



**State Nuclear Regulatory Inspectorate of  
Ukraine**



# **The Remediation Activity Planning at the Former Legacy Site “Pridneprovskiy Chemical Plant”**

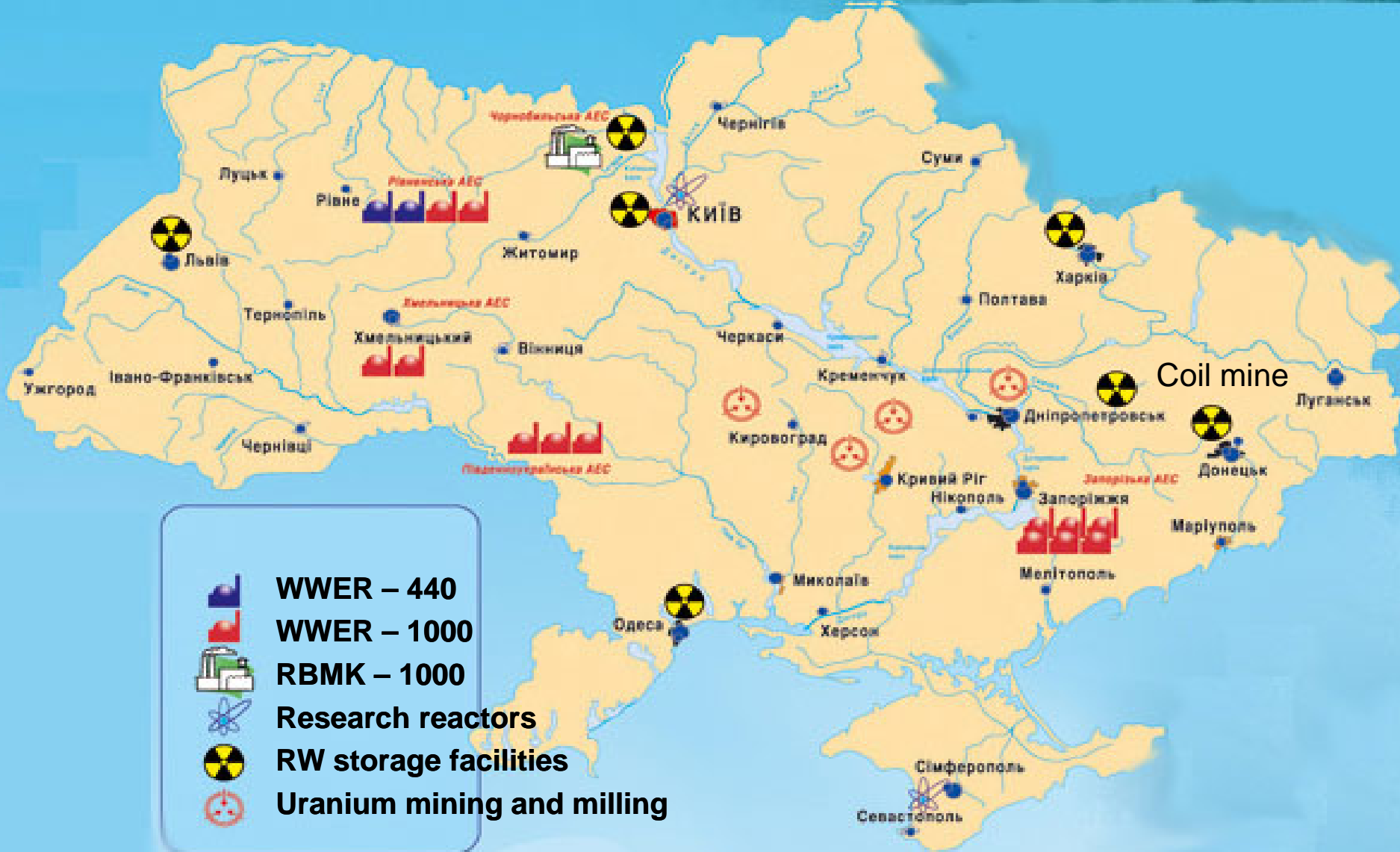
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WM-2015, Phoenix, USA, 16 - 19 March 2015



# Nuclear Applications in Ukraine





# Historical Context



The former U-processing Facility «Pridneprovskiy Chemical Plant» (PChP) is located in Ukraine

Dniepropetrovsk Region

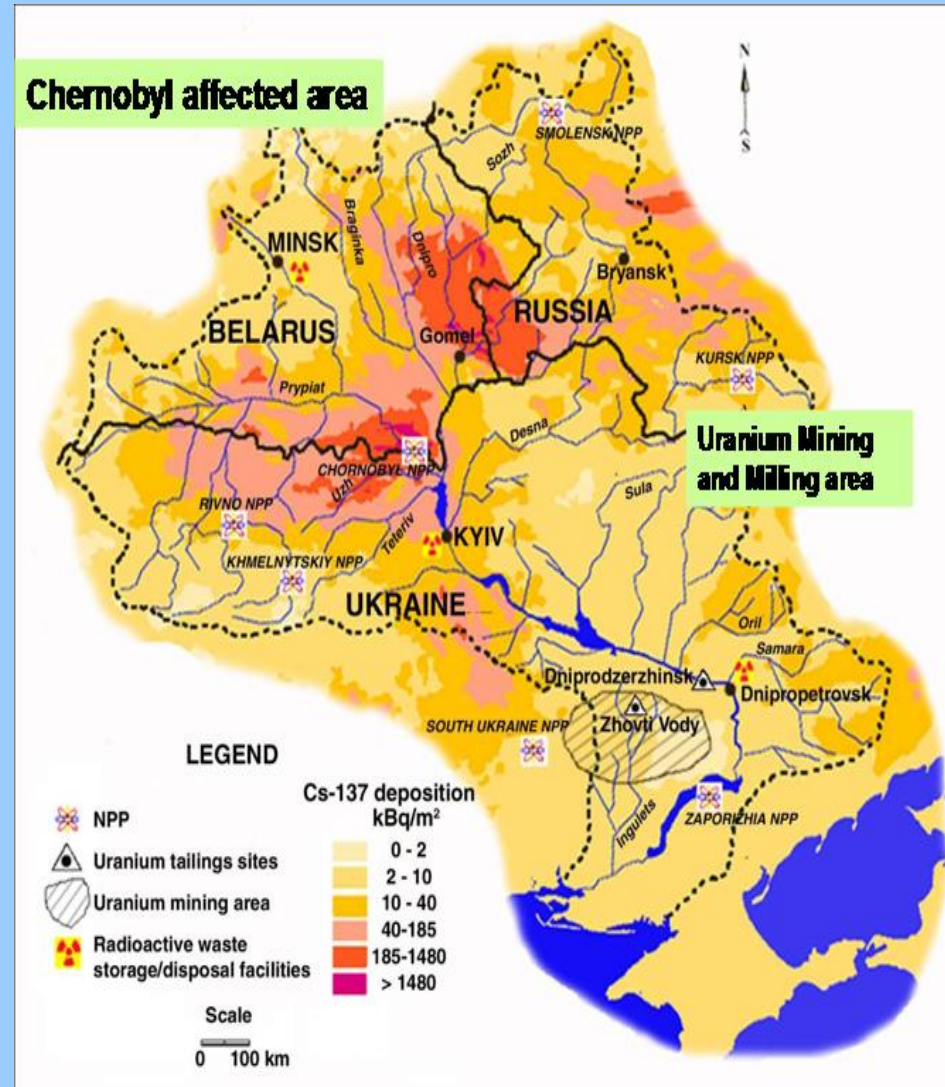
Dneprodzerzhinsk City

In the past it was one of the largest hydro-metallurgical facilities, where uranium ores were processed from 1948 until 1991

State Authorized Governmental Body is Ministry of Energy and Coal Industry

Authorized Regulatory Body is State Nuclear Regulatory Inspectorate

Operator of UPLS is At the moment the PChP UPLS is responsibility of SE "Barrier" which is licensee of the SNRIU





# REMEDIATION ACTIVITIES HISTORY (1)



- **1991-2000** U-Mill production at PChP was stopped. No proper decommissioning plans. No proper site management. No regulation. No strategy. Bad economical situation.....
- **2000-2003** SE “Barrier” was created to provide safe Legacy Site Management . First site characterization studies.
- **(2003)** First Remediation Program to provide safe condition and remediation at the PChP Legacy Site developed.  
Relocation of tailings and demolishing of the most contaminated buildings. First economical estimates show --- Very high cost needed and high uncertainty with Long-term legacy site management. Relocation concept was not accepted.... No other clear alternatives developed... Lack of regulation.
- **2005-2007** Site specific Monitoring & Surveillance programs were established. First priority actions done (decontamination of some buildings, removal most contaminated facilities and pipeline). Tailing cover repairing. Temporary waste storage....Still no Long-term strategy.



# REMEDIATION ACTIVITIES HISTORY (2)



- **2006-2008** Involvement to the IAEA and other International Projects. International experience. Site Inventory studies continue.
- **2008-2009** Preliminary Safety Assessment has been carried. Inter-Agency Government Commission was created to support Legal and Regulatory supervision and site Management. Development of the State Program for Rehabilitation (Second Phase). Inventory studies and systematic site specific studies have been started.
- **2009-2011** State Remediation Program to bring PChP U-production legacy site to the ecological safe and sustainable State is launched. Main focus is to complete first priority actions, Inventory and site characterization studies. Safety Assessment Methodology Study.
- Extension of International cooperation (IAEA, SSM-Sweden, Trainings). Safety issues..... Long-term strategy and Conceptual Integrated EIA and FS needed.
- **2012** – IAEA expert Mission for reviewing activities at the UPLS.
- **2013** - New Phase of State Remediation Program has been developed for 2015-2020.
- **2014-2016** – EC-JSO projects is started for implementation.
- **2014-2016** -- IAEA Consultancy support project.



# Main outcomes of the State Program to support preparedness for Remediation 2003-2009 I 2010-2014

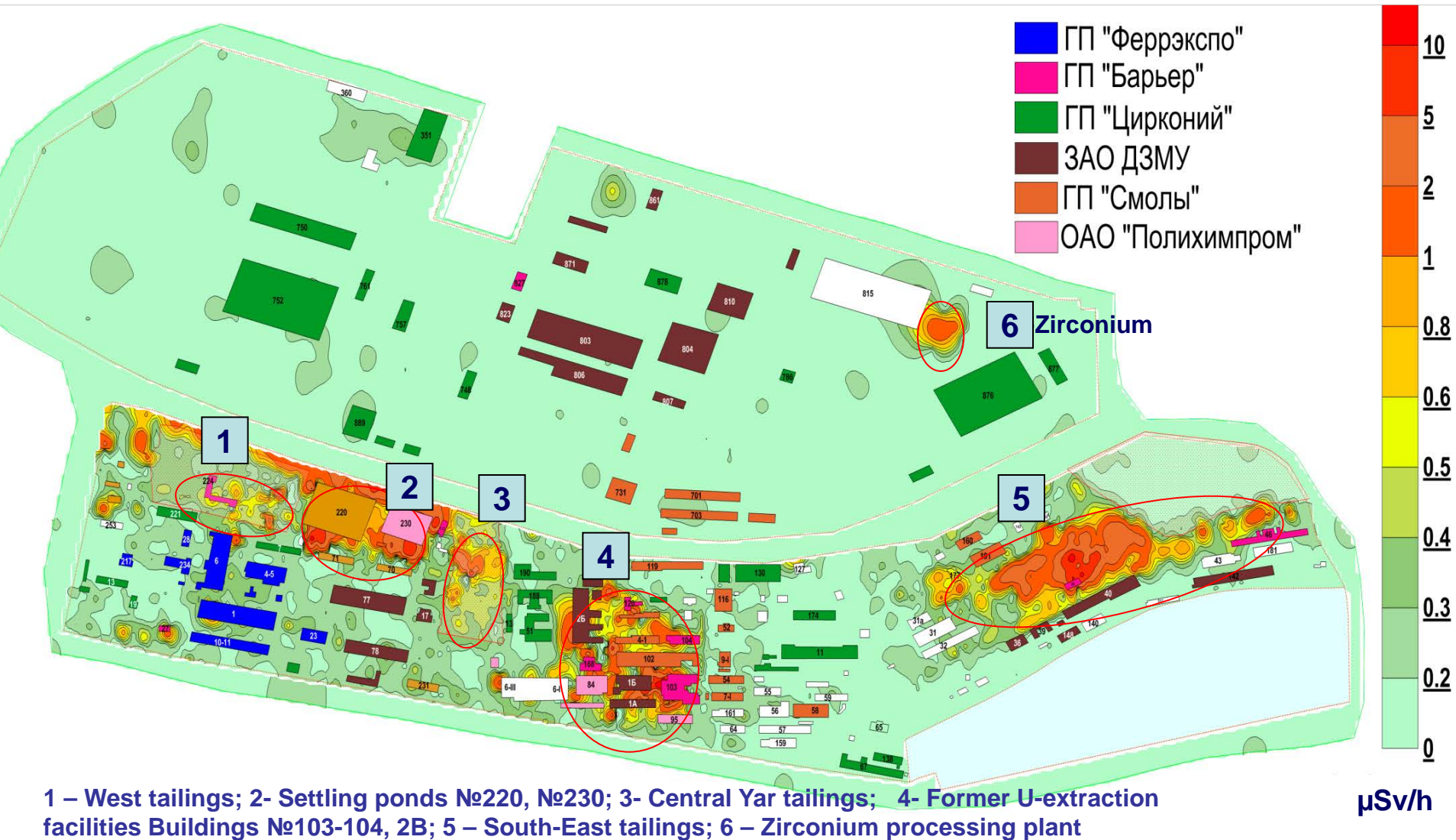


- Development of the Site Operator Infrastructure and its technical capability
- Site characterization and Inventory studies Borehole drilling programs at all tailings and radiological survey at the sites
- Monitoring network and analytical capabilities have been created o
- Preliminary Safety Assessment, Database, Engineering & Designs.
- Overall Remediation Strategy is under development in cooperation with EC and IAEA
- First priority remediation actions were implemented such as:  
(dismantling of some the milling equipment, contaminated pipelines, decontamination; new protective covers at the tailings, collect remained ore materials, mitigate actions, new fences, decontamination workshop, other.....)

**The total cost already paid by Ukrainian Government estimated near 25-30 million USD**

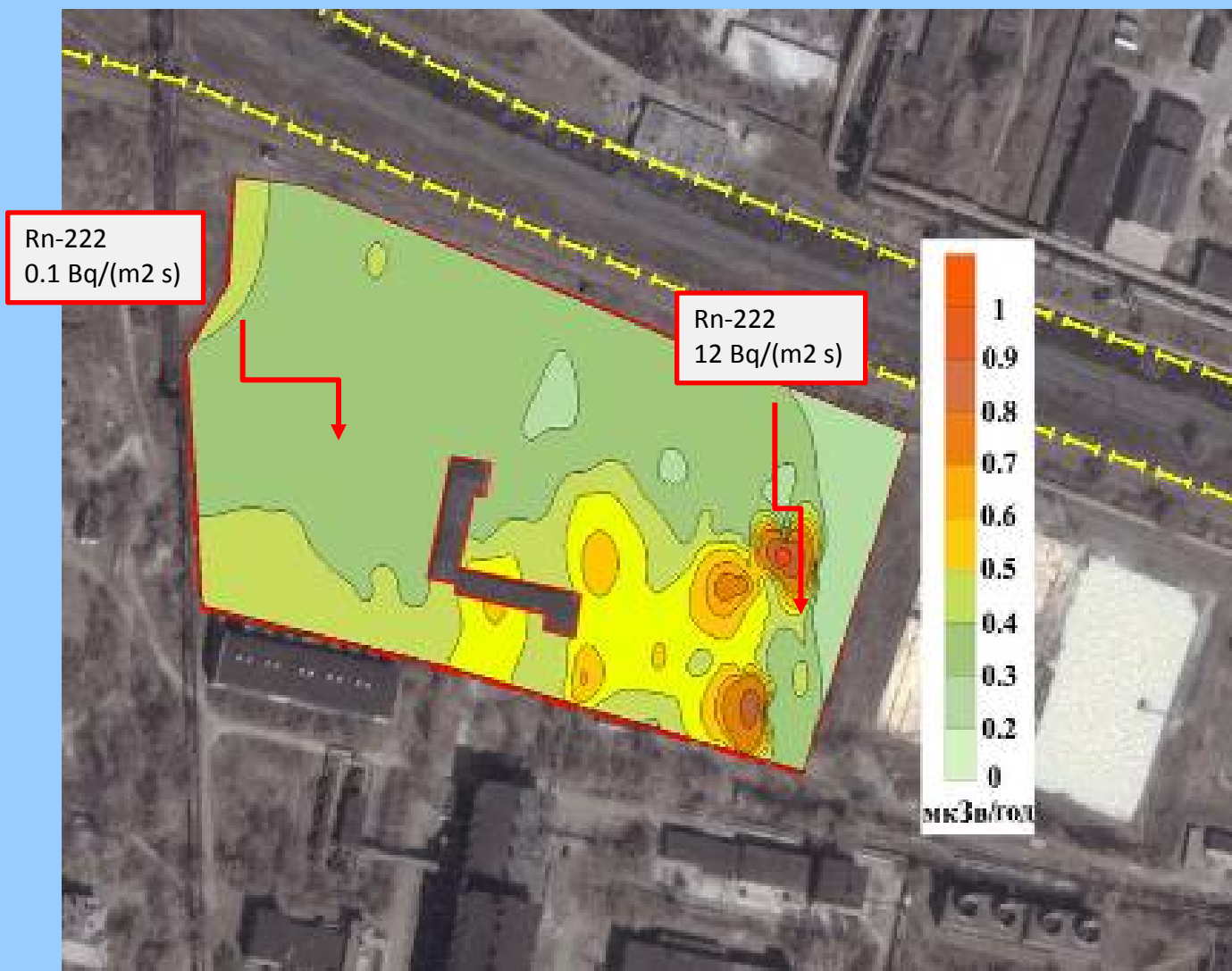
# Gamma-dose rate spatial distribution at the PChP

25-30% of Southern sector has gamma dose rate  $\geq 0,5 \mu\text{Sv/h}$   
(Data UHMI)





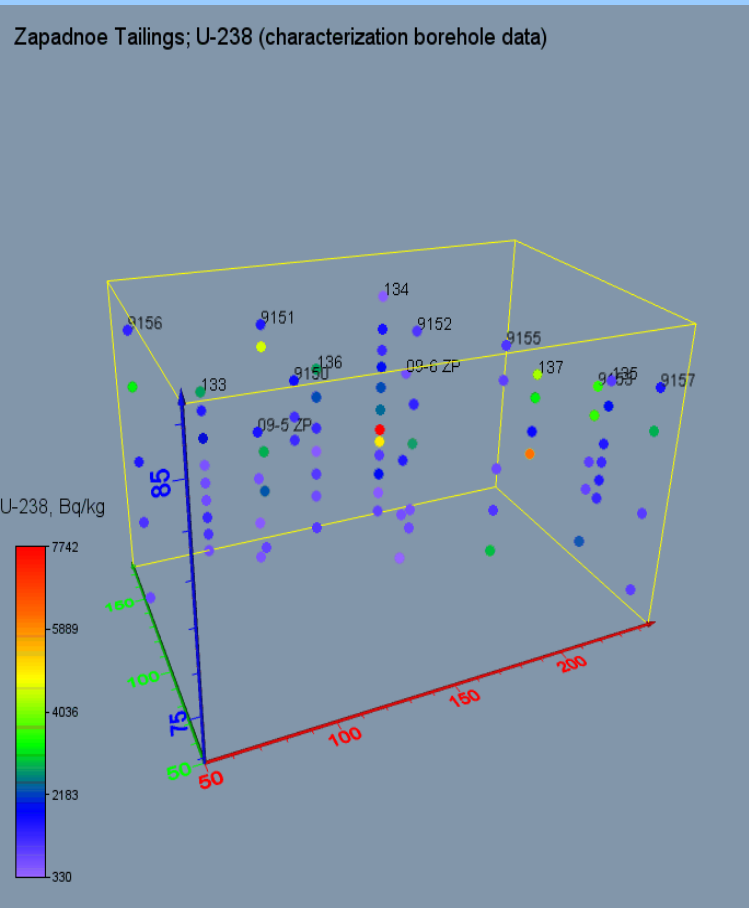
# Gamma-dose rate ( $\mu\text{Sv}/\text{hour}$ ) and Rn-222 exhalation rates at the surface of West tailing



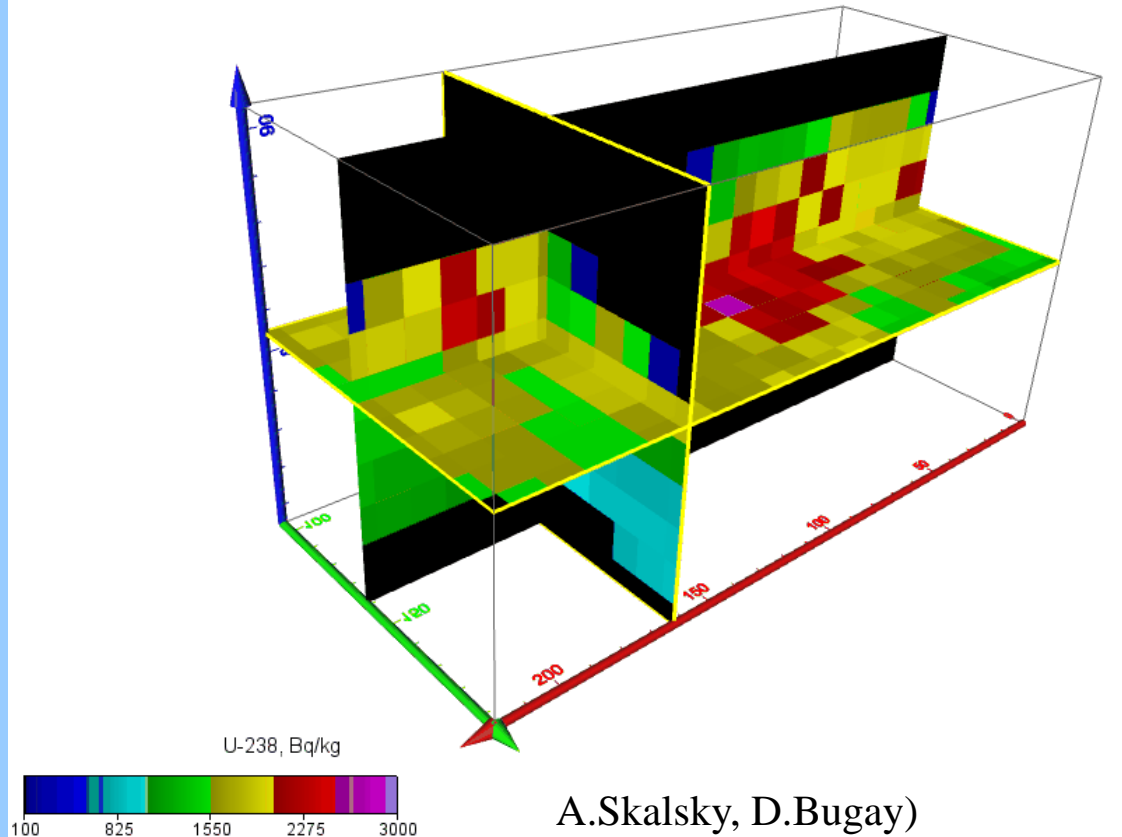




# U-residues in the tailings are significant source of the Long-Term Ground-water contamination



U-238 distribution in Zapadne Tailings (visualization of gridded kriging data)



## 3D Model of Uranium distribution in West tailings

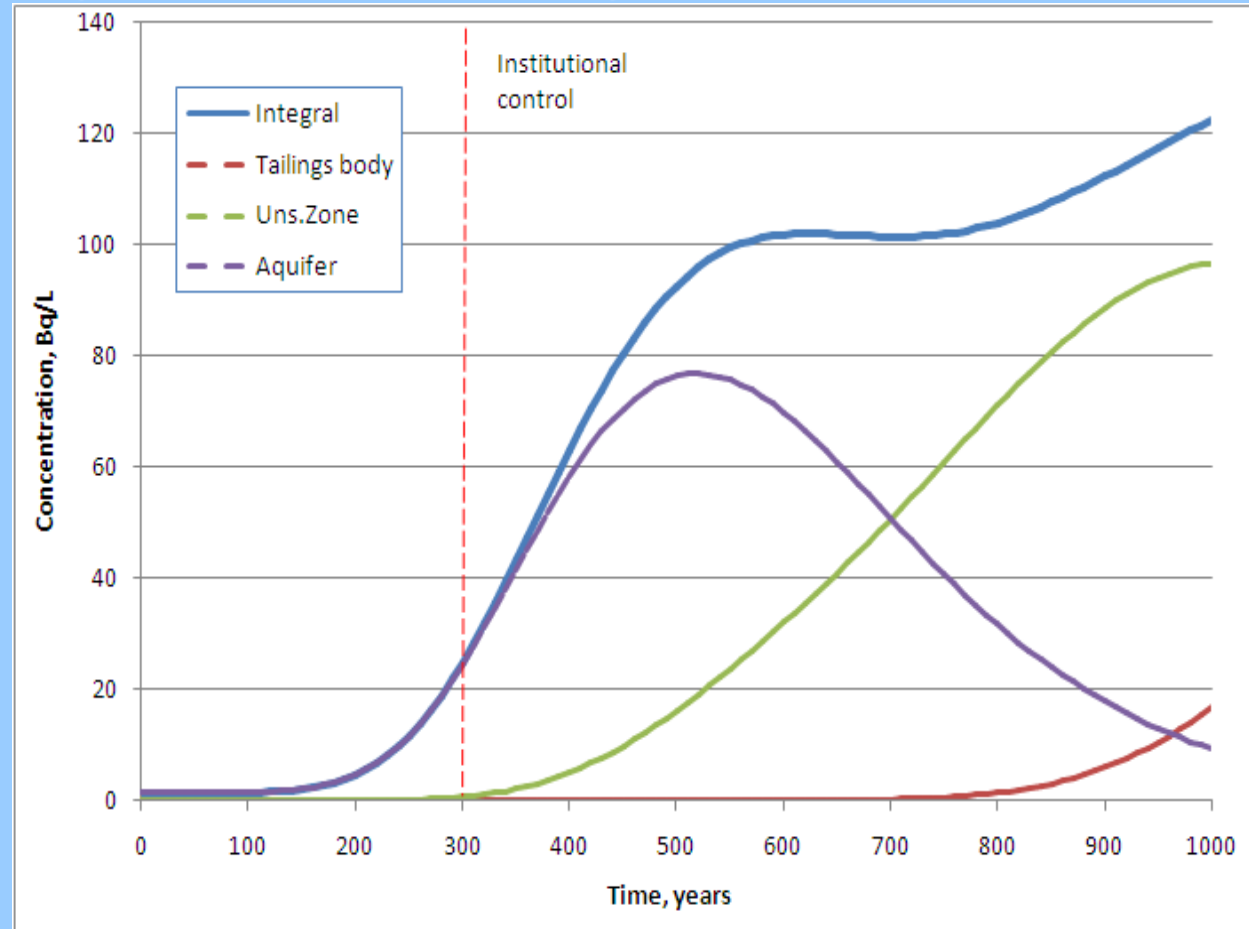


# Predicted U-concentration in well at site boundary (800 m): contributions from different sources (Reference Scenario)



## Conclusion:

Uranium concentrations in the downstream well is governed first of all by historic contamination produced during the exploitation period when large volumes of contaminated waters were disposed to the tailings facility



D.Bugai, M.Kozak, J.van Blerk, R.Avila, I.Kovalets. Radiological Safety Assessment of West Uranium Mill Tailings Facility. ENSURE-II project. 2014.



# Existing Radiological Safety criteria and Current situation



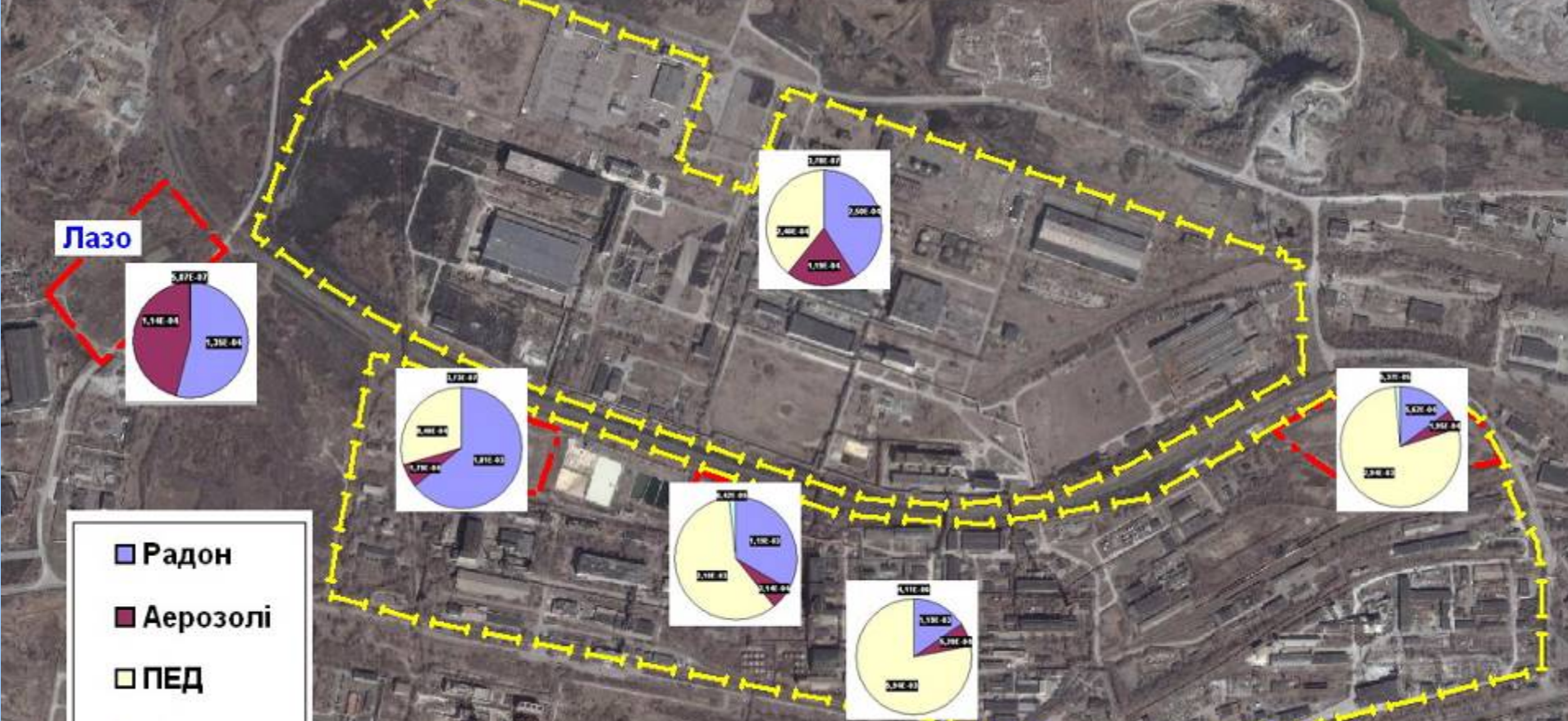
Personnel (A)	- 20 mSv/y
Personnel (B)	- 6 mSv/y
Public	1 mSv/y

Specific admissible activities for are established by Radiation Safety Rules (NRBU-97) for specific activities in air (annual limit of inhalation and permissible concentration for specific activities, and Rn-222; as well for surface contamination for premises, equipments and working dresses

Maximal annual equivalent doses for **workers** at the PChP site at present (no remediation) can reach **5-20 mSv a year**, depend of expose scenarios....



In most of cases expected doses for **Public** living at the surrounding inhabitant areas are less of **0,1 mSv a year**.



Main expose pathways are Gamma dose, Rn 222 at the tailing and in contaminated buildings



# Preliminary Remediation Options



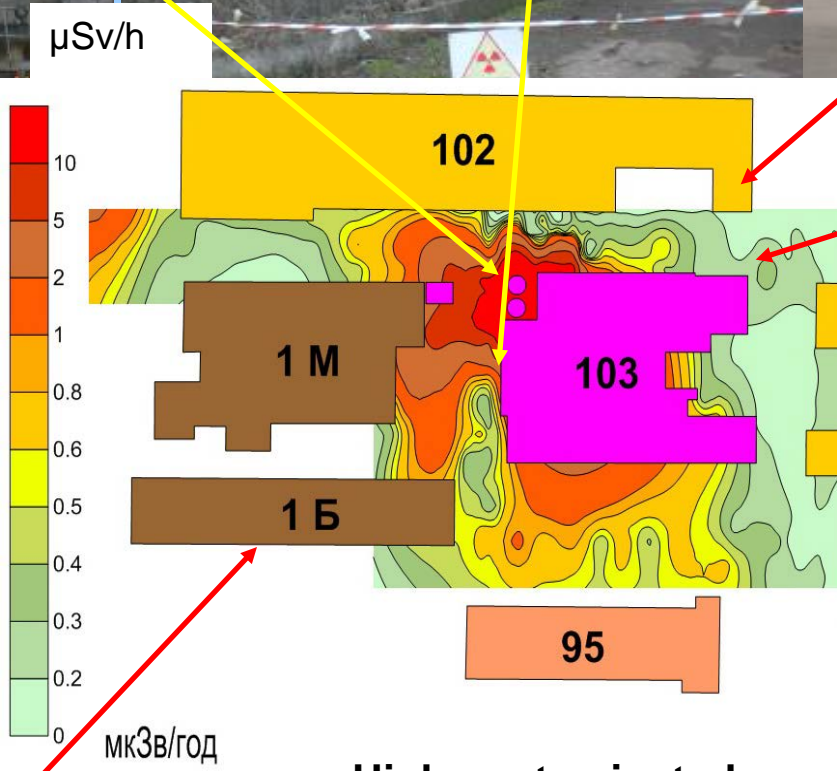
1. Clean-up of the site according remediation end state criteria
2. Stabilize tailing dumps and emission barriers in place as a temporary solution
3. Decontamination and demolishing of the most contaminated buildings and temporary storage facilities



- To create adequate and sufficient Site Management system
- Support International Partnership Programs
- Support Long-term monitoring and surveillance programs at the site
- To develop Remediation Plan and its Implementation
- Institutional control with involvement Business and Stakeholders



The highest Gamma dose rates reaches 100-300  $\mu\text{Sv/h}$  on the top of the columns near building 103



Working place area



High contaminated U-extraction facility 103  
Is **First Priority** for Decontamination and Demolishing





# Condition inside of the former U-extraction facility (103)



Reactors Columns, Tanks with U-extr. residues, Spills, Yellow cake

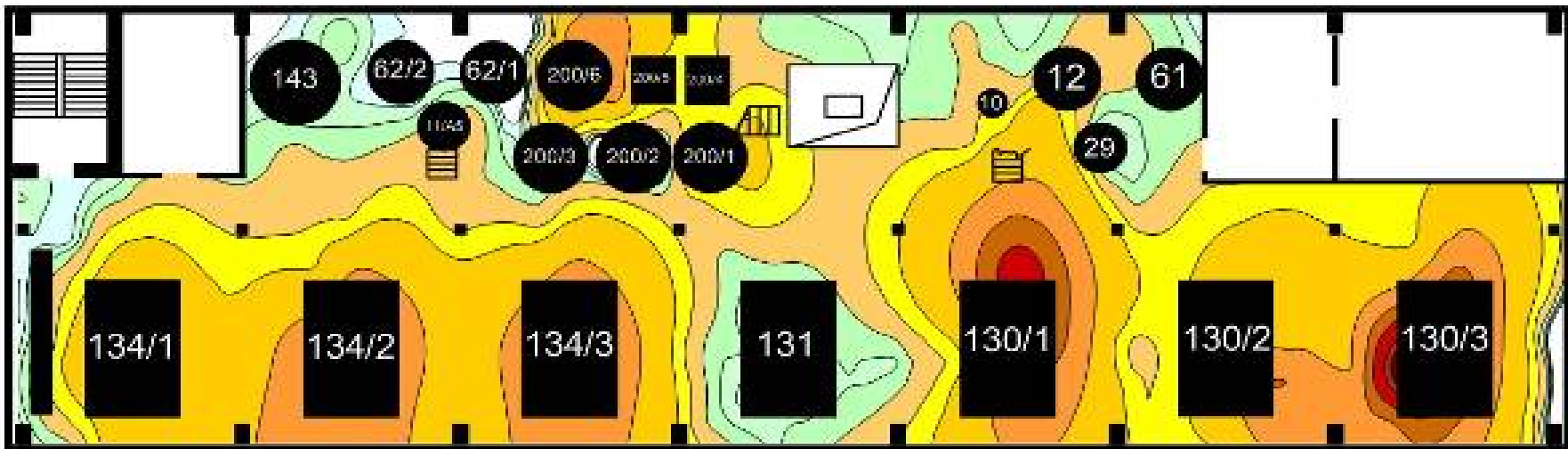


# Building-103 (third floor). Gamma dose rates 100 -1000 $\mu\text{Sv/h}$



Будівля 103. Відм. 9,300 - 12,400

$\mu\text{Sv/h}$



МКЗв/год

The strategies and safe technology for demolishing is still a question...

Level 3	Specific radionuclide in the spilled materials, $\text{Bq}\cdot\text{g}^{-1}$ dry, w					
	U-238	Ra-226	Pb-210	Po-210	Th-230	Th-228
mean	12,1-24,5	13,5-17,4	5,6-7,7	5,6-7,7	9,7-24,0	0,2-0,3
min	5,5	4,3	1,38	1,38	2,3	0,02
max	50-75	60-180	28,5	28,5	98,4	0,05



# Preliminary dose assessment for workers at the different scenarios of exposure at the “Building 103”

Scenario	Receptor	Calculated Dose (mSv/a)	Main Pathway(s)
Normal Conditions			
Normal Scenario 1	“Building 102” worker	1.6	Gamma, Radon
Normal Scenario 2	Characterization Worker	1.7	Gamma
Inside “Building 103”	D&D Preparation	1 $\mu$ Sv/h – 1mSv/h	Gamma
Abnormal Conditions			
Abnormal Scenario 1 - Strong Wind	“Building 102” Worker	0.041	Aerosols
Abnormal Scenario 2 - Tank Spill	PChP Worker (inside and outside)	0.1 to 1	Aerosols
Abnormal Scenario 3 - Intrusion	PChP Worker	1 - 2	Gamma





# Current situation.... Challenges



- Due to extra ordinary economical situation all Programs and Projects in the frame of State National Remediation Program have been stopped.
- The Operator of the UPLS (State Enterprise “Barrier”) is currently ceased its functioning (Number of Staff is reduced on 60%). No funds, No salary
- Monitoring and Surveillance Programs are stopped.
- The only safeguard and selective radiation control survey are in place.
- Worst condition is identified in the former U-extraction facility №103, with high risk of dispersion of high contaminated materials on the industrial site in the case of the building destruction.
- IAEA UKR 0932 project is in place and focus on consultancy and training.
- EC funded project leading WISUTEK ( Germany) and FACILIA AB (Sweden) is currently under implementation, aiming Overall Remediation Strategy Development
- Involvement of UA counterparts and experts in the EC projects are very limited.
- Grate interest to extend cooperation between UA partners and potential Funding and waste management companies in USA.



# Result of successful rehabilitation



WM-2015, Phoenix, USA, 16 – 19 March 2015



**Thank you for your attention now and cooperation  
and assistance in future!**



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                          e-mail: [riazantsev@hq.snrc.gov.ua](mailto:riazantsev@hq.snrc.gov.ua)