



Bundesamt
für Strahlenschutz



Interdisciplinary
research symposium
on the safety of nuclear
disposal practices



1986

Radiation exposure in the Chernobyl area - then and now

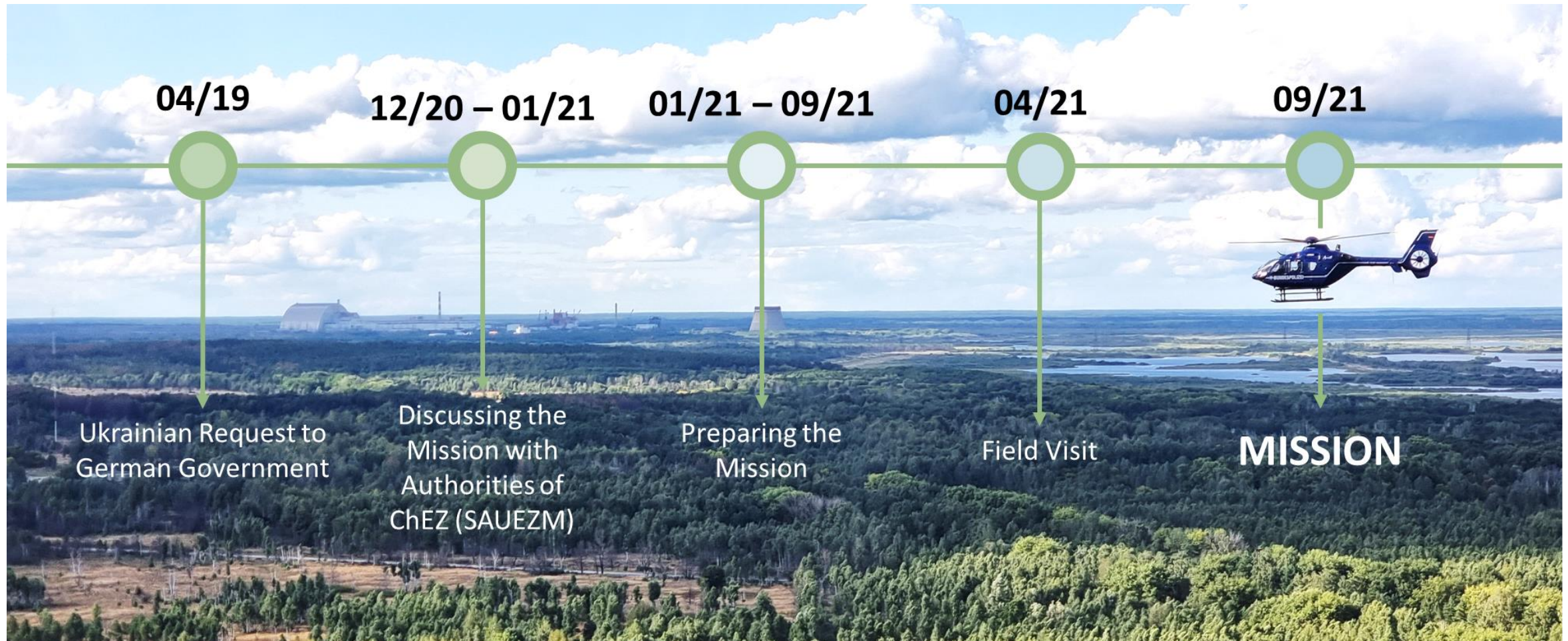
Christopher Strobl



2021



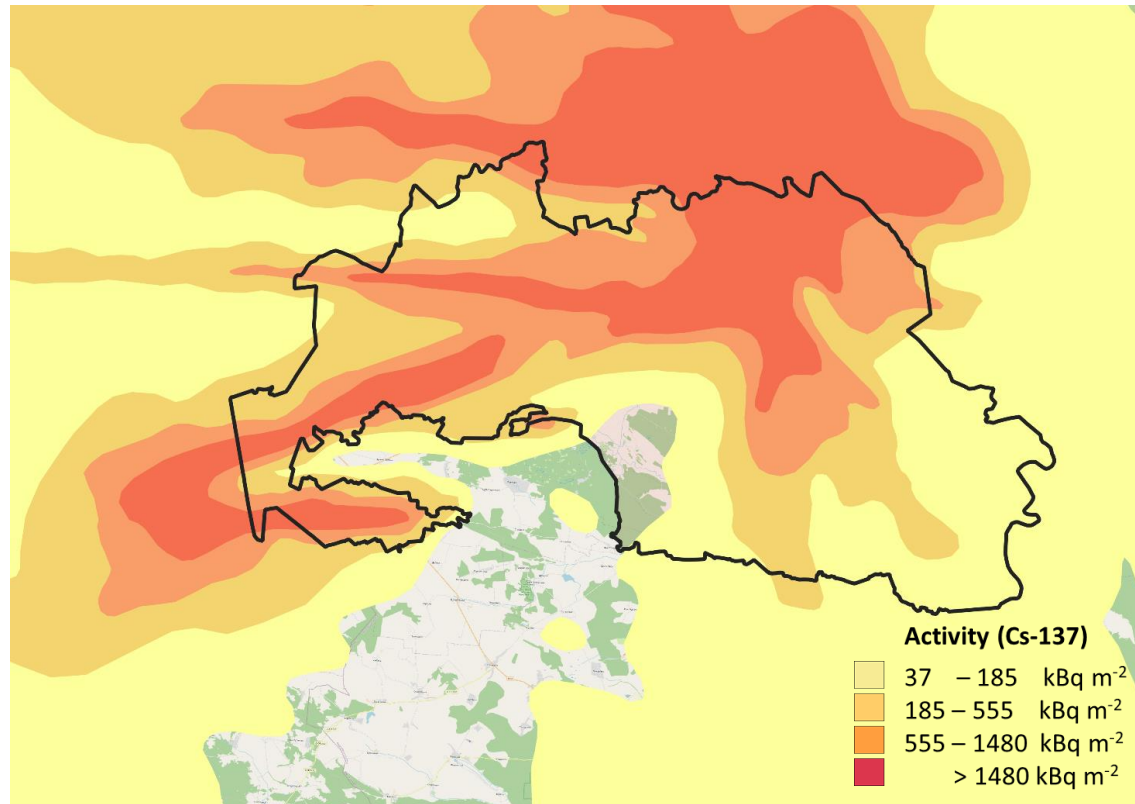
“Chernobyl” measurement campaign - Professional policy support



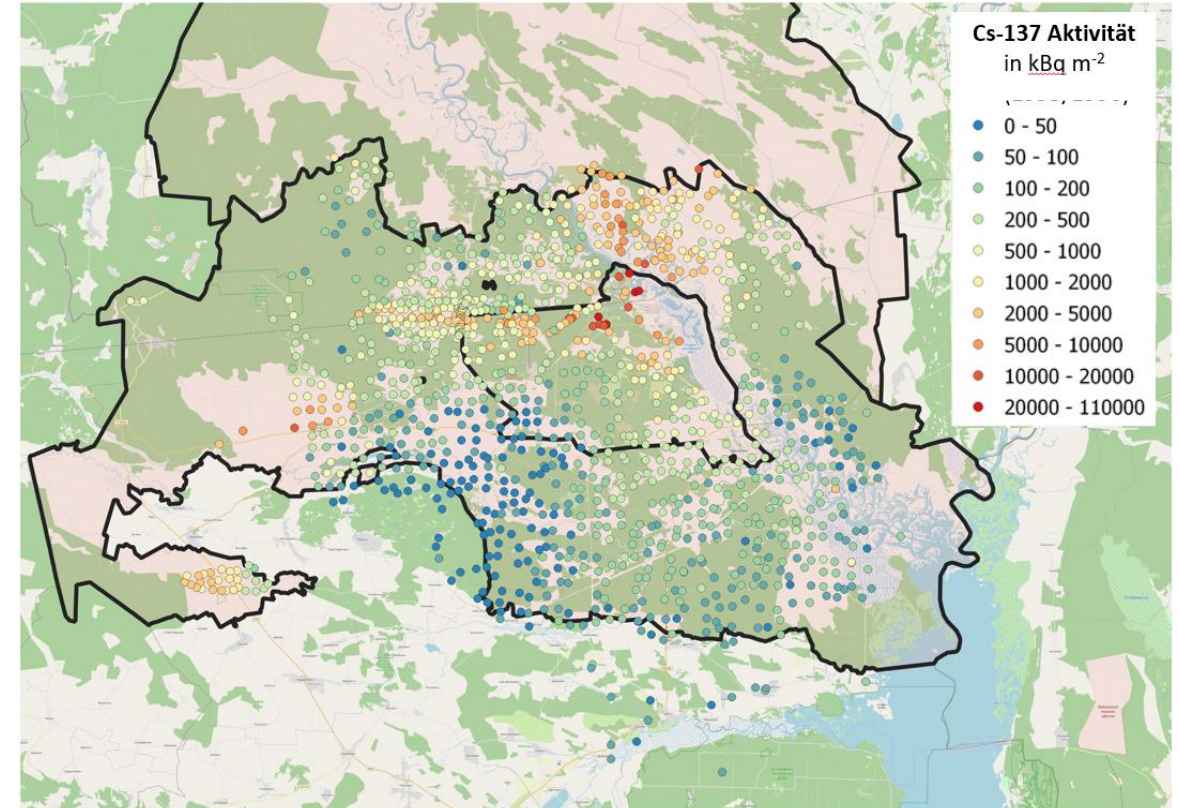


Previous data basis

Spatial distribution of Cs-137 in 1989
[Measurement data – Interpolation [IAEA 1991]]



Detail mapping 1995 -1997
(1.200 Soil samples)



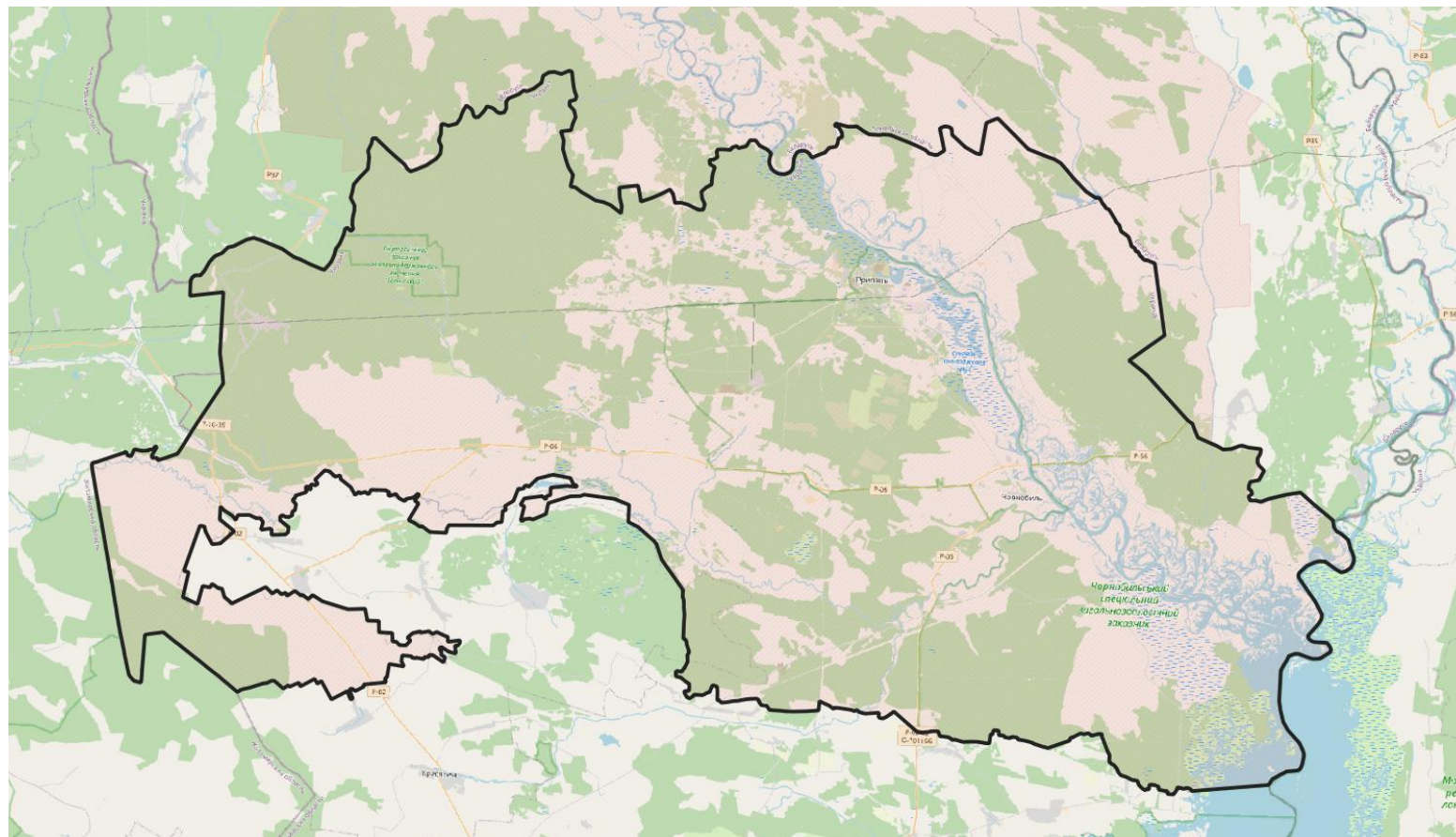


Measurement job

Comprehensive **remapping**
of the Ukrainian part of the exclusion zone

Total area 2.600 km²

Measurement duration 10 Flight days

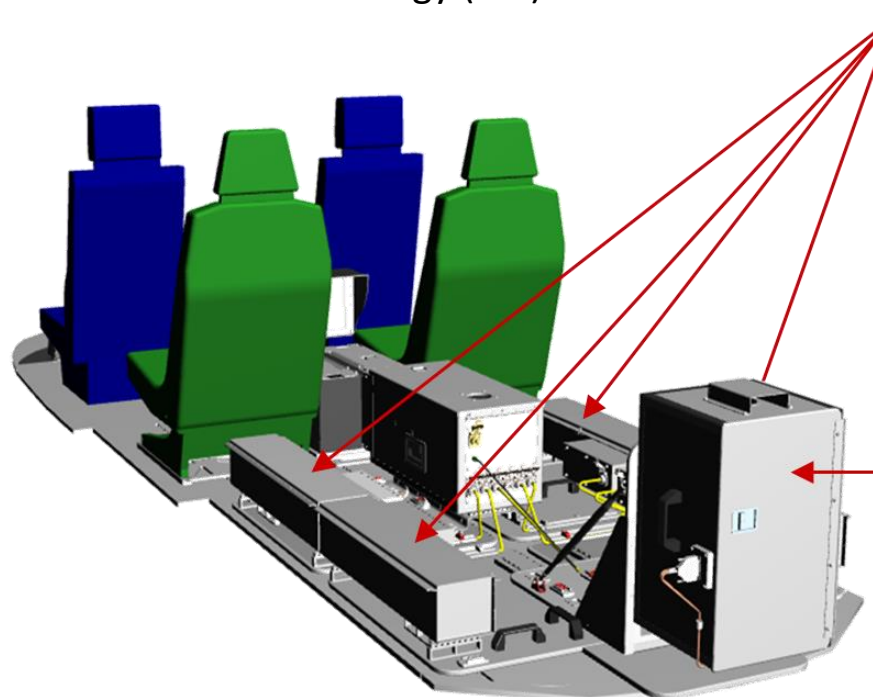
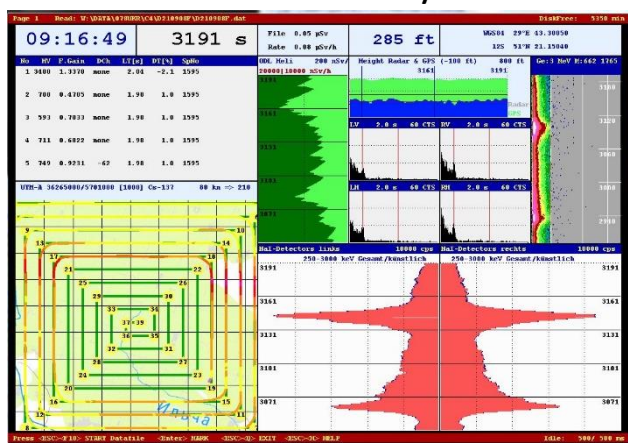




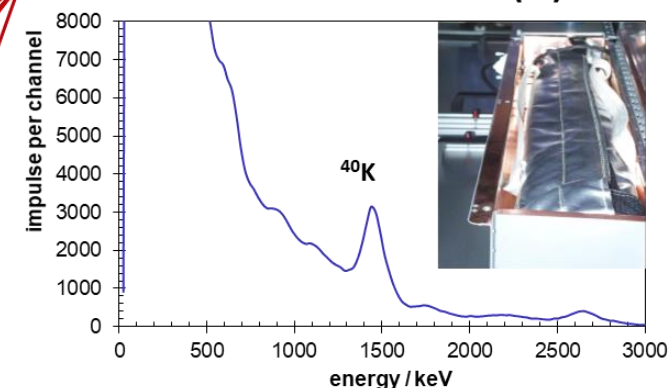
Applied radiation protection § 161 StrlSchG
§ 1 IMIS-ZustV

Measuring system - cooperation with the Federal Police

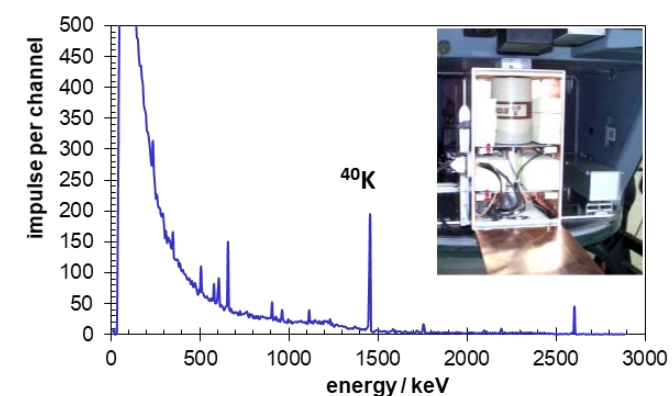
Measurement- and analysis software (BfS) Measurement technology (BfS)



4 Szintillationsdetektoren NaI(Tl)



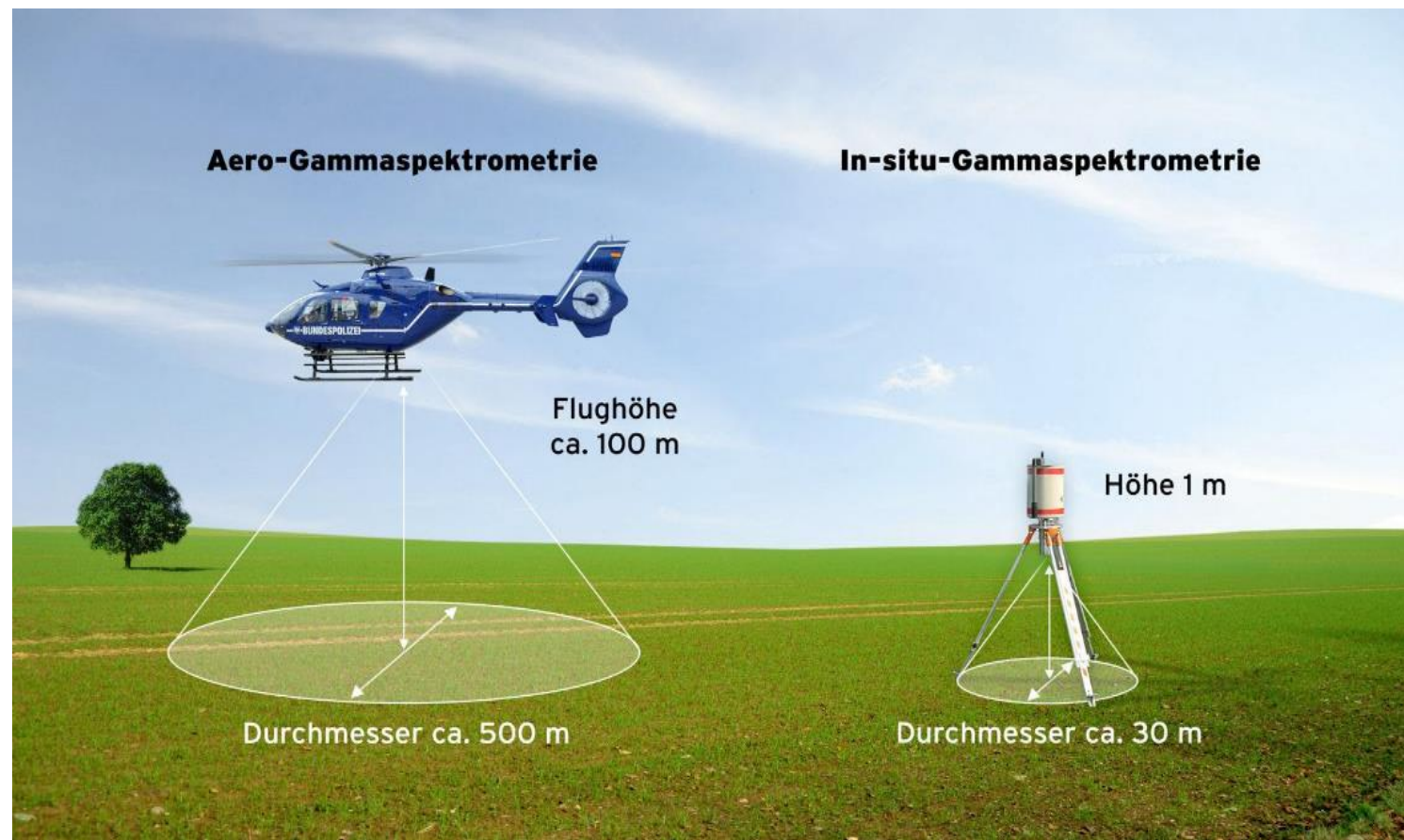
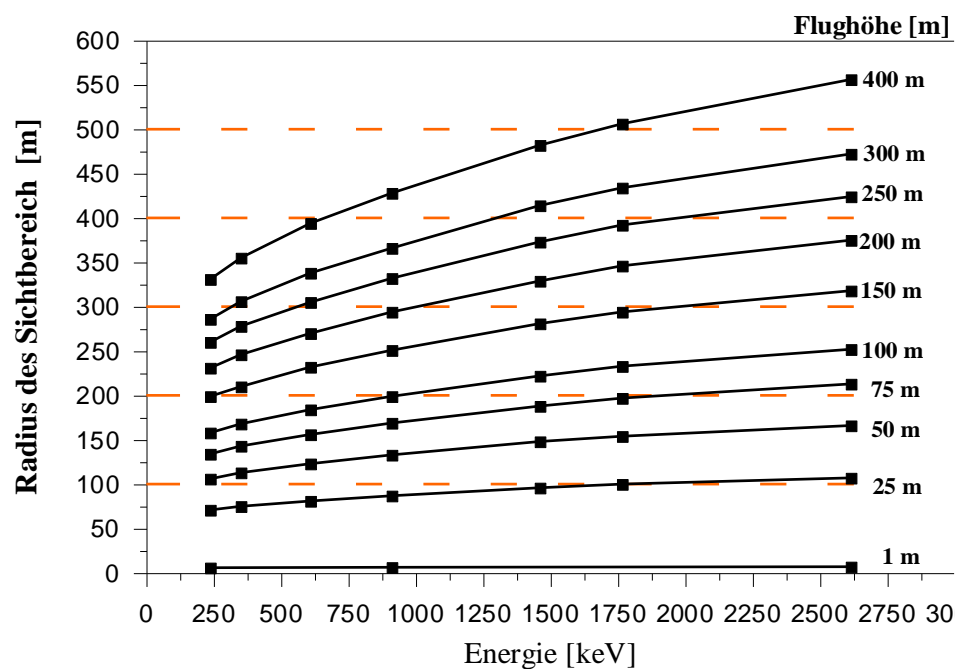
1 Halbleiterdetektor HPGe



Helicopter (Federal Police)



Measuring system - visual range

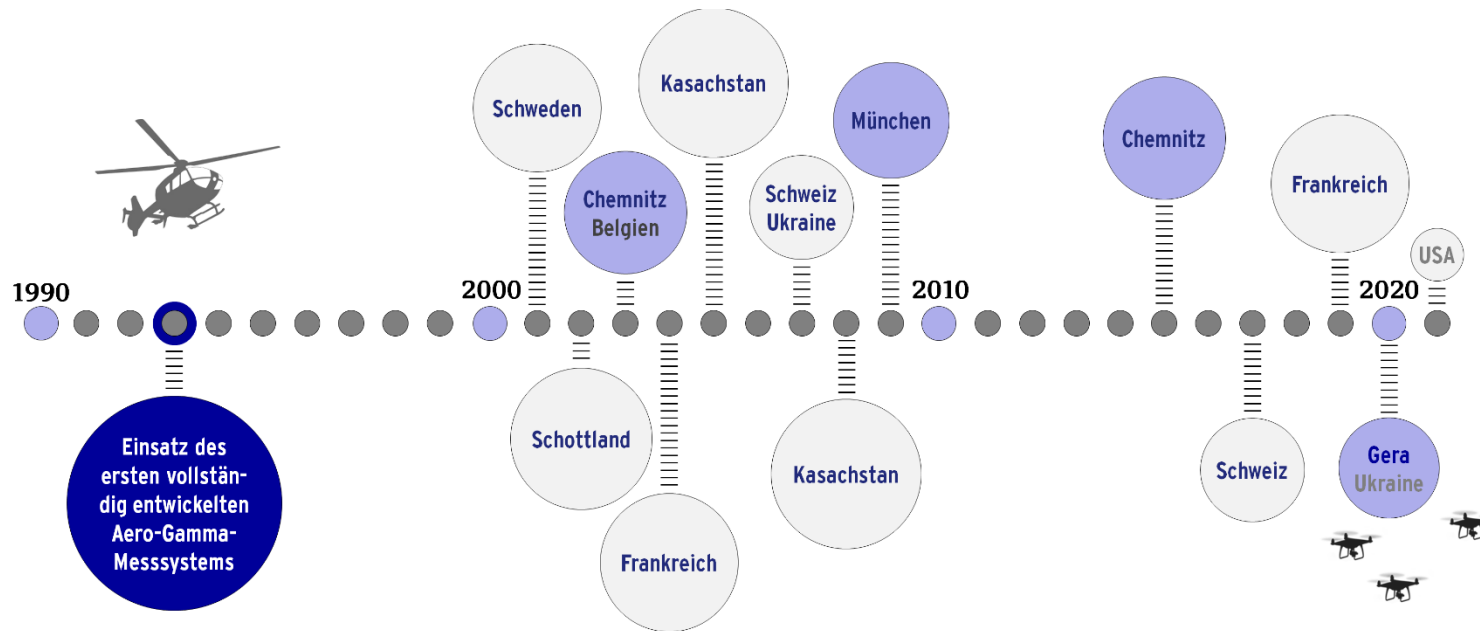




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Measurement expertise in helicopter measurements

European Network – CH/F/CZ/D



Radiation exposure in the Chernobyl area - then and now

Seite 7





Measurement campaign - Logistics challenges

Airfield



Fuel



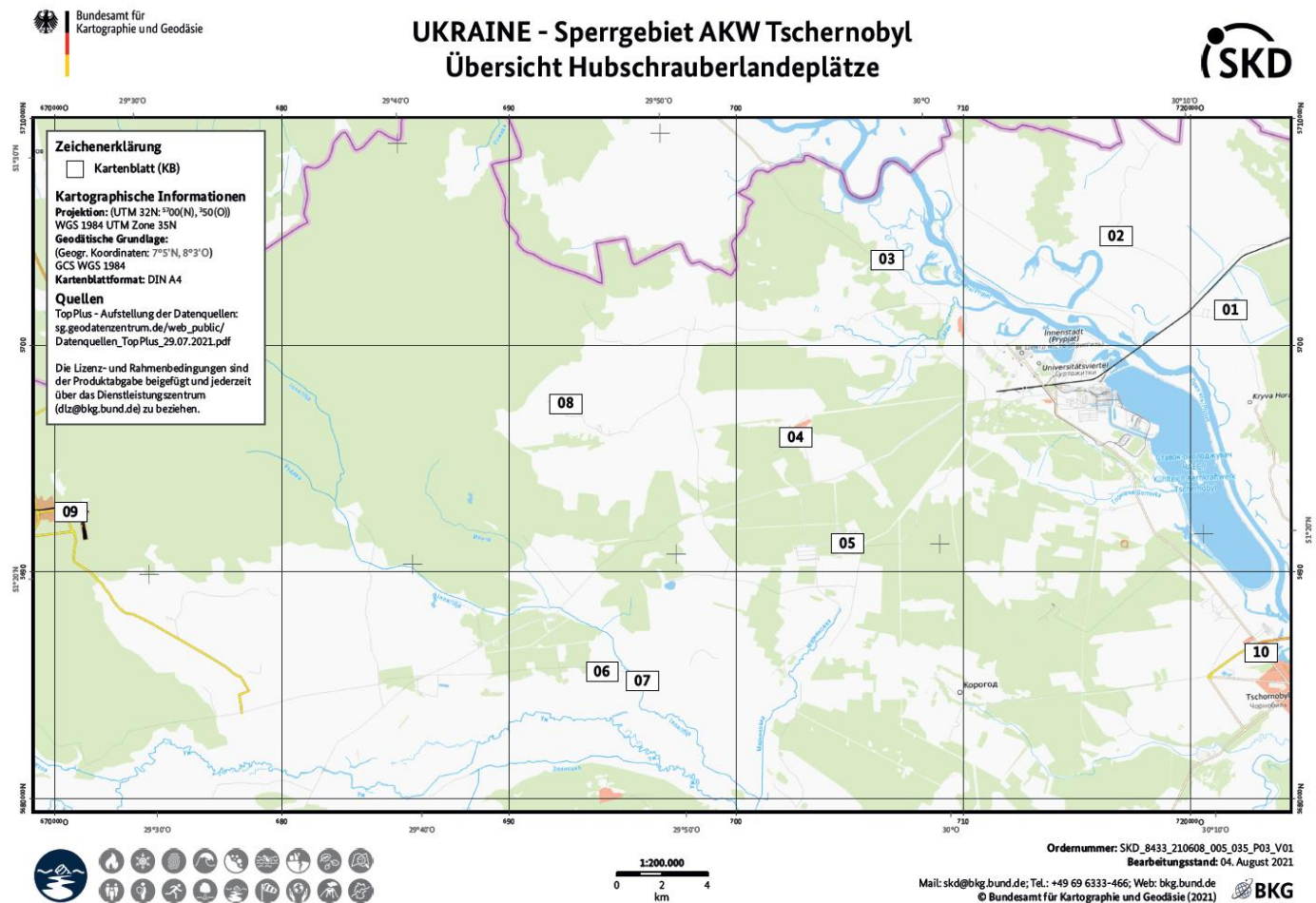
Firefighters





Measurement campaign - Logistics challenges

Helicopter alternate landing pads

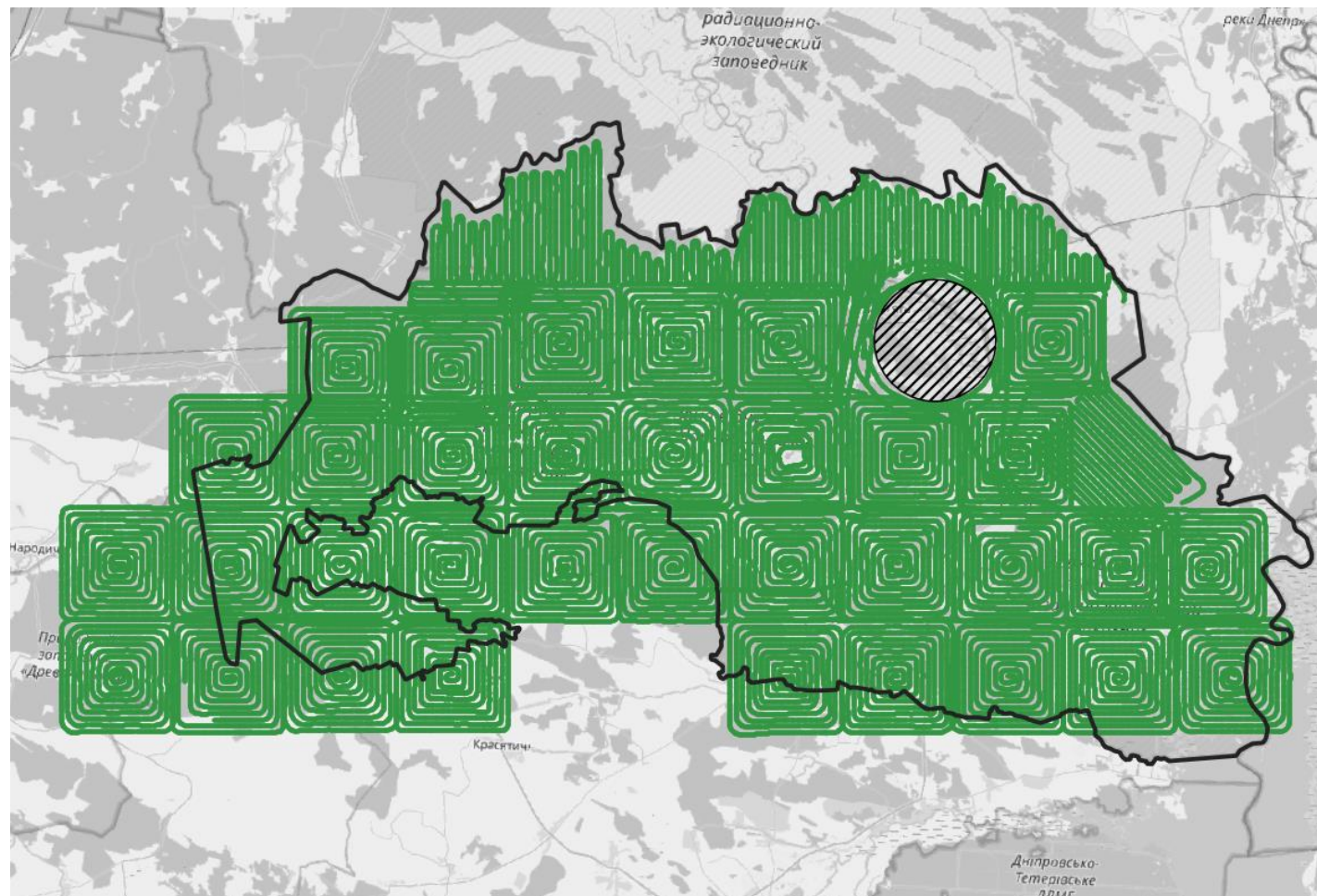




Measurement results

airborne measurements

max. coverage **97 %**

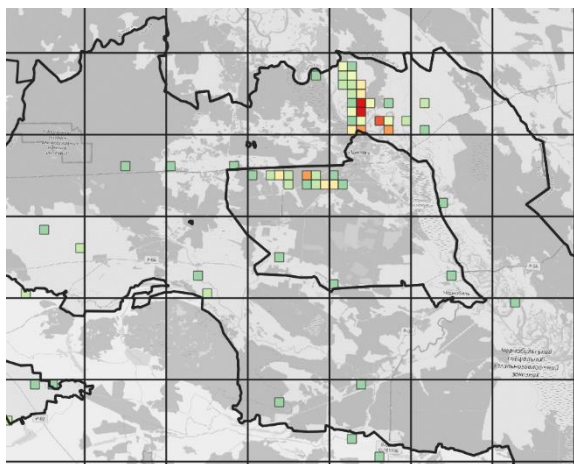




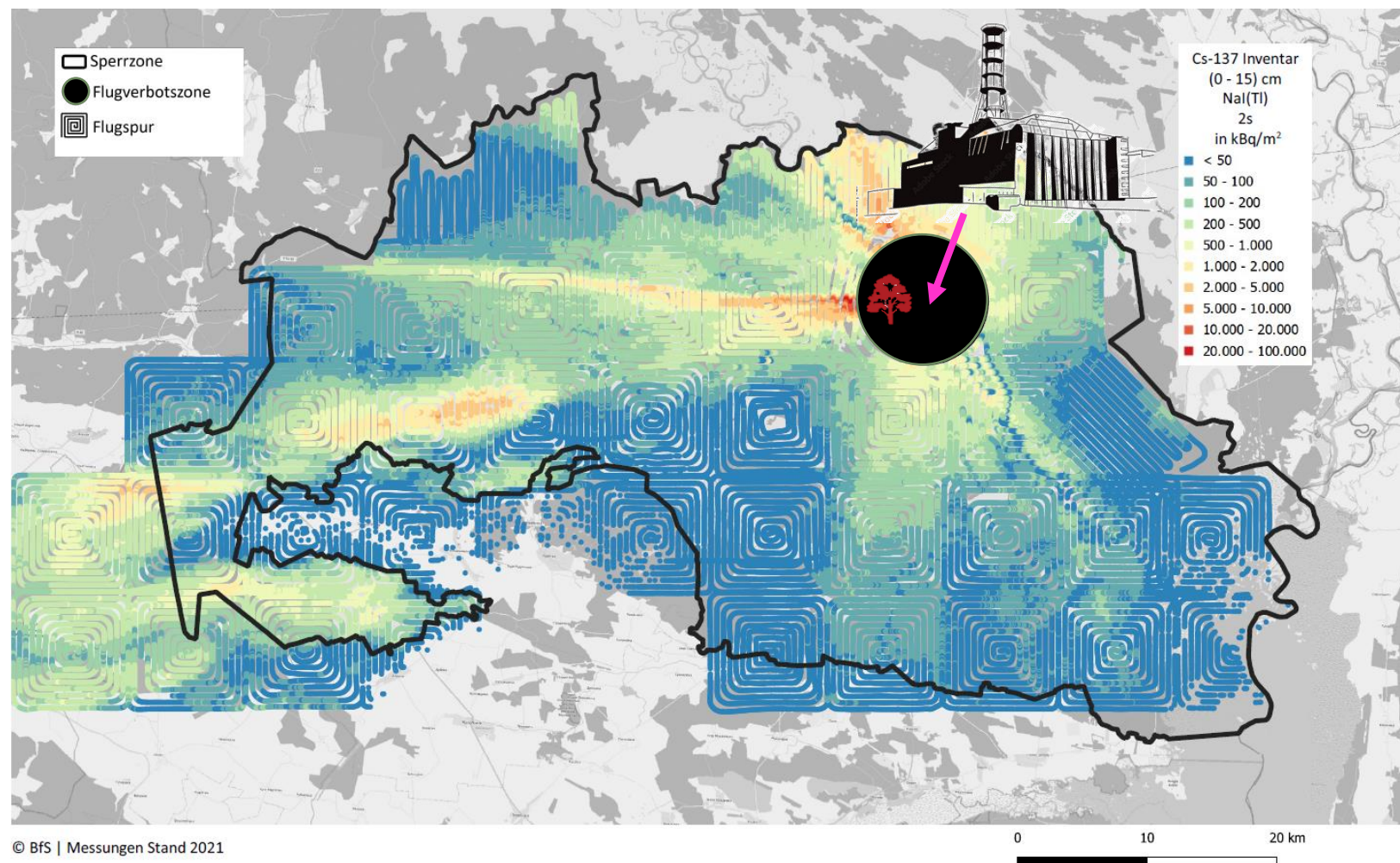
Measurement results

airborne measurements

^{154}Eu (HWZ 8,6 a)



^{137}Cs (HWZ 30,19 a)





Measurement results - maximum value

0,1 mSv/h

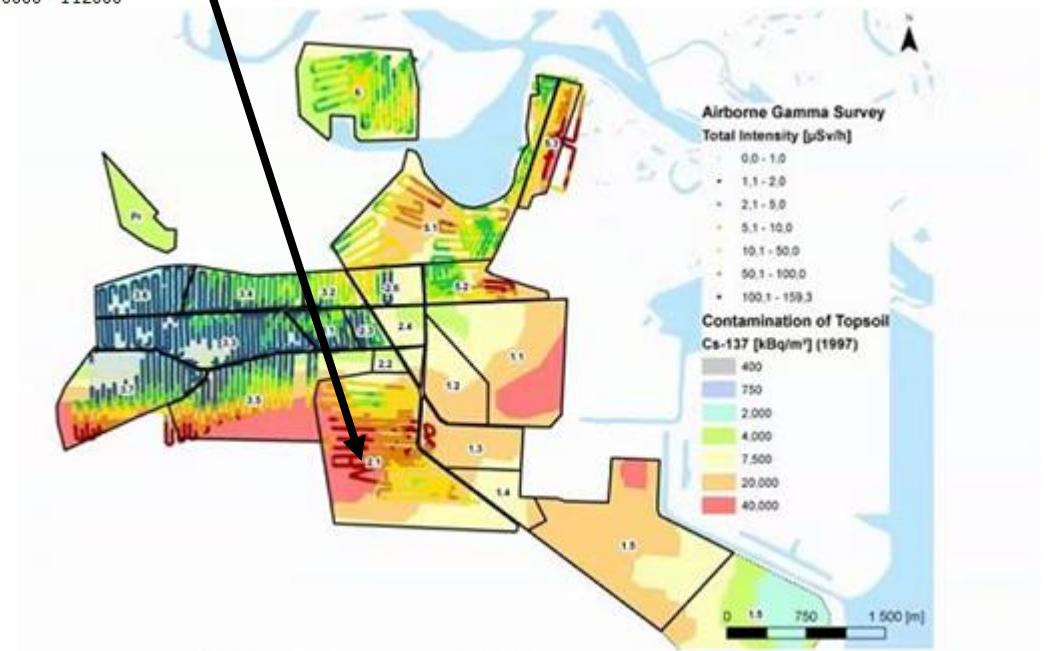
Red Forest



ODL
NaI(Tl)
2 s
nSv/h

- 10000 - 50000
- 50000 - 100000
- 100000 - 112000

UAV Measurements
Molitor et al. 2018



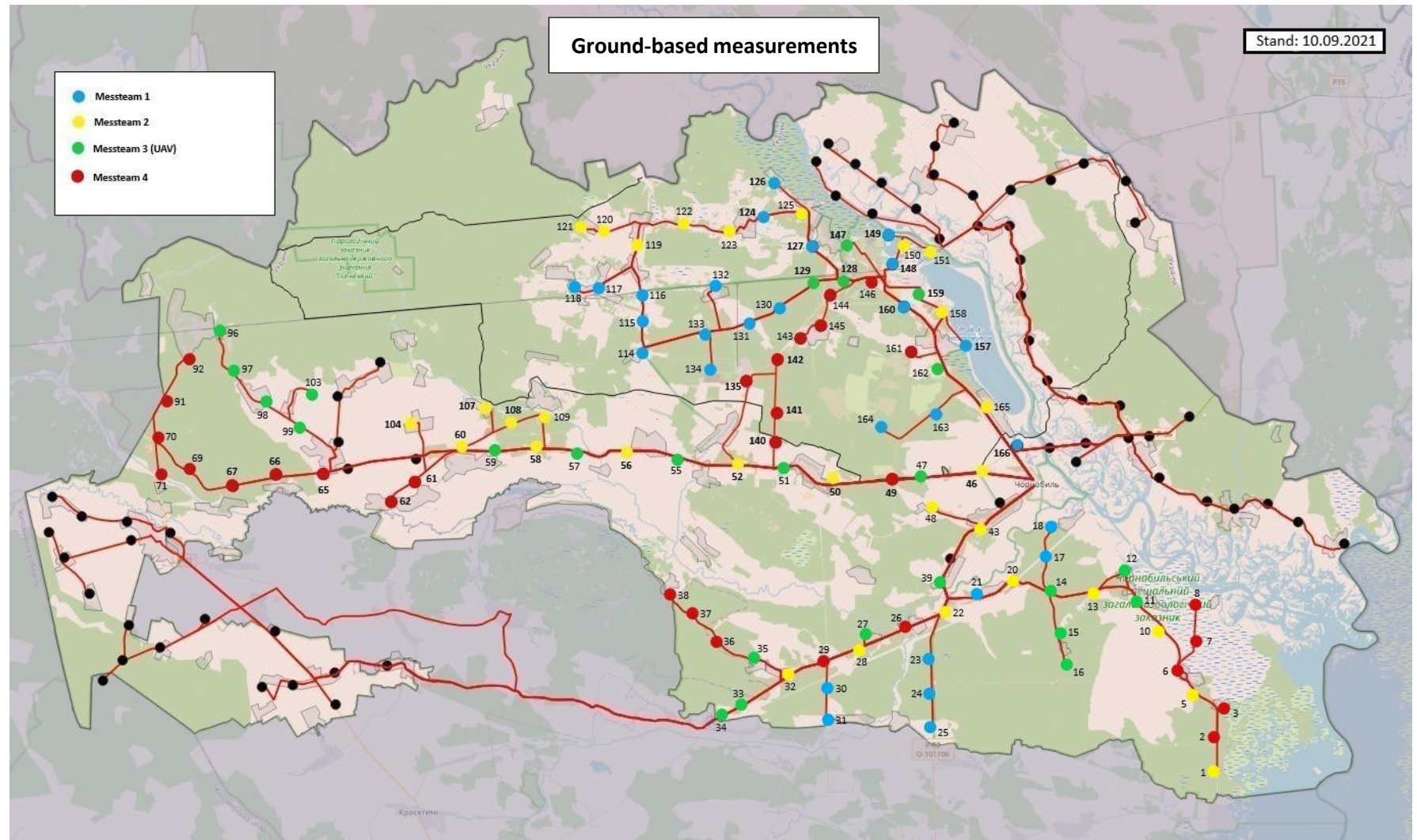


Measurement mission

ground-based measurements

at a total of **183**
measurement sites

Goal: **Quality assurance** of the
helicopter-based
measurements



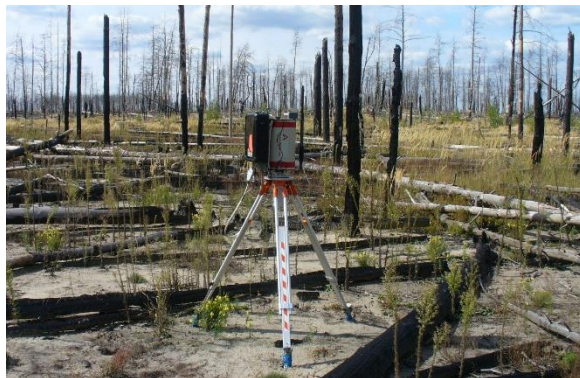


Bundling of different measuring methods and cooperation with the Ukrainian LABORATORY of ECOCENTRE

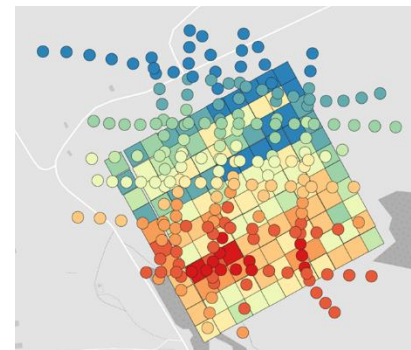
Vehicle based measurements



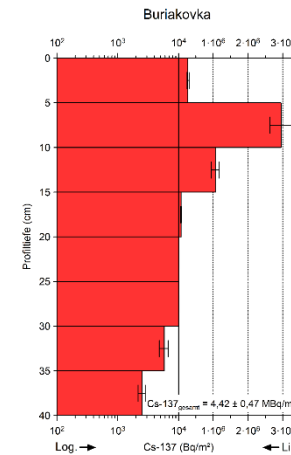
In situ gamma spectrometry



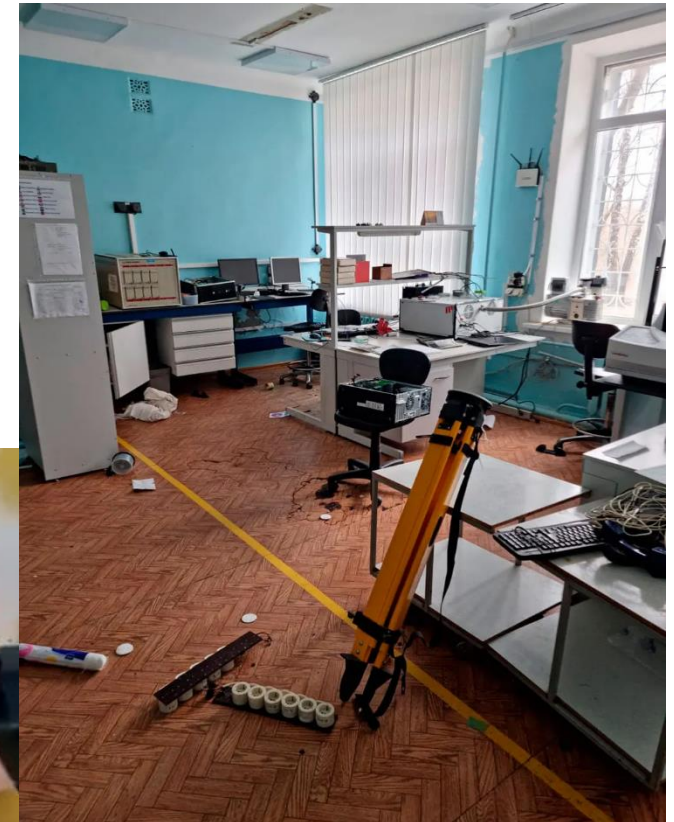
Reference areas



Ground profiles



Lab in the exclusion zone - March 2022

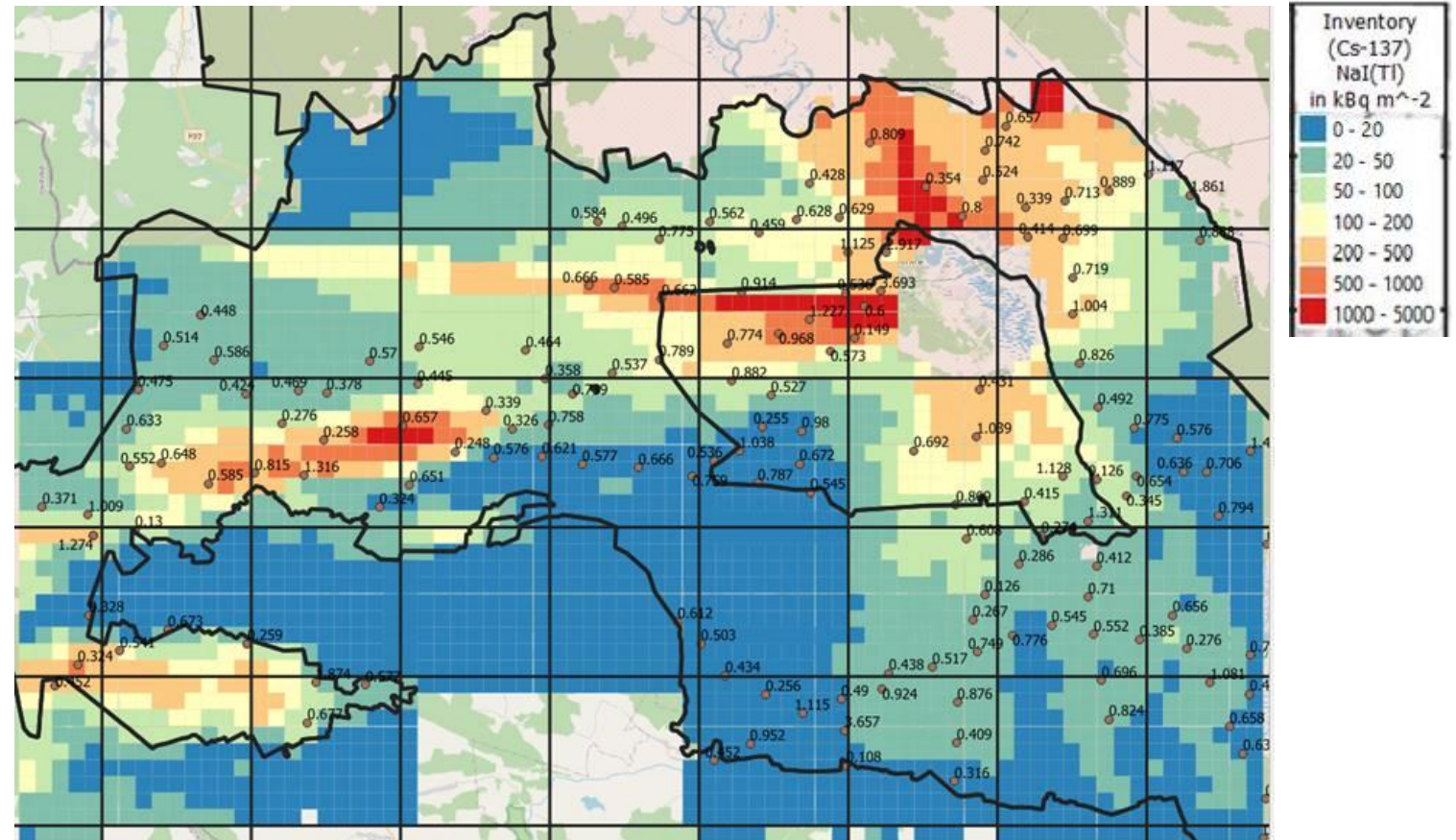




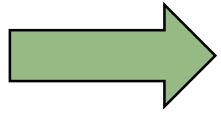
Measurement results - consideration of geometrical factor

$$\text{Ratio} = \frac{\text{Cs-137 Inventory (Air)}}{\text{Cs-137 Inventory (ISM)}}$$

Cs-137 Inventory (Air) and calculated Ratio

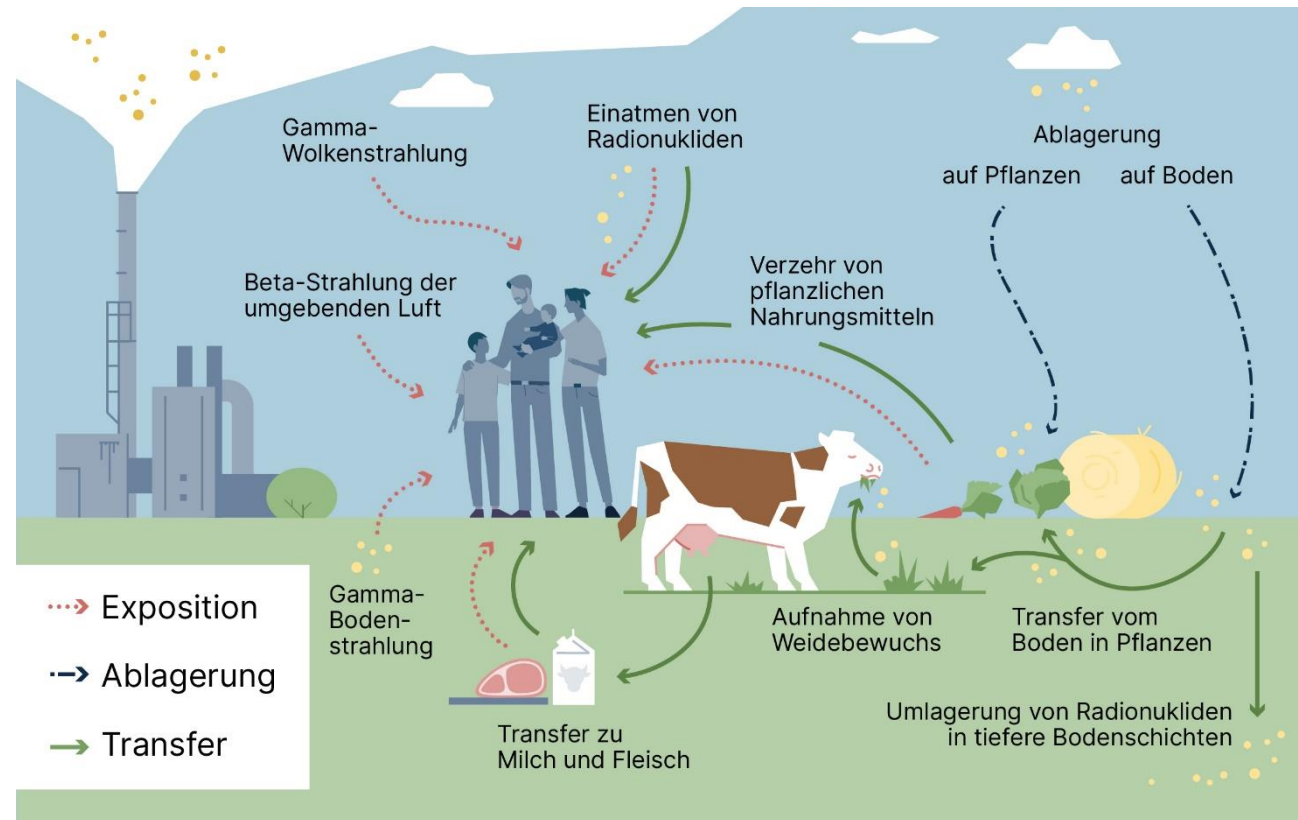


Radioecological models



Scientific studies on the transport
processes of radioactive
substances in environmental media

Examples of contamination and exposure pathways for airborne discharges

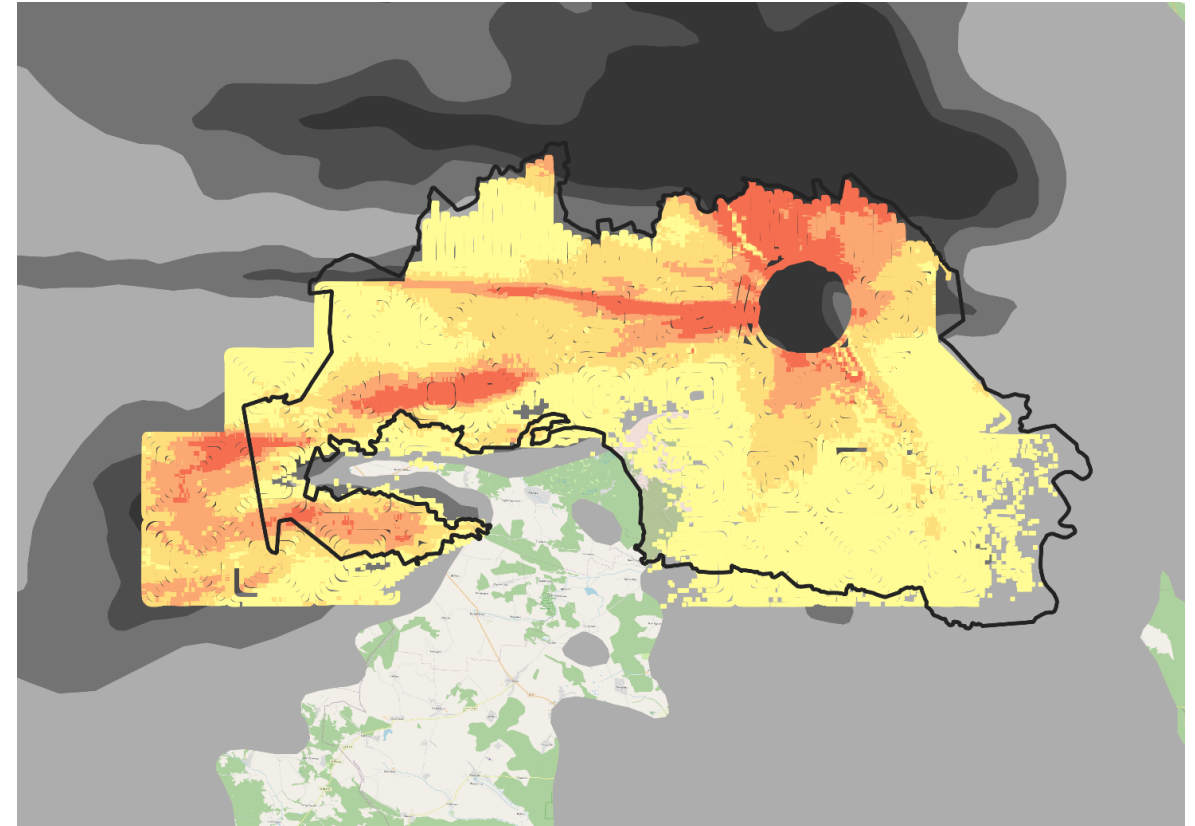
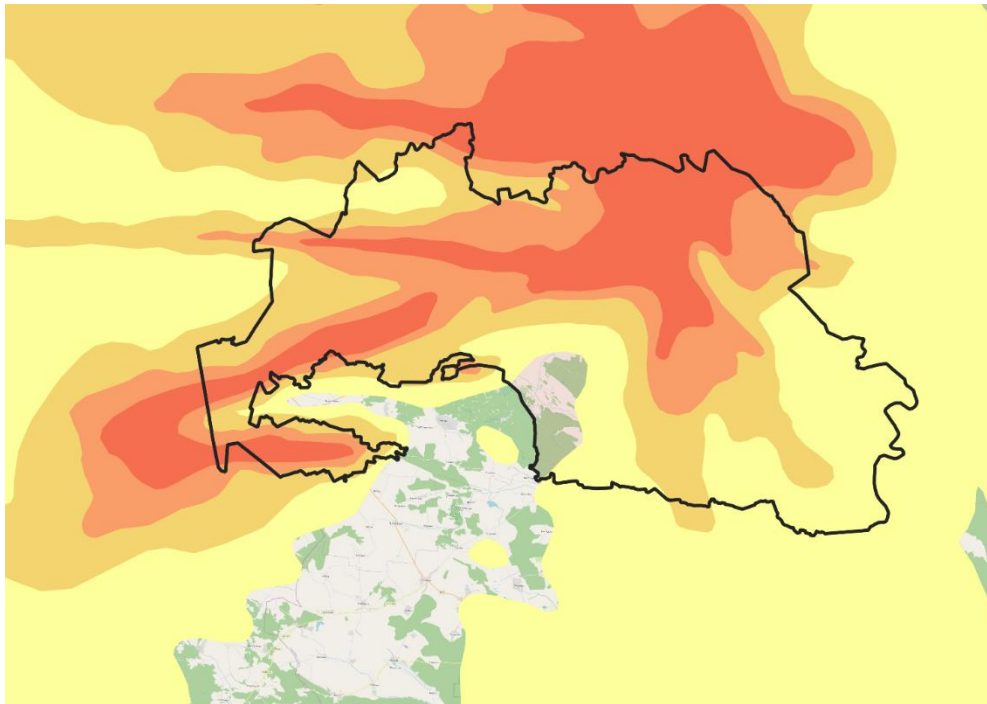




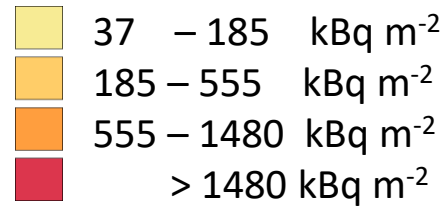
Interpretation - measurement results

Back calculation of the measured values to 1989

IAEA Publication 1991



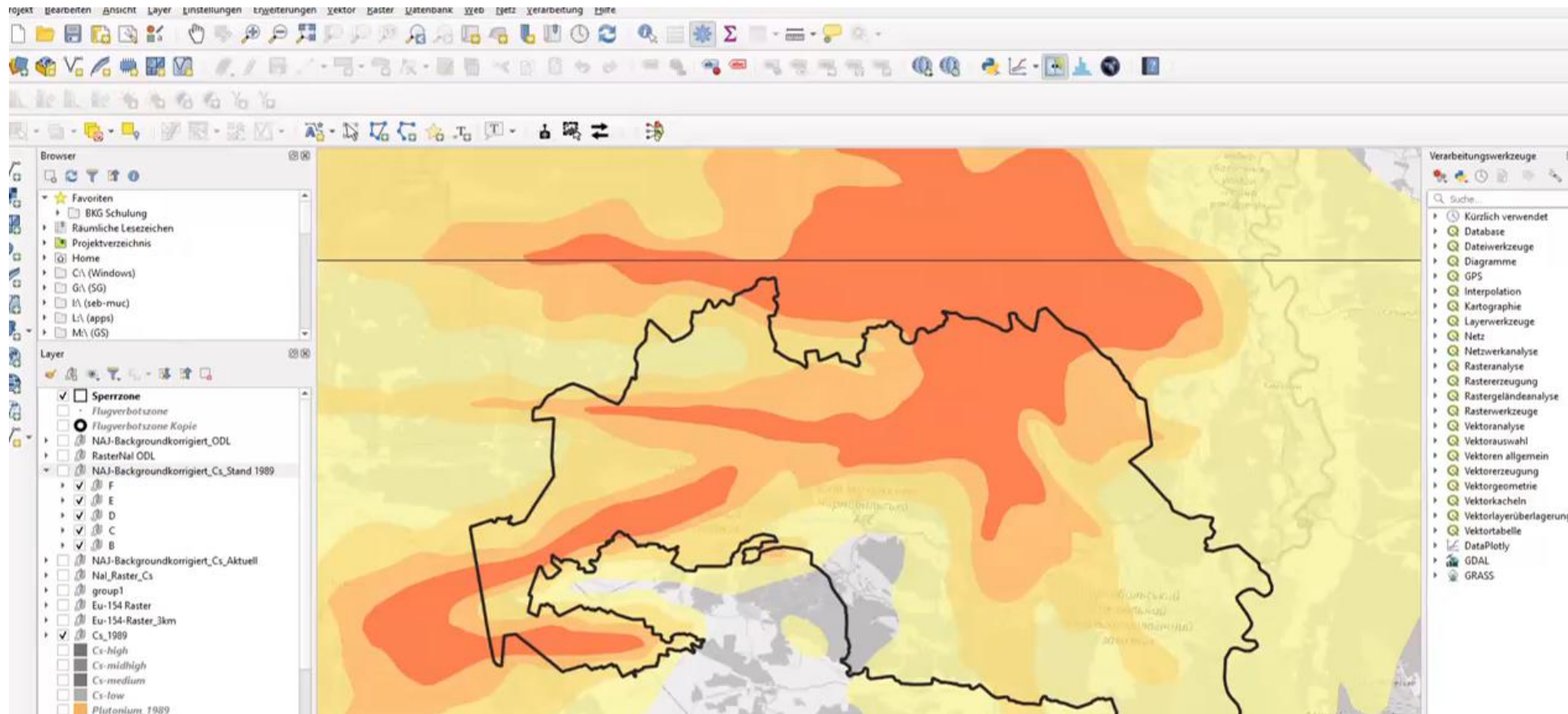
Activity (Cs-137)



Measurement campaign 2021

Geographic Information System

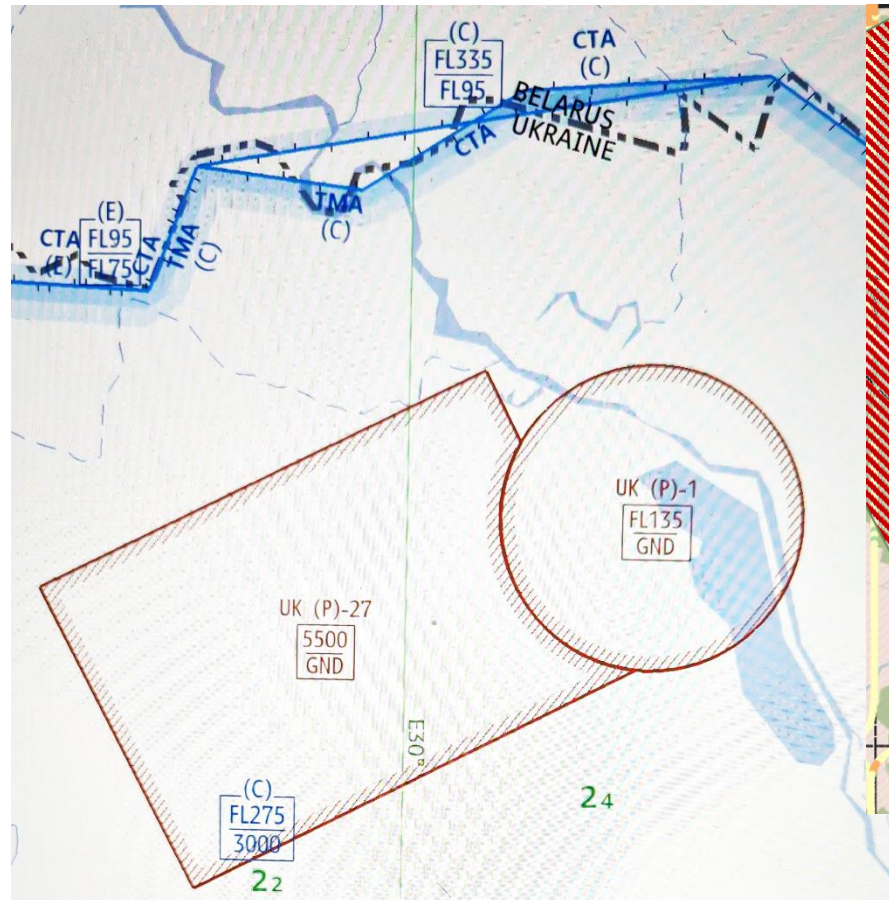
Comparing the measured values with QGIS





Radioactive waste vector complex

Restricted flight zones





Radioactive waste vector complex



(Picture source: SAUEZM)



Technical question

Is a return to the old home possible?



One of the residents still living in the Exclusion Zone after the Chernobyl disaster (Image: Mediadrumimages/RobynVonSwank)



Several families have recently moved to cheap neighbourhoods near to Chernobyl despite the radiation warnings (Image: Mediadrumimages/RobynVonSwank)

Technical question

Radiation exposure of soldiers who stayed in the exclusion zone



conservative estimation ~ **120 mSv**

Assumptions

Period of stay in the exclusion zone: **35 days** (24.02. – 31.03.2022)

External exposure

– Stay at the place maximum gamma ODL outdoors

Inhalation – No respiratory protection – increased breathing rate
– permanent whirling up of dust

Ingestion – uncontaminated food

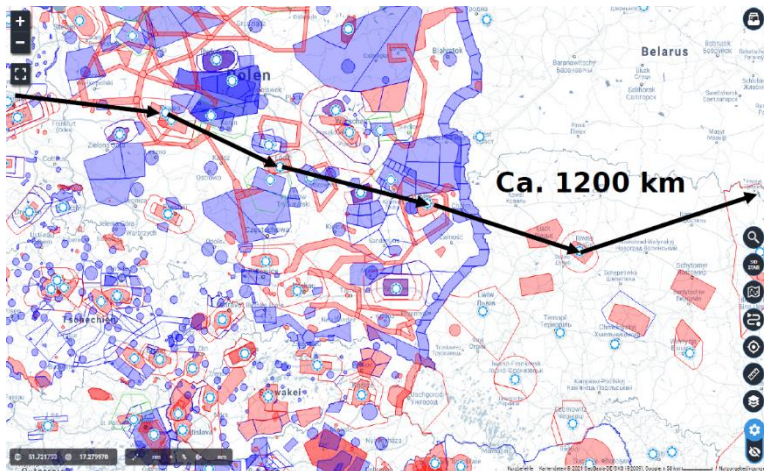
Maximum ODL – **Measurement campaign 2021** – **100 μ Sv/h**

Ground contamination – **Measurement campaign 2016** – **Am-241 und Sr-90**

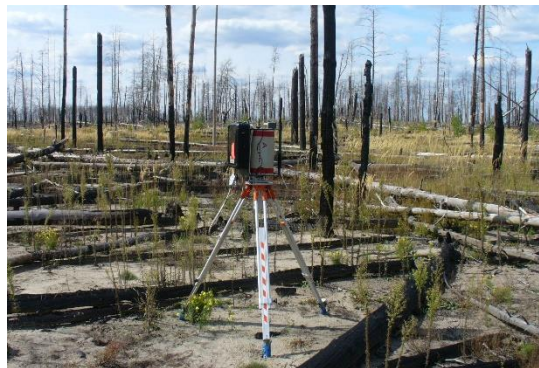
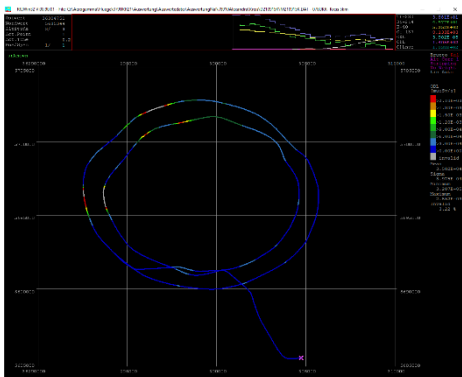


Resilience

German Federal helicopter in Chernobyl



Metrological challenge



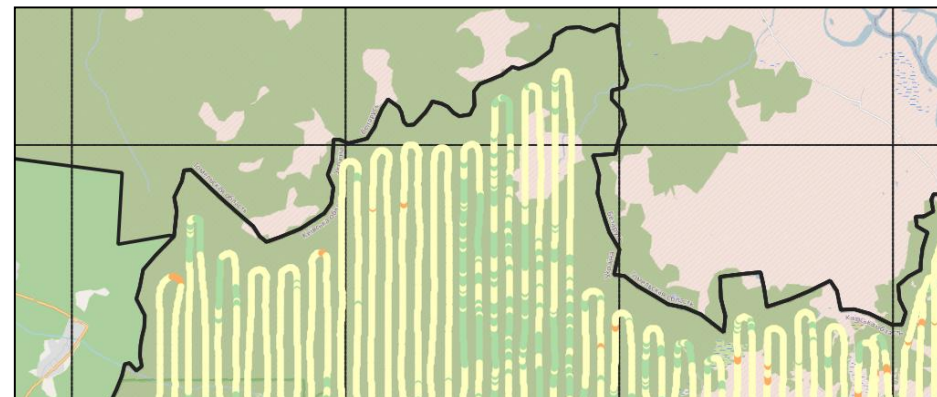
Ukrainian-German cooperation



Physical effort



Diplomatic entanglements



BELARUS

UKRAINE

Border



**Bundesamt
für Strahlenschutz**

Legal Notice

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