed as 500) from the UNE epicenter of WB 1315. All gases show maximal concentration above the UNE epicenter, found cracks at the figure.

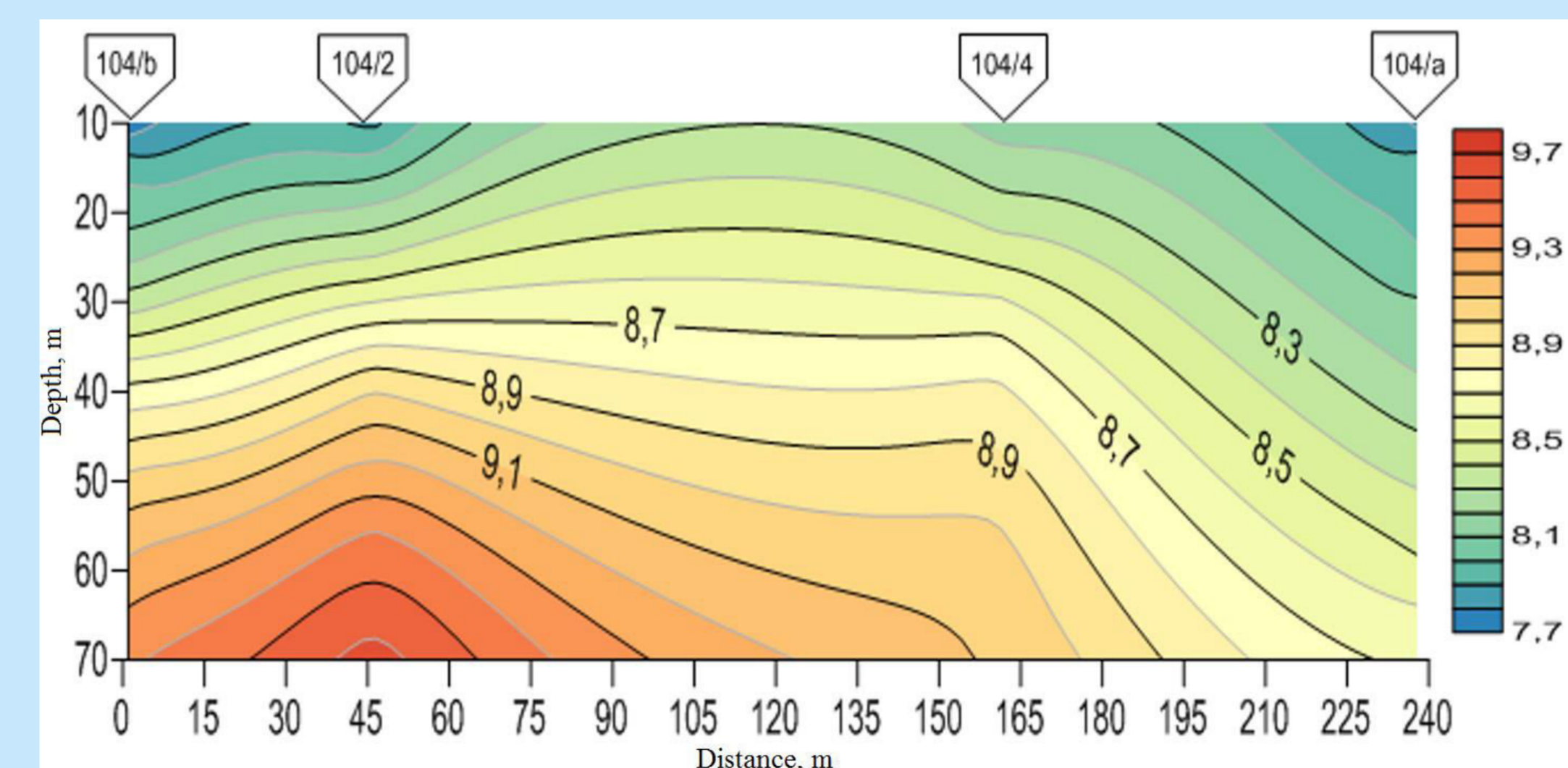


The head of WB 1315

The head of WB 1010 is characterized by gas emission with CO<sub>2</sub> concentration up to 70%, also presented methane, hydrogen.

It is obvious that the increased gas emissions implies the presence of technogenic effects of the UNE in rocks. One of the signs of long-term processes of rock destruction in the epicentral area leads to gas emission, which allows one to identify potentially dangerous WB susceptible to collapse.

## Ground water thermal anomaly



Temperature anomalies are presented in the form of elevated groundwater temperatures at depths of up to 150 m near a number of WB (at WBs 104, 125, 1061). At the same time, most of the wells do not have hydrogeological wells in close proximity to study the thermal regime of groundwater. However, work in this direction is being actively conducted.

The average values of the groundwater temperature at the level of the “neutral” layer at the test sites “Balapan” and “Sary-Uzen” are 1-2 °C higher than those typical for the northern part of Central Kazakhstan where the STS is located.

Studies show the presence of “warming up” of groundwater, which continues for a long time.

**WBs at the site “Balapan”, which may be categorized as dangerous objects are: 1010, 1086, 1053, 1223, 1201, 1234, 1236, 1309, 1315, 1316, 1318, 1322, 1323, 1325, 1326, 1328, 1331 1340, 1355, 1421 “Glubokaya”.**

**WB at the site “Sary-Uzen”, which may be categorized as dangerous objects: 102, 104 and 111.**

**CONCLUSION: The presence of WB with gases emissions and thermal anomalies of groundwater confirms the presence of processes, caused by unknown reasons, and the presence of a UNE long-term impact on the subsurface.**