



2016 Rio  
**norm VIII**

Eighth International Symposium on Naturally  
Occurring Radioactive Material – NORM VIII  
Rio de Janeiro, Brazil, October 18 -21, 2016

**CHARACTERIZATION OF U-PRODUCTION RESIDUES,  
CONTAINING HIGH ACTIVITY CONCENTRATIONS OF TH-230  
AND RA-226 AT THE FORMER PCHP U-PRODUCTION LEGACY  
SITE IN UKRAINE**

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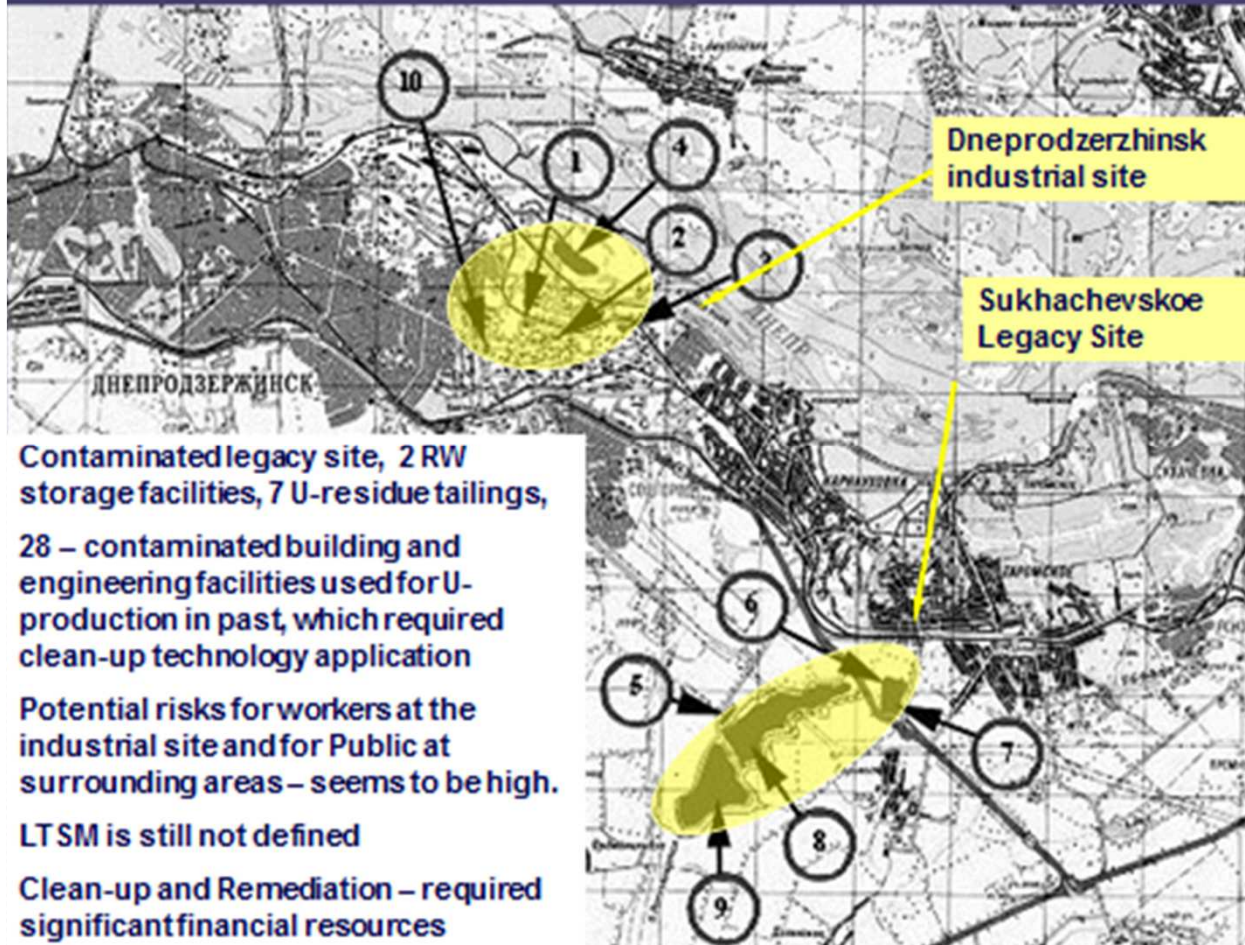
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# Background

“Pridneprovsky Chemical Plant” (PChP) in Dneprodzerzhinsk is legacy of U-production facilities in Ukraine where the ambitious State Remediation program is under development

## Uranium Production Legacy at Dneprodzerzhinsk (1947-1991)



Large area (100 ha) with gamma dose rate  $> 0,5 \mu\text{Sv/h}$

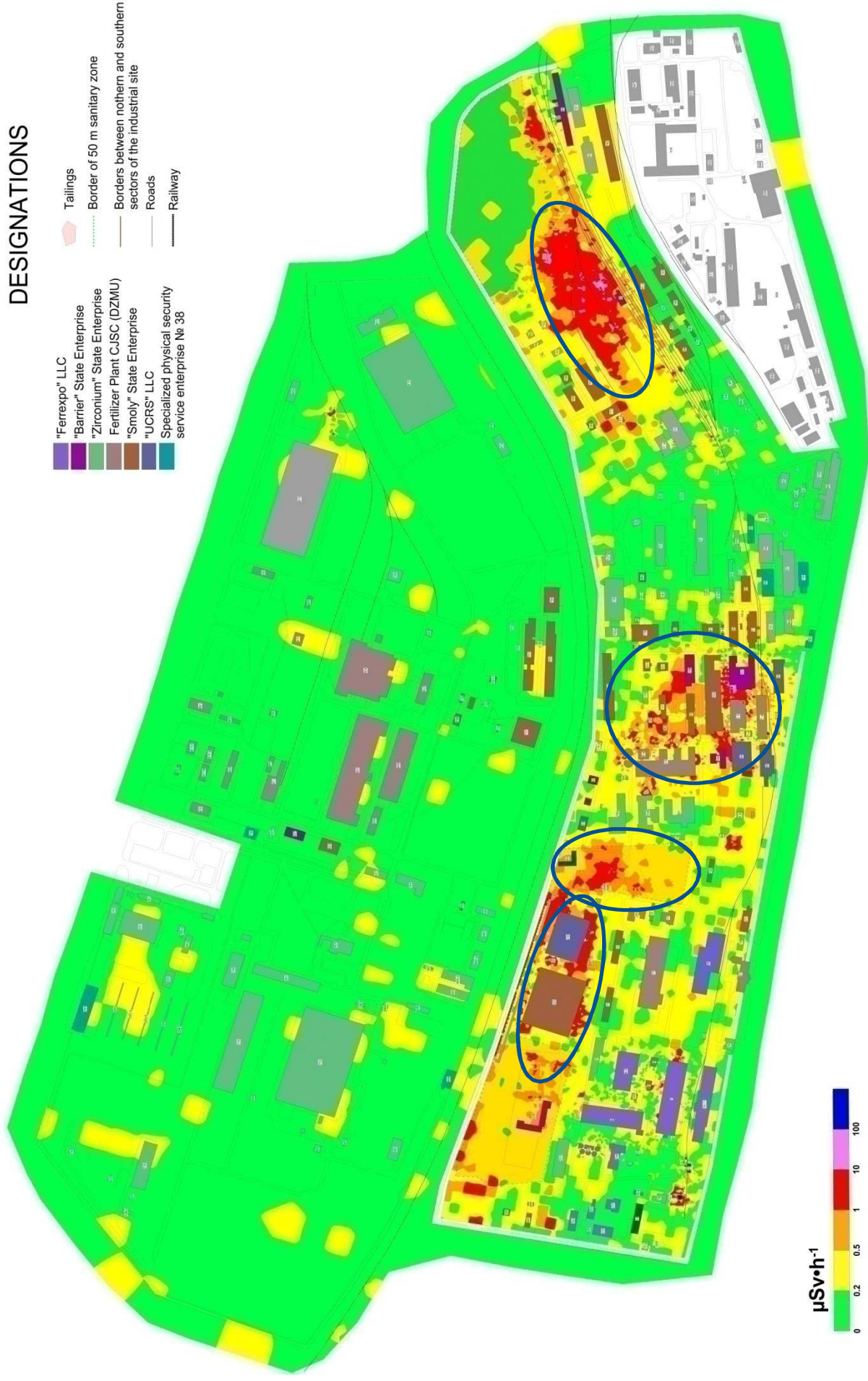
5- high contaminat. buildings ( $1 \mu\text{Sv/h}$  -  $1 \text{mSv/h}$ )

Several **U-tailings** and number of “hot spots”

Several ponds containing high contaminated sludge (**U-238, Ra-226, Th-230**)

High chemical pollution of soils and groundwaters

# Spatial distribution of gamma dose rate at the territory of the former "Pridneprovsky Chemical Plant"



## Specific features of the Site contamination

- Large amount of radioactive residues containing high activity of Uranium, Th-230 and Ra-226 are still containing in the tanks and equipment.
- Large amount of U-production residues in fine dispersed materials are presents in spills near some apparatus and leaked pipelines inside of the most contaminated buildings and at the territory
- High activity concentrations of Th-230 and Ra-226 (irom 10-50 Bq/g to 400-600 Bq/g) were identified in many places of Buildings #103, #104, 2b and also in the sludge materials.
- The characteristics of Uranium, Th-230 and Ra-226 in the different buildings and surrounding environment (soils, aerosols, river water and groundwater) are versus of type of the U-and Th containing Ores and also technology used at the PChP industrial site
- This study is part of site characterization and remediation planning

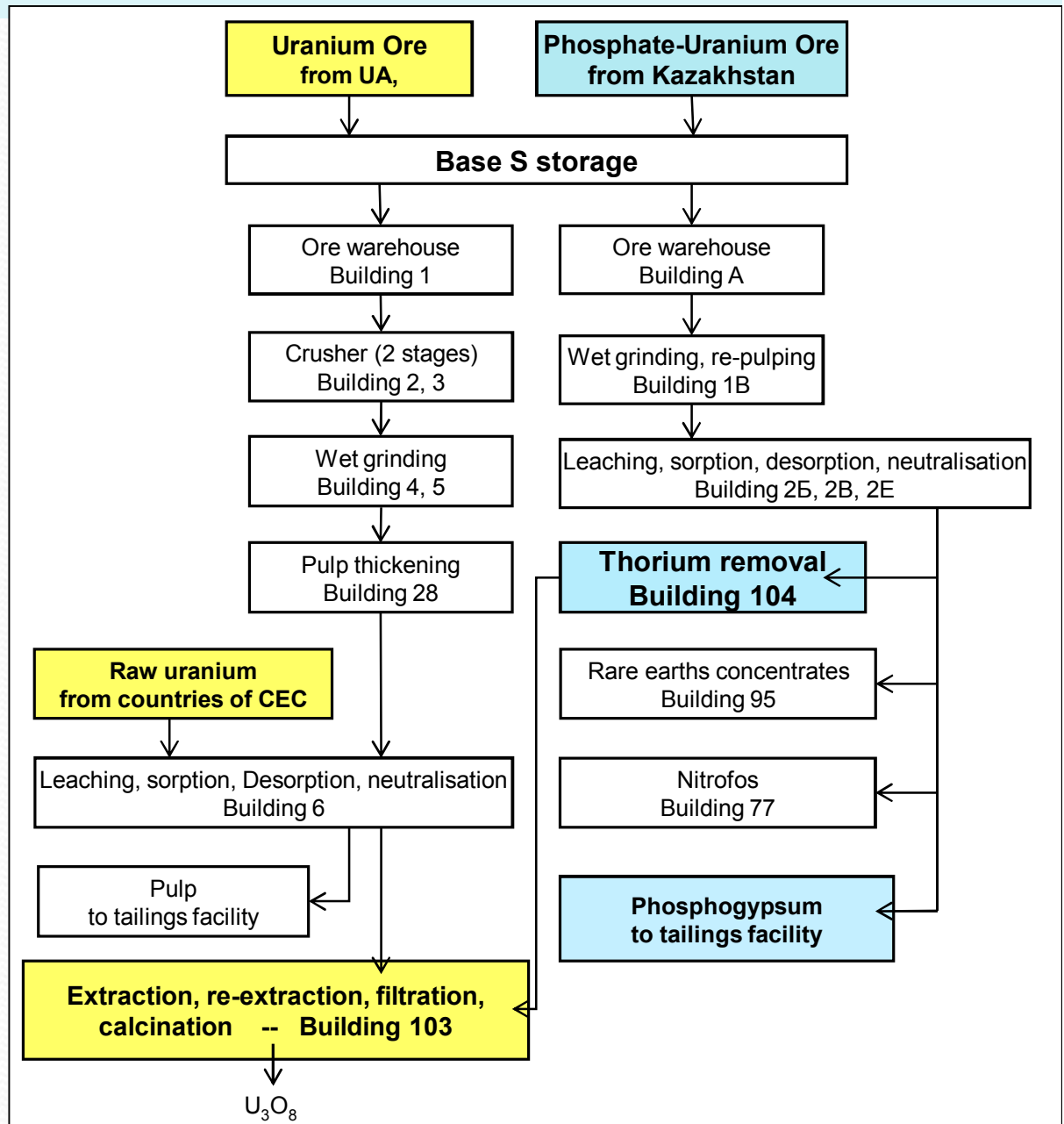
# U-extraction technology used for different type of U-ores

**U-ore residues from extraction of mineral materials from UA and countries of CIS, Bq/g**

U-238	Th-230	Ra-226
0.4-3.5	40-600	1.5-22.0

**Residues from extraction of the Phosphate U-Ore (Kazakhstan), Bq/g**

U-238	Th-230	Ra-226
10-3200	10-150	10-1700



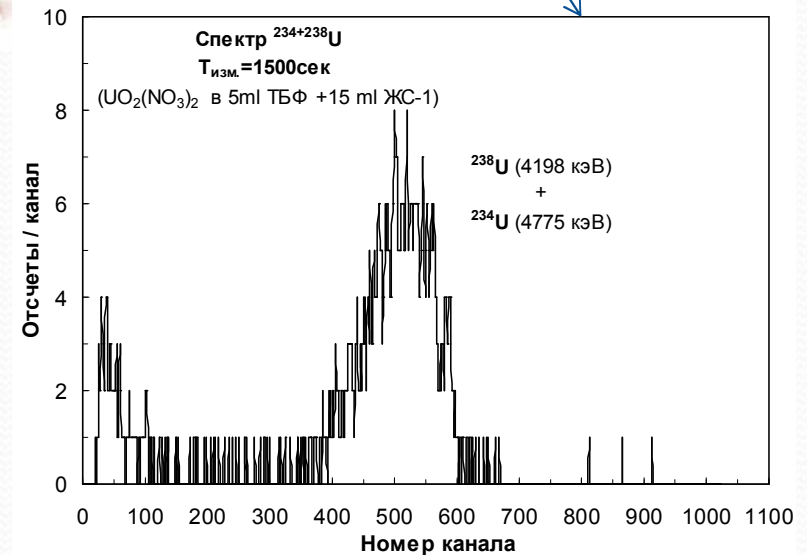
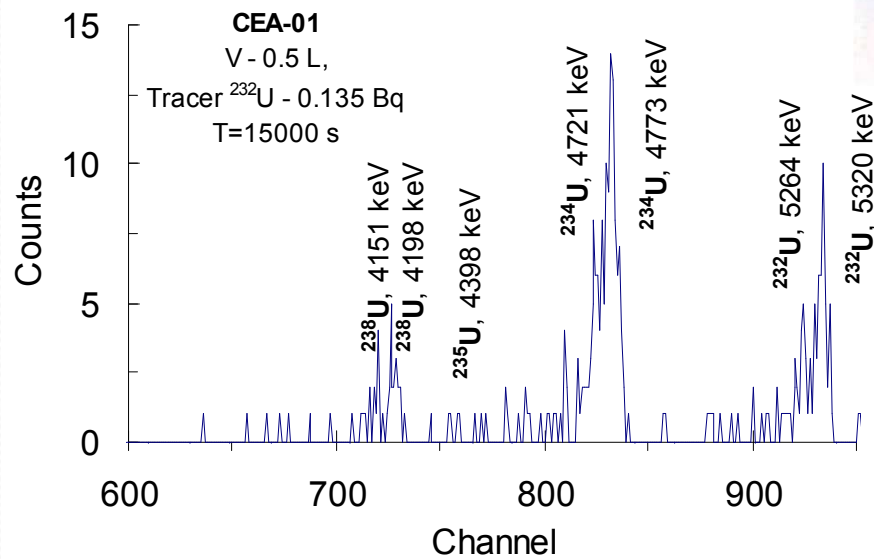
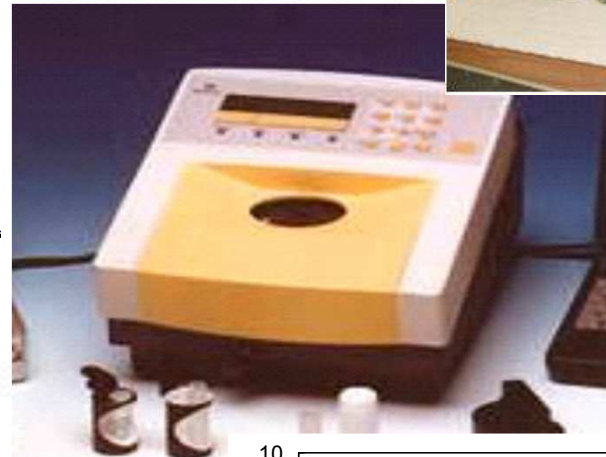
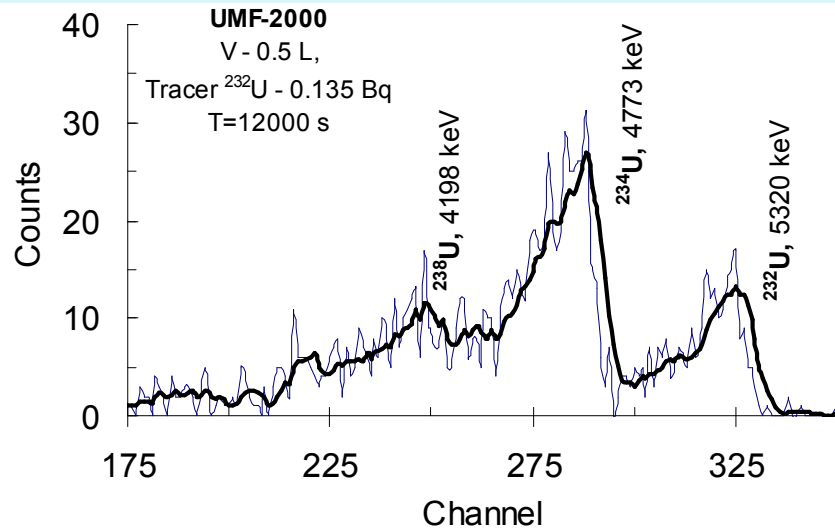
## Analytical laboratory UHMI includes

High efficient gamma, alpha and LLC spectrometry devices as well as basic radiochemical and environment sample preparation facilities





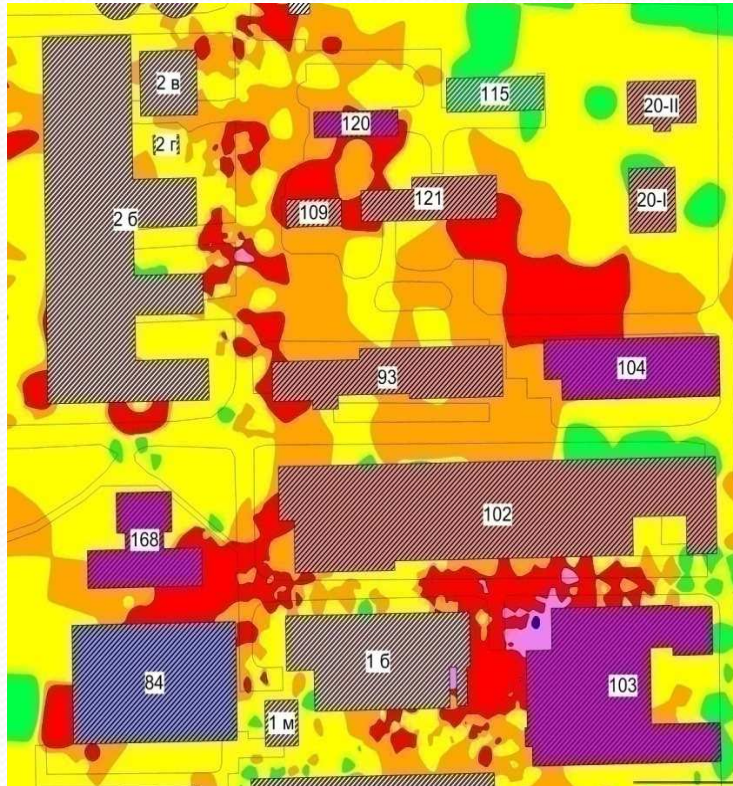
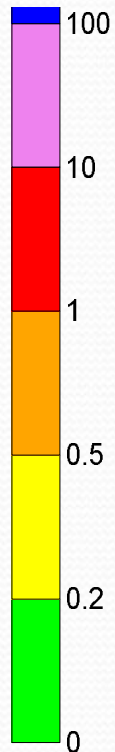
# Simplified methods for U-Th series radionuclides determination in waters (UMF-2000, and LLC)





# Complex of U-containing ore materials milling, grinding, settling purification and final U-extraction-calcination ( Building 103) and Th-extraction and purifications (Buildings 2b and 104)

$\mu\text{Sv/h}$

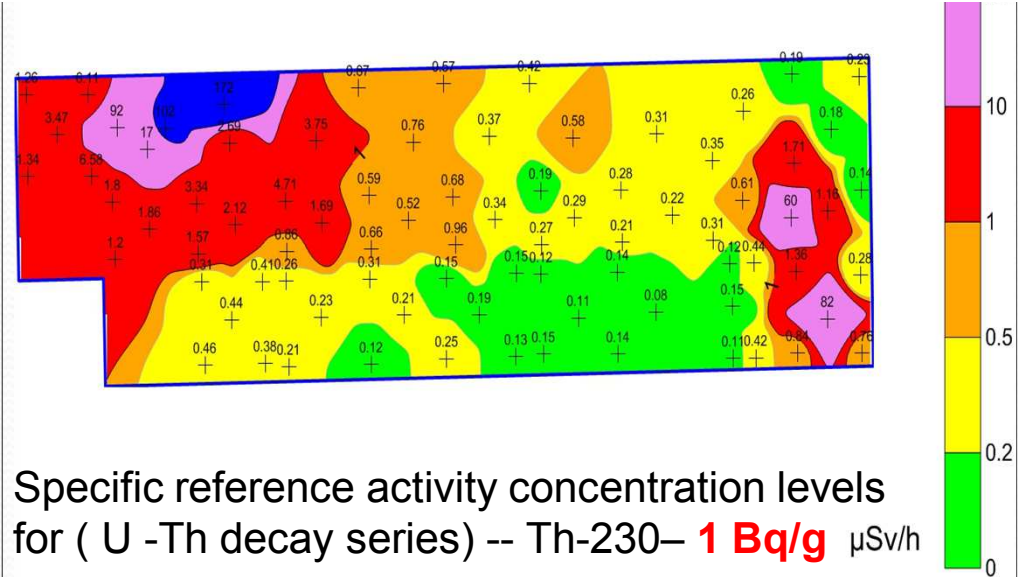




# Specific Feature of radiological hazards in the Building 104 is high specific activities of Th-230 identified in the spill and extraction columns

## Data UHMI & Ecomonitor, 2016

Samples	Activity concentration, Bq/g			
	Pb-210	Ra-226	Th-230	Th-232
S104-01	19.3	27.6	<b>574</b>	4.7
S104-02	0.8	2.6	<b>250</b>	2.3
S104-07	21.4	10.2	<b>253</b>	2.9
S104-09	30.8	7.9	<b>35.2</b>	0.3



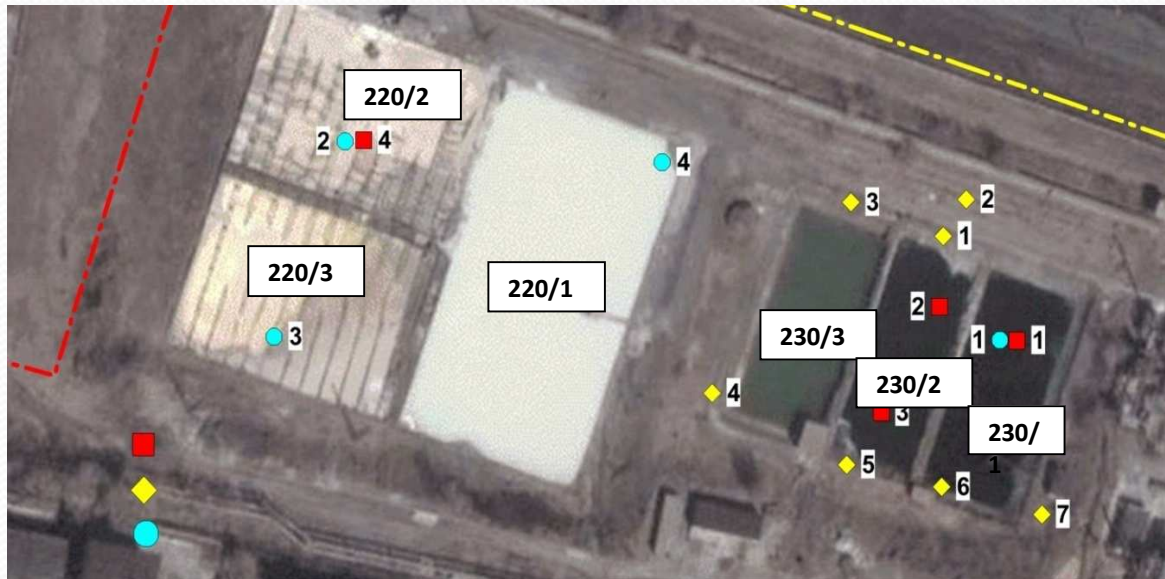
# Radiological Hazards containing materials with high activity concentrations of U, Ra-226 and Th-230 around sludge ponds

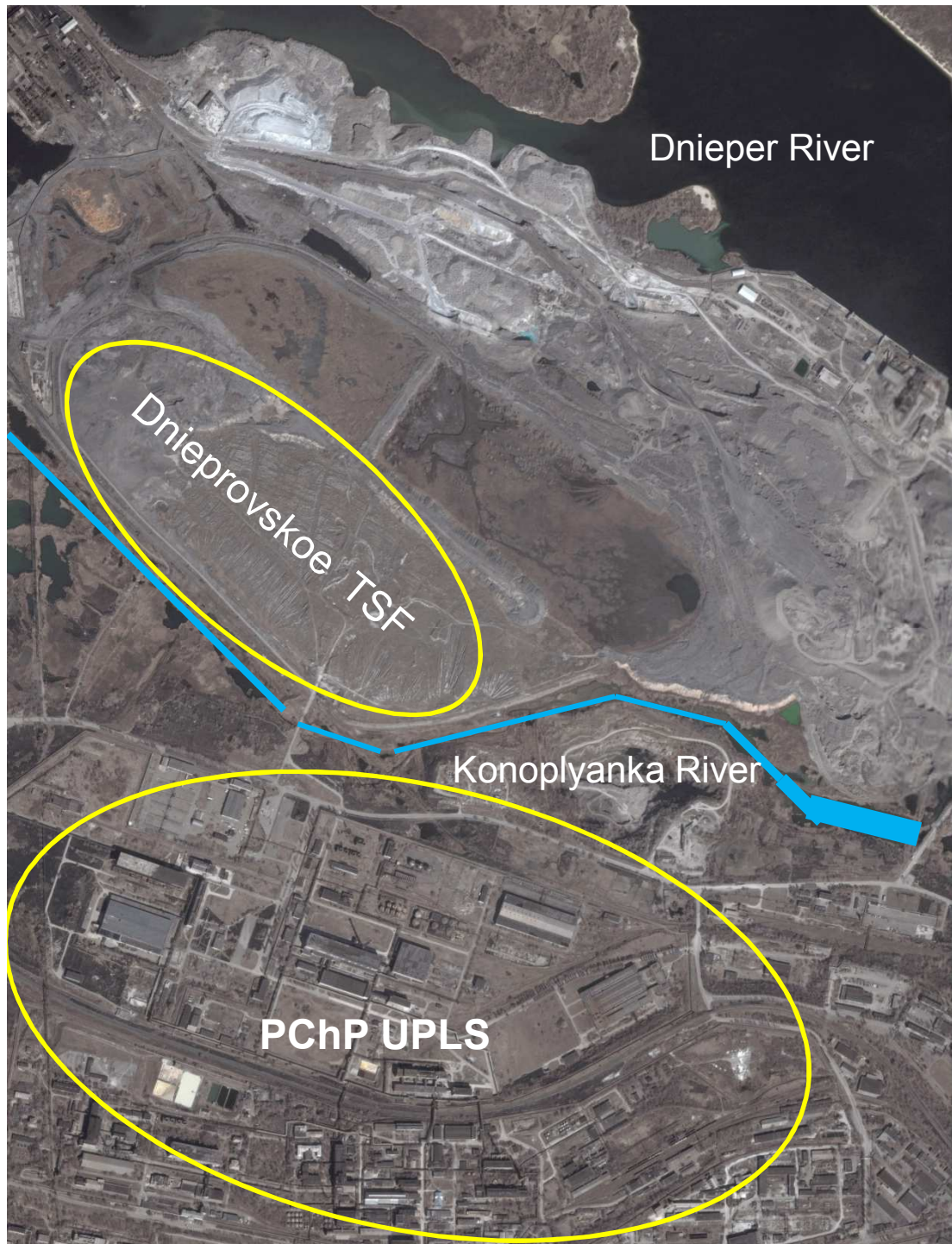


Selected "hot spots" to be removed around ponds 230 and 220



Sludge materials in sedimentation pond 230 (cell 12) are high contaminated by Th-230 (15-240 Bq/g) and toxic metals (Arsenic)  
Other materials in the pond 220 can be released from regulatory control

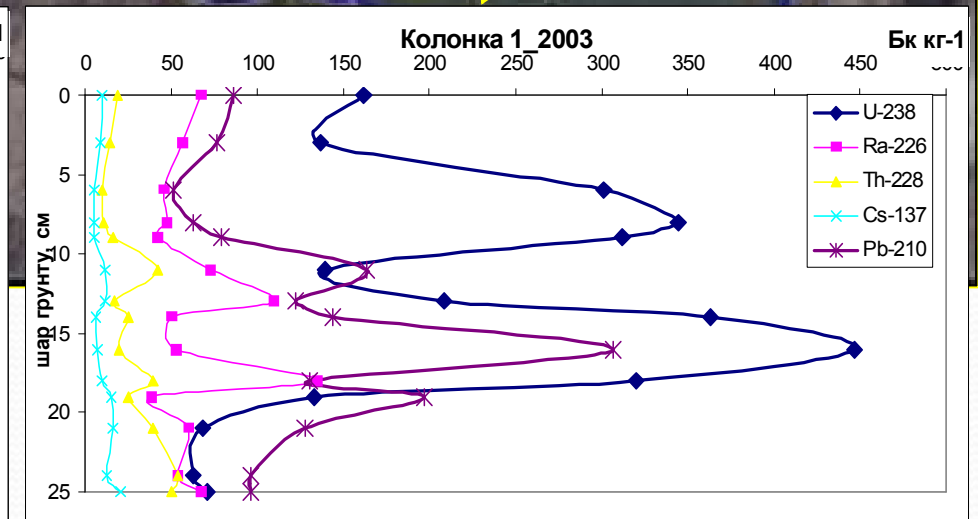
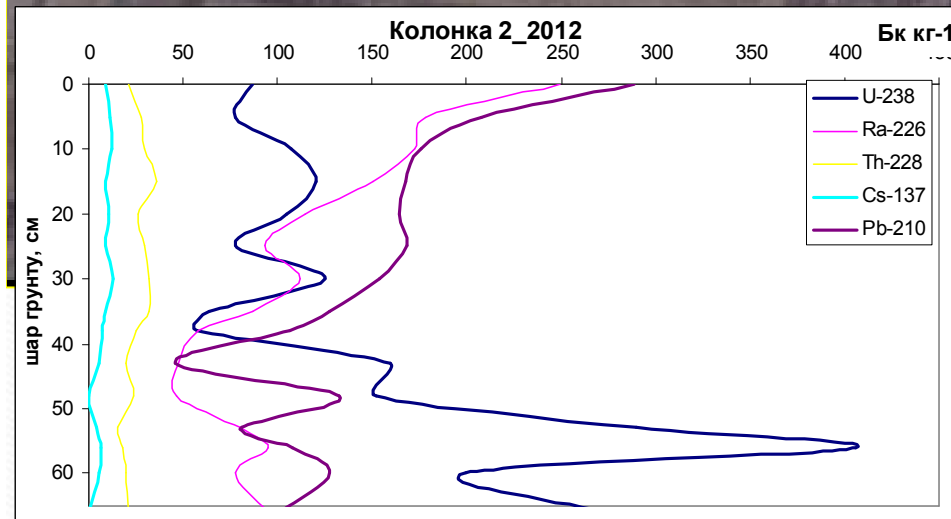
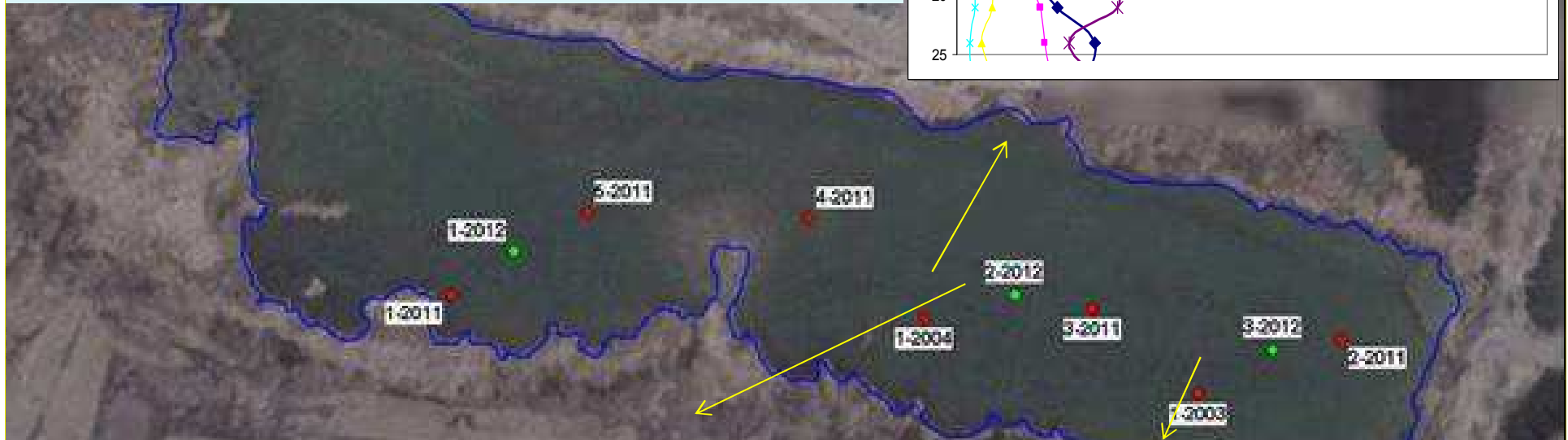
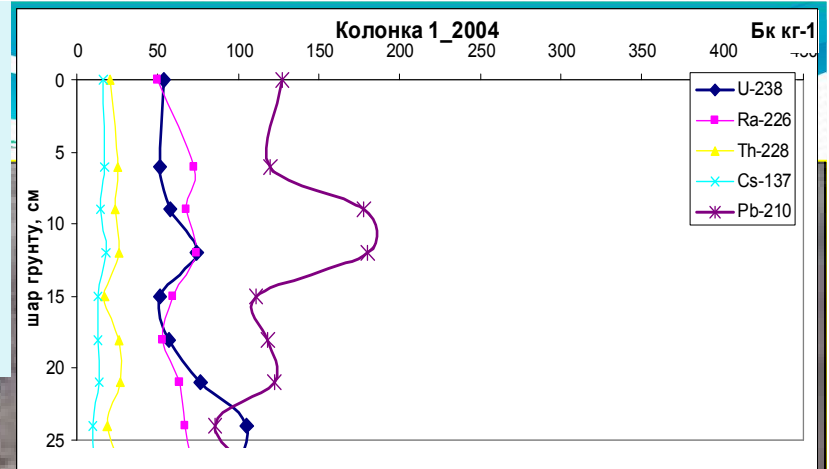




Dredging of the bottom sediment in Konoplyanka river may significantly improve ecological situation at the surrounding areas

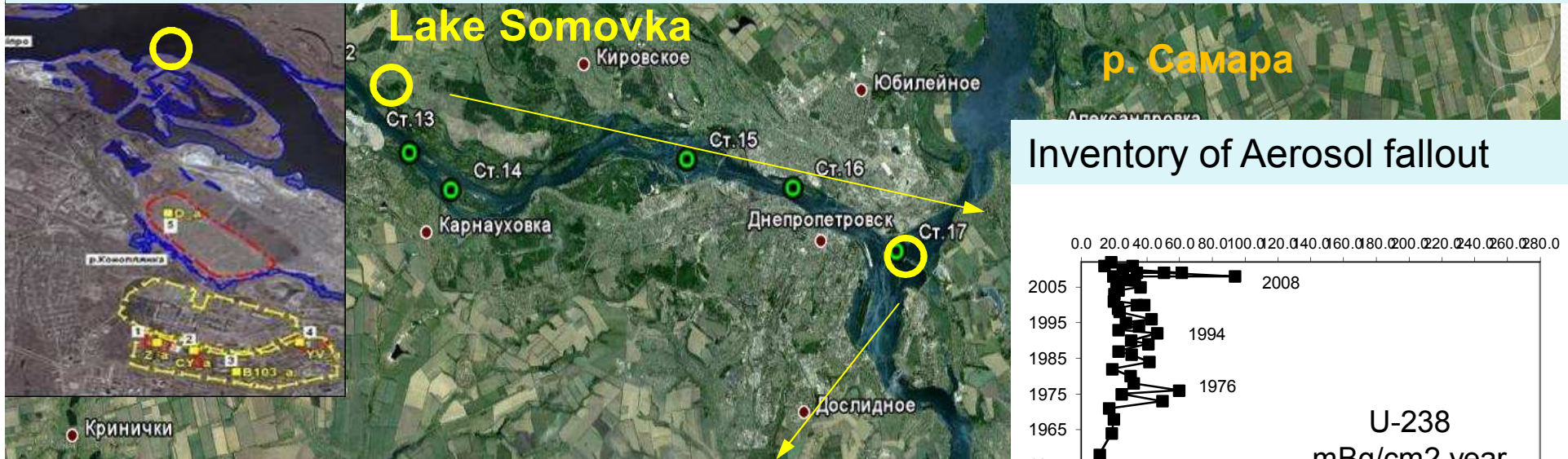


Contaminants from the PChP ULS Inlet to the River Konoplyanka and mainly deposited in the bottom sediment Contaminated water inflow to the Dnieper reservoir

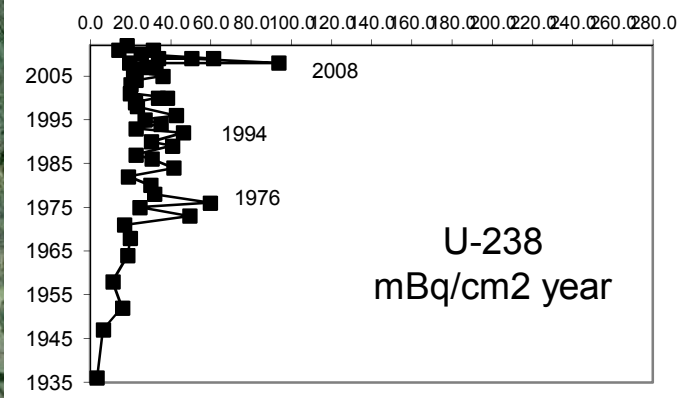


# Dniepr reservoir has accumulate contaminants from PChP site.

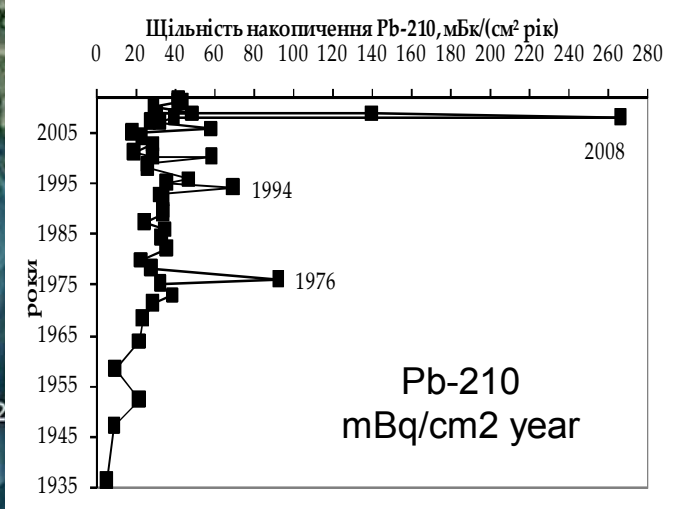
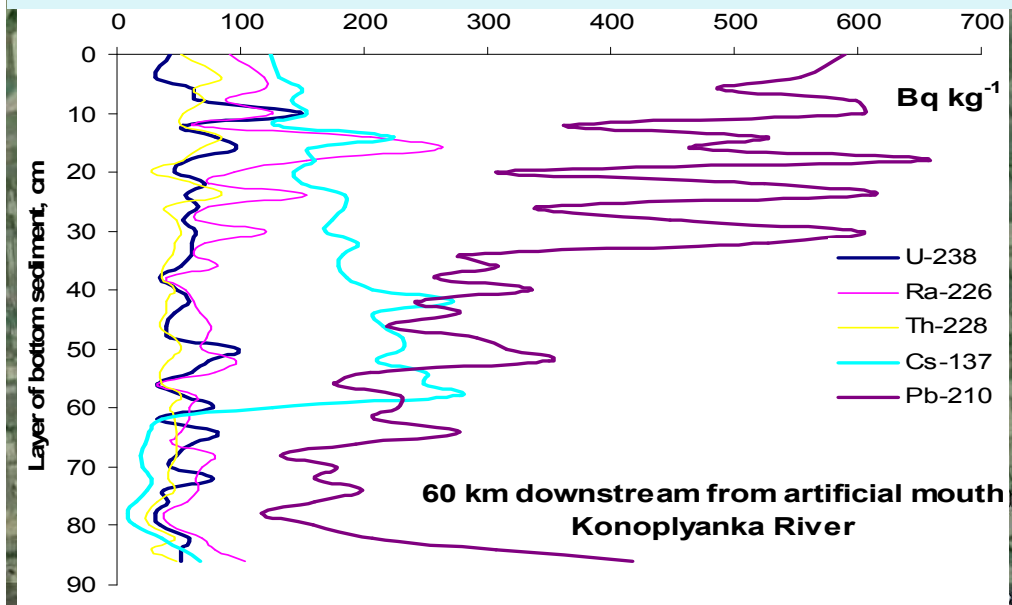
## Impact of the PCh P site via aquatic pathways are very low



Inventory of Aerosol fallout



Radionuclides in bottom sediment





# The State Program (2016-2017) is under implementation

The program is developed to provide Safe management at the legacy site, to support functions of the SE "Barrier" (Operator) ensure its functions such as:

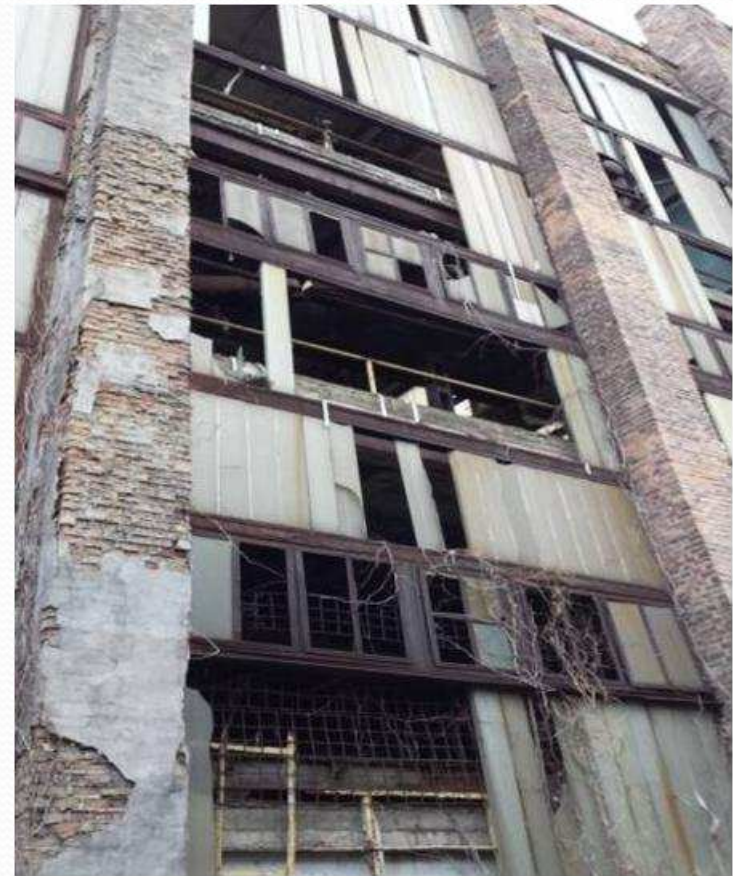
- Site Safety management (radiological and non-radiological), –surveillance and monitoring
- Preparedness to further and ongoing remediation activities to be implemented in the frame of EC projects (2017-2020)
- Provision security and Radiation protection at the site
- Coordination and support of the site investigation and actions for remediation strategy planning (national and international)
- Public communication and data management

## **In the Frame of EC project planned for 2017-2018 the Emergency Measures to Improve Safety and Stability at the most contaminated facilities will be implemented. The tasks are following:**

To fix or collect high contaminated dispersed materials in the buildings of the former U-extraction facilities (103 and 104)

To stabilize the most contaminated buildings (sealing windows and walls), Repair tailings covers, decontaminate some hot spots, establish fences and more strict radiation protection control actions.

- It may help significantly reduce the immediate radiological risk until implementation of remediation actions (including establishment of boundaries)
- To raise awareness on and near the site about the conditions of the site and measures to mitigate the risk.



# Specific tasks to be implemented

- Development of special enterprise for decontamination, recycling and possible re-processing of the wastes to be generated during remediation
- **Vacuum and wet decontamination techniques may be used and tested for its possible application for selected premises which high contaminated by dispersed residues and spills .**
- Decontamination technologies used in EU and USA for clean-up and radioactive waste management of the high contaminated (U-Ra) dispersed materials



# Acknowledgement

We appreciate very much to EC funds making possible to complete basic site characterization studies in the frame of EC-UA U4.01/10G also project partners (FACILIA AB, WISMUT GEO), JSO-UA) as well as Ministry of Energy and Coal Industry and Regulatory body of Ukraine on deep concern and efforts to support this study. Also we appreciate IAEA for sufficient consulting and financial support making possible to present this report on the NORM Symposia

**Thank you very much  
with hope on further cooperation  
to be developed**

