

Time series data from in situ gamma spectroscopy measurements

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Env. Rad. Surveillance in Germany

After Chernobyl:

foundation of IMIS (Integriertes Mess- und Informationssystem)

- 1) Routine program:
surveillance of all important media (air, water, soil, food, ...) with high sensitivity
- 2) Emergency program:
dedicated quick surveillance of important media

Data are fed into a nationwide central data bank; form input for decisions regarding countermeasures



In Situ Gamma Spectroscopy within IMIS

In situ gamma spectrometers are operated by different institutions: nationwide

- BfS (Federal Office of Radiation Protection): mobile (air and road)
- DWD (German Weather Service): 39 fixed stations

regional

- All 16 Federal States: at least one mobile system (road)



Mobile in situ system for IMIS

In Situ Gamma Spectroscopy within IMIS

In situ gamma spectrometers are operated by different institutions:

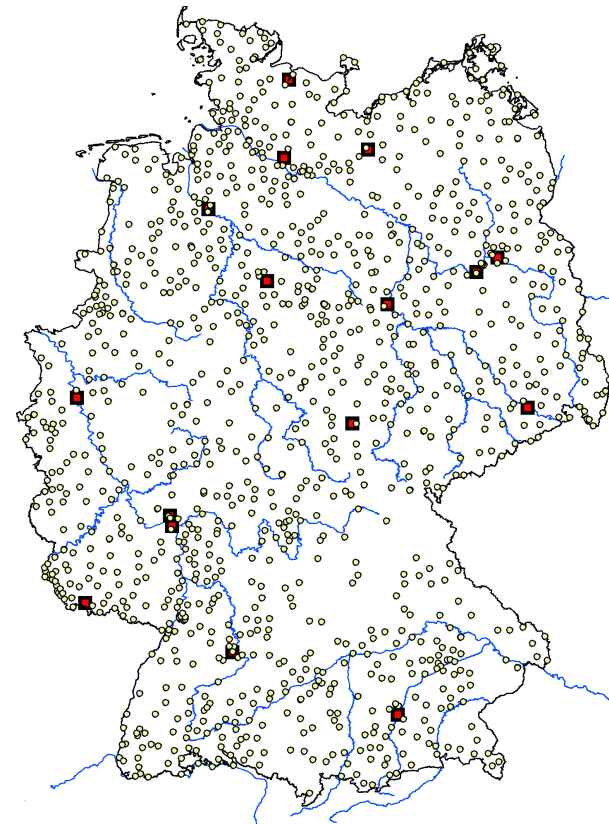
nationwide

- BfS (Federal Office of Radiation Protection): mobile (air and road)
- DWD (German Weather Service): 39 fixed stations

regional

- All 16 Federal States: at least one mobile system

In 2011, more than 1000 spectra have been recorded



Sites where in situ spectra have been recorded in 2011

0 50 100km

IMIS
Bundesamt für Strahlenschutz
(im Auftrag des BfS)

In Situ Gamma Spectroscopy within IMIS

Hardware:

- hpGe detector, $\varepsilon \geq 10\%$
- monolithic spectrometer electronics, notebook
- half-automatized spectrum recording and analysis
- detection limits:
200 Bq/m² (⁶⁰Co, routine)
1500 Bq/m² (emergency)

Data transfer to IMIS data bank via GSM network; only the results are sent



Field work ...

	Bremerhaven	Weddewarden		
BI-214	4.855E-01	1.65E+01	1.844E-03	
CS-137	4.965E-01	1.23E+01	8.138E-04	
K-40	1.430E+01	1.04E+01	5.778E-03	
PB-212	6.136E-01	1.47E+01	2.467E-04	
PB-214	5.501E-01	1.59E+01	3.982E-04	
TL-208	1.752E-01	1.93E+01	1.425E-03	
Isotop	Konz. (kBq/m ²)	Fehler(%)	ODL(uSv/h)	

Excerpt from a sample data set

In Situ Gamma Spectroscopy within IMIS

Recording of and analysis of spectra is mostly not performed by trained scientists

Routine data are checked for plausibility by BfS, but not used further

Stored data are just numbers, not spectra

Routine data are not intended for further use

BUT:

A huge data pool has built up over the years

Might it be usable for further evaluation and research?

In Situ Gamma Spectroscopy in Bremen

Local situation:

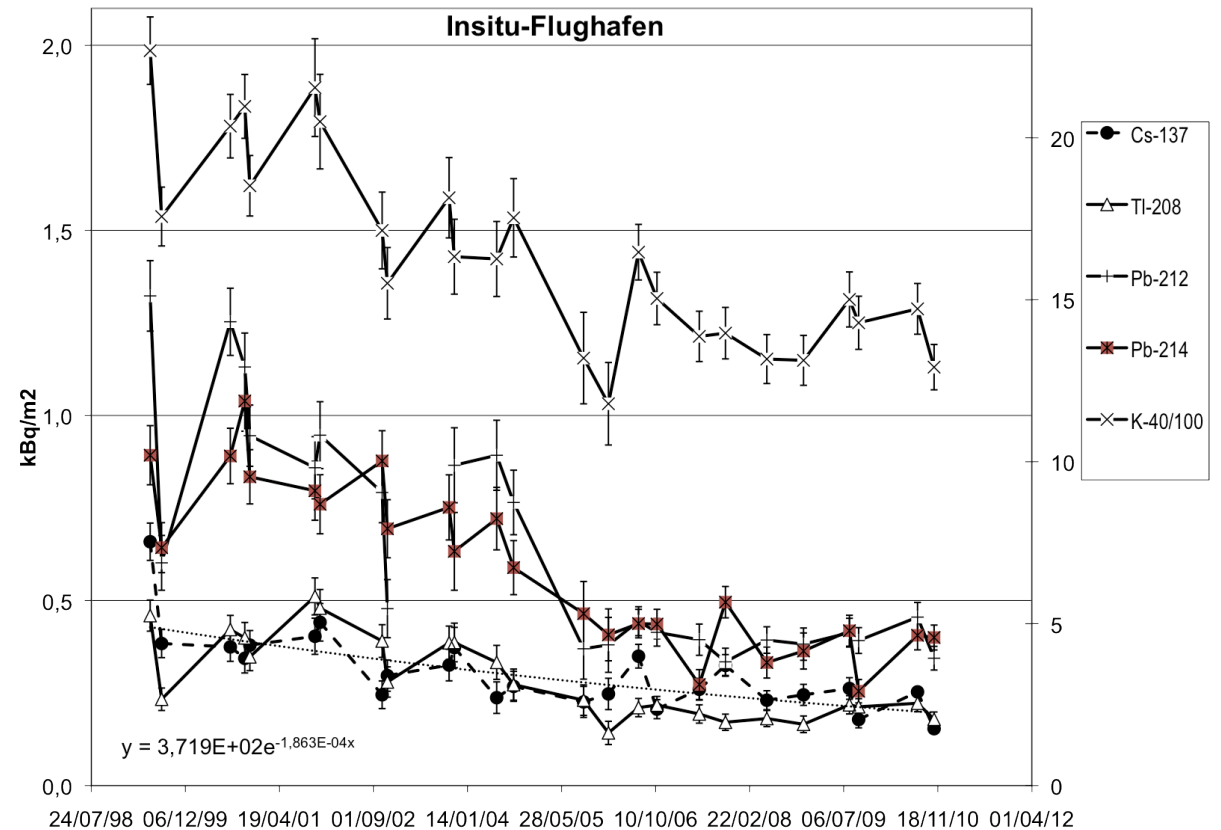
- NW Germany, flat landscape
- data from 6 measurement points, normally visited 2 times per year
- time series for 13 years
- 3 different detectors
- 3 different operators
- 1 computer/local data storage system
- Natural and artificial (^{137}Cs) isotope levels comparatively low
- history of sites unknown
- > could be a „typical“ situation



In Situ Gamma Spectroscopy in Bremen

Example 1:

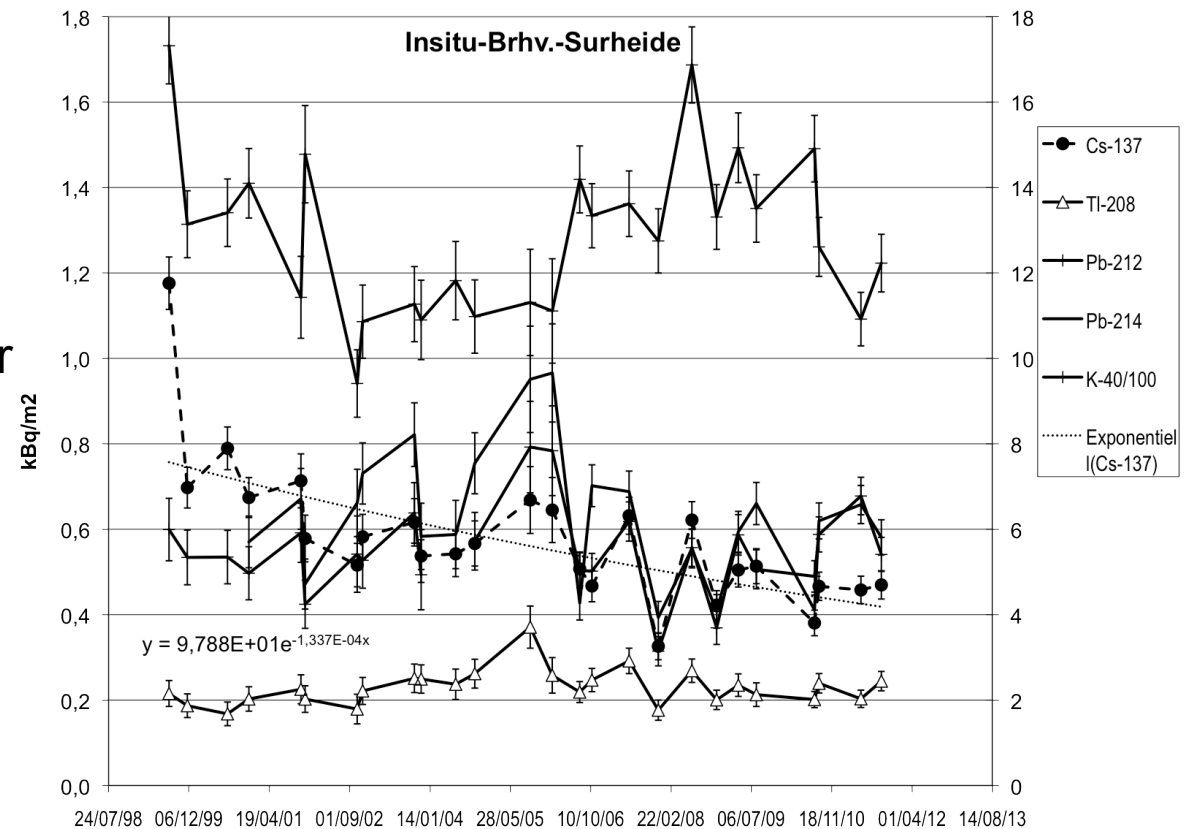
- Lawn
- All isotope concentrations decrease



In Situ Gamma Spectroscopy in Bremen

Example 2:

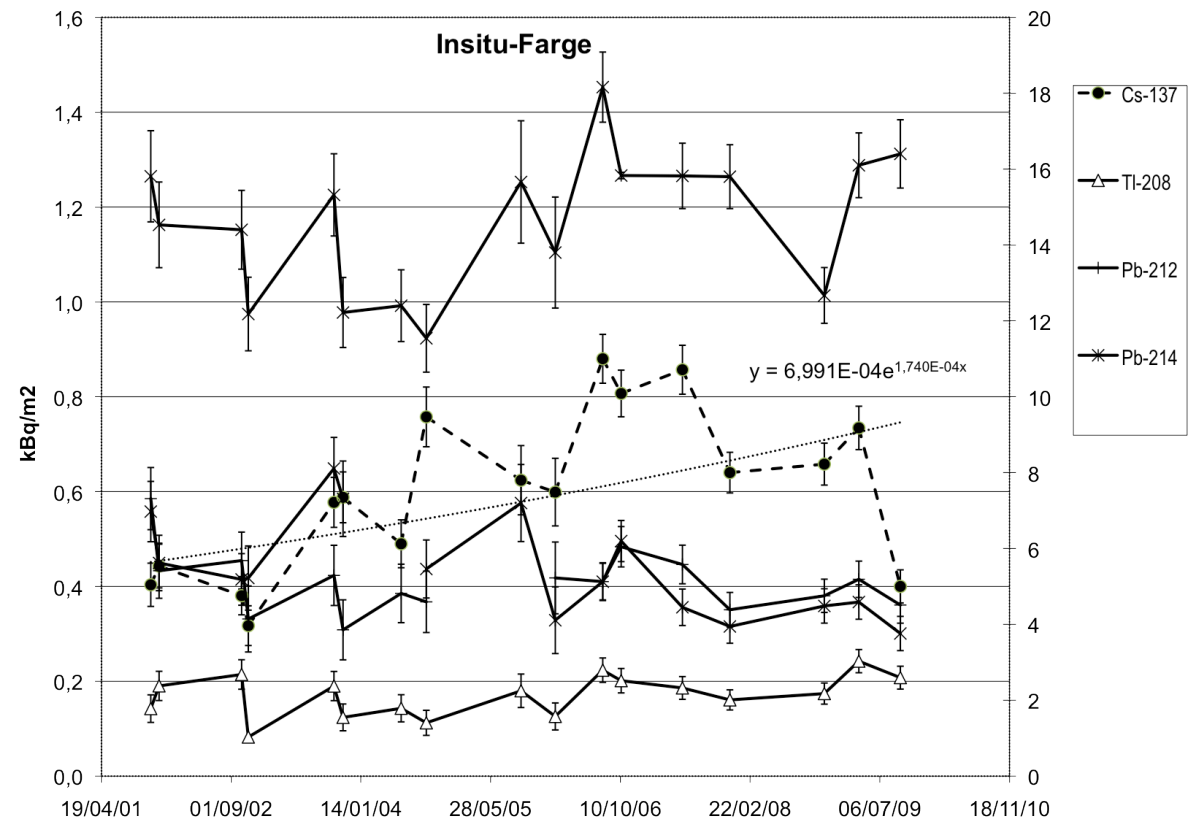
- uncultivated
- all concentrations remain fairly constant, except ^{137}Cs
- ^{137}Cs decreases with $T_{1/2} < 30$ yr
(interpretation: combined weathering and rad. decay)



In Situ Gamma Spectroscopy in Bremen

Example 3:

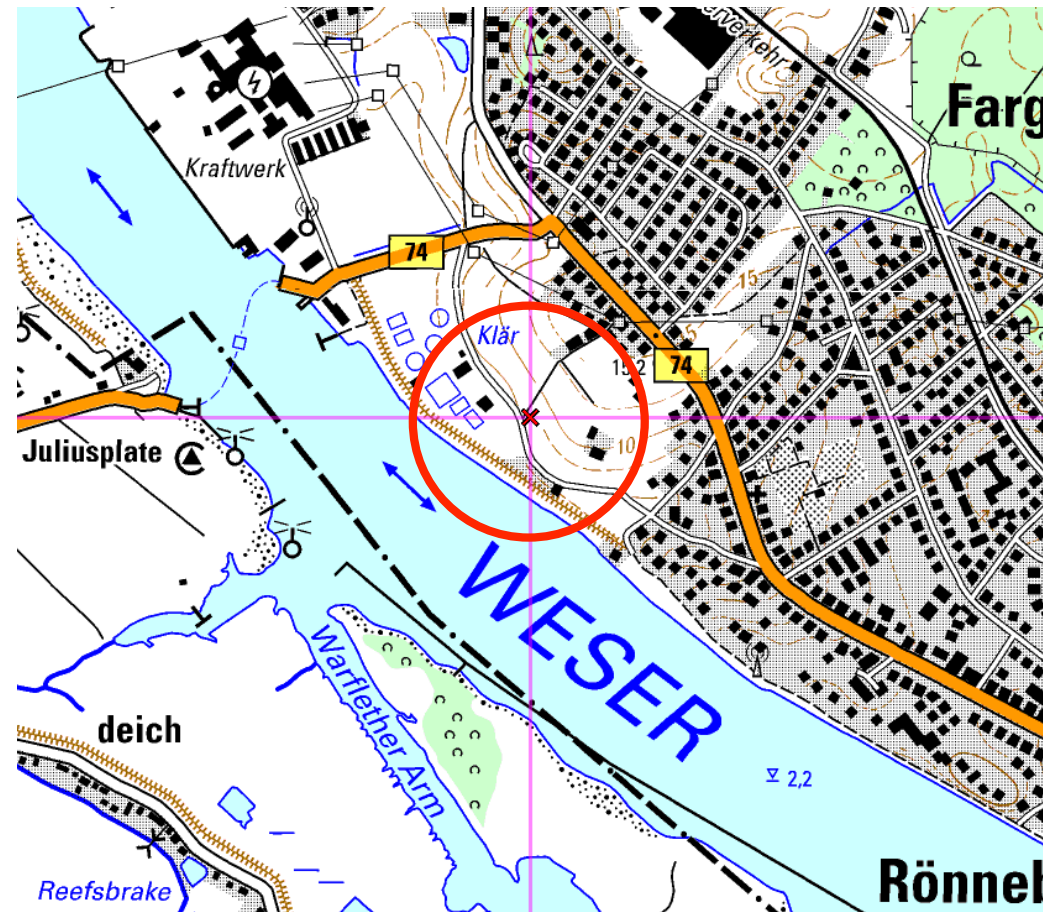
- uncultivated
- all concentrations remain fairly constant, except ^{137}Cs
- ^{137}Cs increases!



In Situ Gamma Spectroscopy in Bremen

„Interesting“ example 3:

- uncultivated
- all concentrations remain fairly constant, except ^{137}Cs
- ^{137}Cs increases!
- interpretation: erosion (only site with level differences)



Usability of IMIS Routine In Situ Data

- Despite the irregularities in recording of the data and the uncertainties in the site histories, part of the time series appear fairly constant
- ^{137}Cs mostly shows the expected continuous decrease
- Increase of ^{137}Cs data with time coincides with the possibility of deposition by erosion
- The huge data pool appears worth to be investigated further

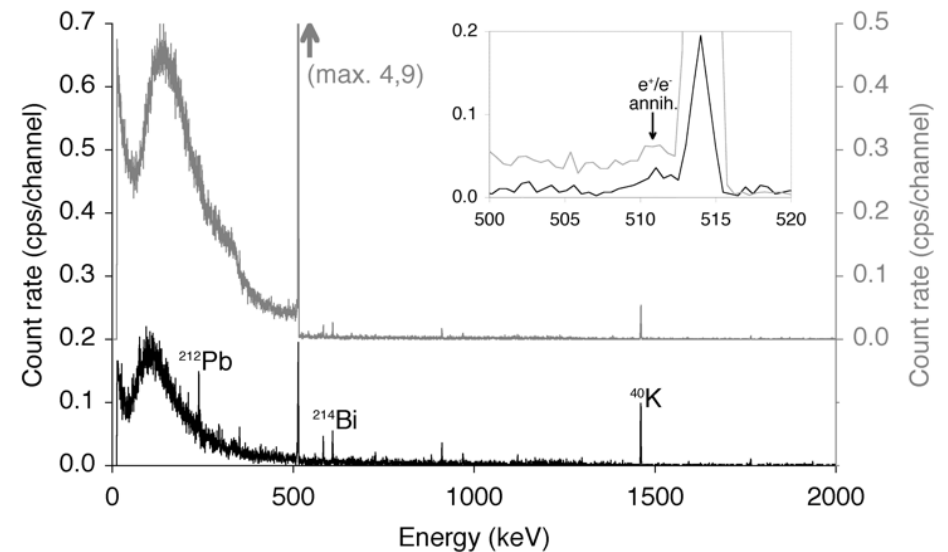
Thank you for your attention!

Other uses of an In Situ spectrometer ...

Identify cargo which triggered a radiation alarm (^{85}Kr)



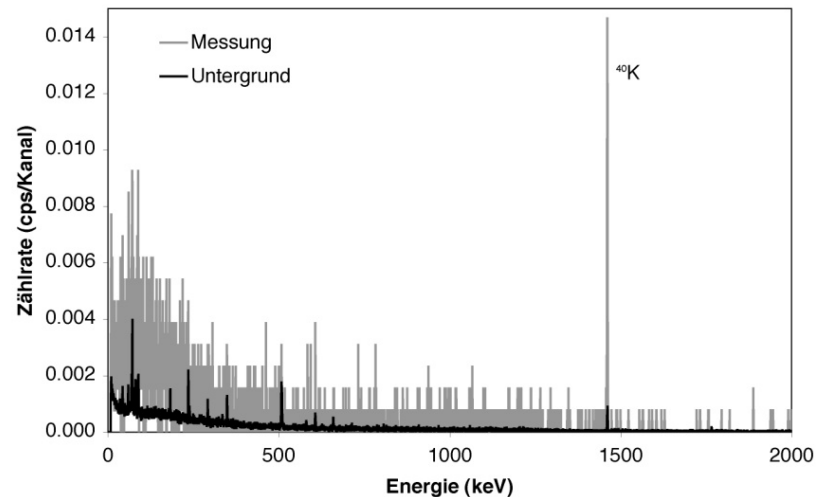
Krypton gas cylinders in an oversea container



In situ spectrum showing the 514 keV ^{85}Kr line

Other uses of an In Situ spectrometer ...

Build a whole body counter!



*Spectrum obtained from a volunteer in 20 min. (grey),
background spectrum (black)*



Improvised WBC setup, using an old 10 cm lead shield