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Challenges of Radiological Environmental Impact Assessment for Ukrainian Uranium Legacy to Safely Remediate the Site of Pridniprovskiy Chemical Plant

Zakhar Ivanov, Hennadii Chumak

Department for Emergency Preparedness and Radiation Monitoring

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1. Historical background of the former Uranium Mill Pridniprovskiy Chemical Plant

Intensive development of Uranium Mill in Ukraine began in the early 50s of the twentieth century.

Since 1949 PChP milled more than 65% of uranium ores from uranium deposits in Central Asia, East Germany, and Ukraine.

Due to the collapse of the Soviet Union PChP ceased its activities in 1991.

Location of PChP

2. Actual status of the PChP industrial facility site

Current status

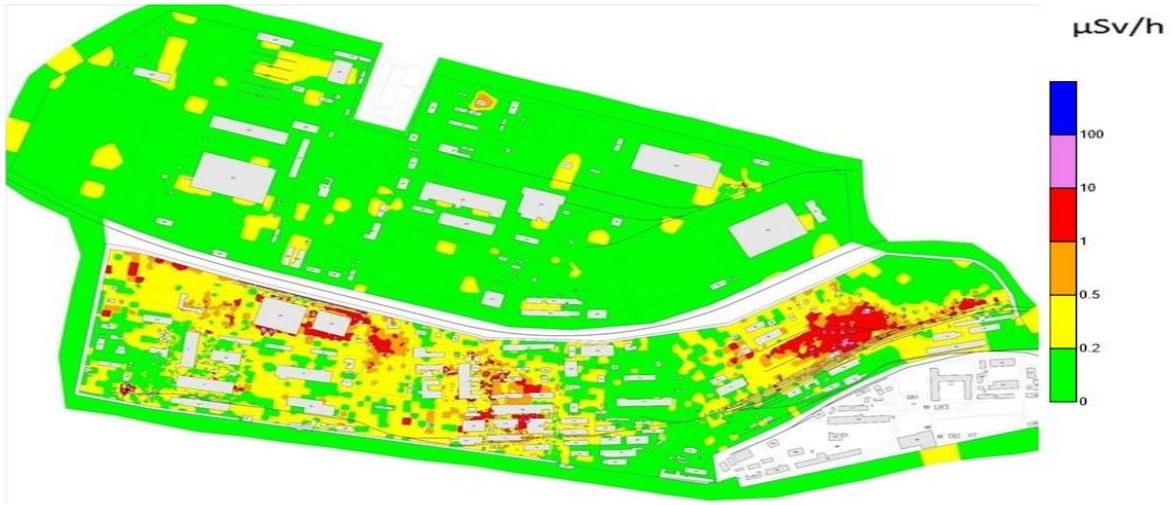
Kamyansk industrial facility site of the PChP:

Northern part:

DR <0.3 μSv/h.

Southern part (contaminated area of the industrial facility site)**:**

DR <10.0 μSv/h.



Gamma radiation DR at the PChP site

Technological containers and fragments of pipelines was used at PChP

2 . Actual status of the PChP industrial facility site

Status of the most contaminated buildings of the southern part of the PChP industrial facility site

Building	Gamma DR, μSv/hour		Rn-222 concentration, Bq/м^3		Building purpose	Total area, m^2
	Min	Max	Min	Max		
103	0,23	3360	56	1100	Uranium ore grinding and milling	1759
104	0,20	285	150	700	Uranium sorption from radio-chemical solutions	4620

Building 103

Building 104

Most contaminated buildings

2. Actual status of the PChP industrial facility site

Tailing ponds of the Kamyansky industrial facility site of PChP

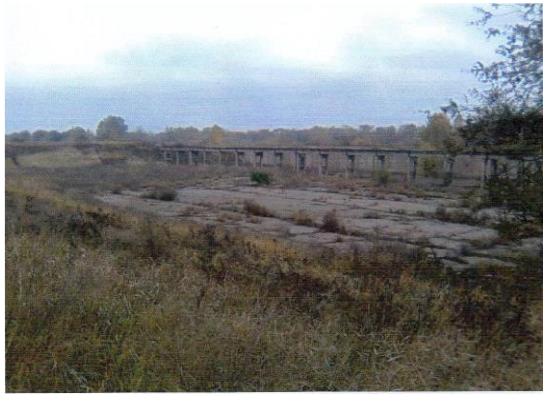
Name	DR at the surface, μSv/h	Waste volume, million tons	Area, thousand m^2	Activity, Bq
Dniprovske	<1,0	12,0	730	$1,4 \cdot 10^{15}$
Pivdenno-Skhidne	<0,3	0,33	36	$6,7 \cdot 10^{13}$
Centralny Yar	<15,0	0,22	24	$1,04 \cdot 10^{14}$
Zakhidne	<30,0	0,77	40	$1,8 \cdot 10^{14}$

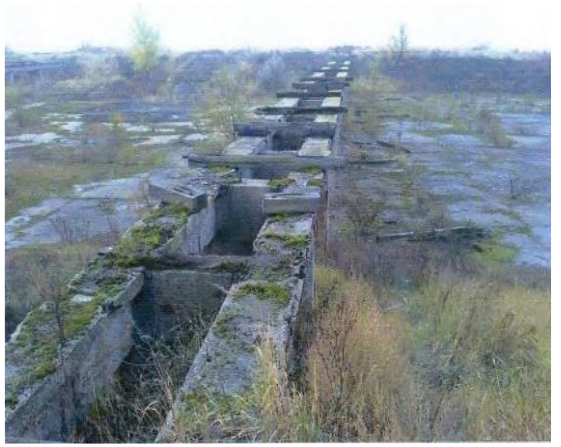
Tailing ponds of the Kamyansky industrial facility site of PChP

2. Actual status of the PChP industrial facility site

Tailing ponds and storages of the «Sukhachivske» industrial facility site of PChP

Name	DR on the surface, μSv/h	Waste volume, million tons	Area S, thousand m^2	Activity, Bq
«Sukhachivske» 1st, 2nd section	<5,4	28,6	1606,0	$9,8 \cdot 10^{14}$
Lanthanum fraction	<0,3	0,007	6,0	$8,6 \cdot 10^{11}$
«Basa C» and «DP 6»	<24,0	0,34	268,0	$7,7 \cdot 10^{14}$





Tailing ponds and storages of the Sukhachivsky industrial facility site of PChP

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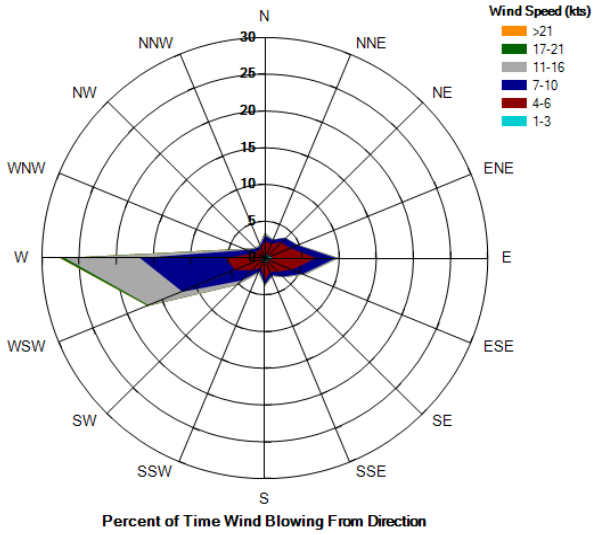
3. Assessment of doses to the public living near the tailings ponds of «Sukhachivske-1» and the storages of «Basa C»

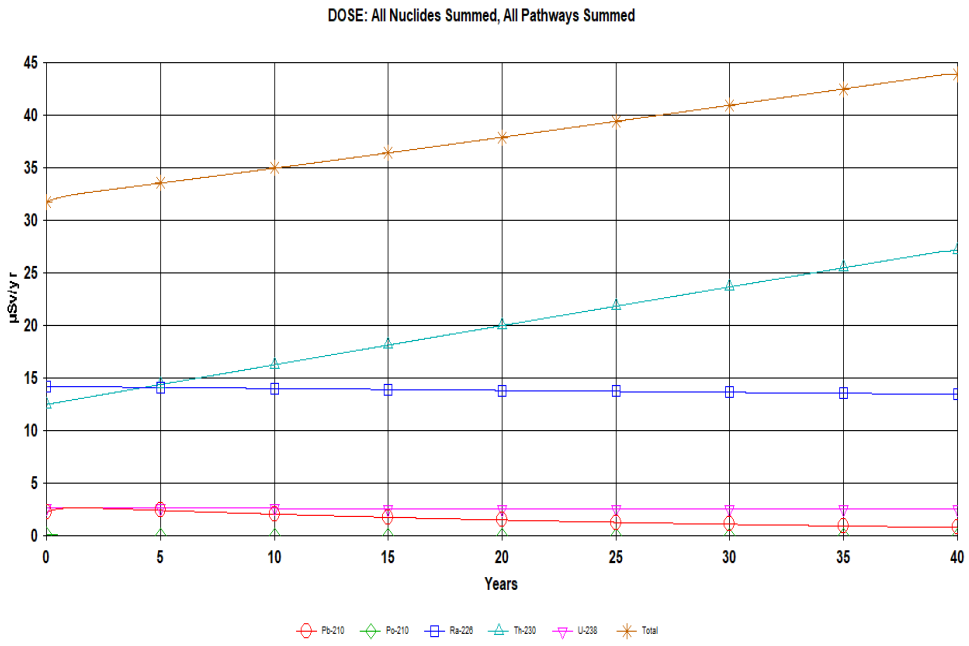
Name	Activity, Bq/kg				
	^{238}U	^{226}Ra	^{230}Th	^{210}Po	^{210}Pb
«Sukhachivske» 1st section	2500	6200	5980	11120	11140
«Basa C»	57022	3590	221652	129952	493256



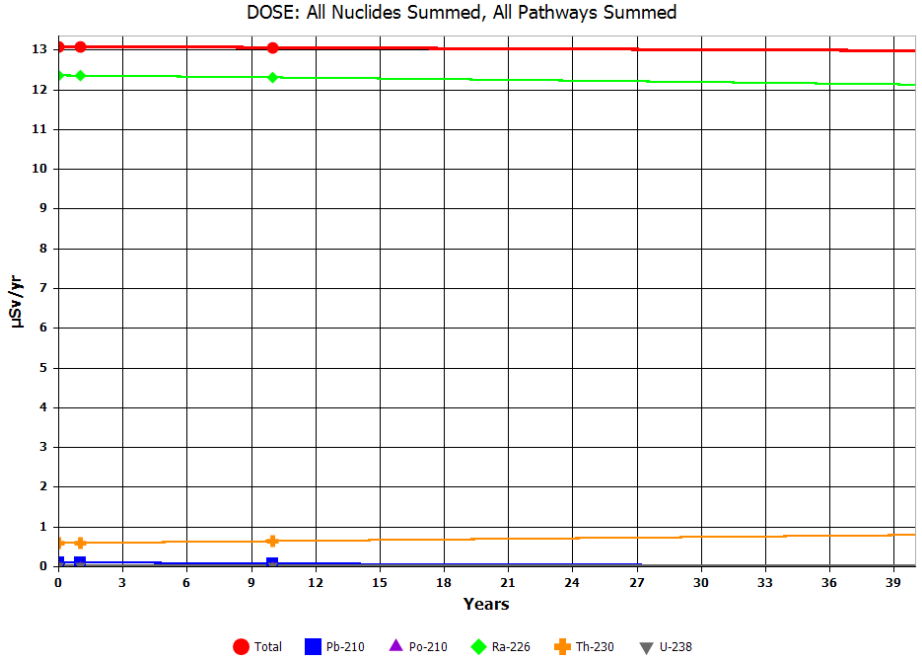
Taromske village location

3. Assessment of doses to the public living near the tailings ponds of «Sukhachivske-1» and the storages of «Basa C»

Doses to the public living in Taromske village calculated with RESRAD-OFFSITE



Dose to the public from the «Base C» storage facility is 32.1 μSv/year



Dose to the public from the «Sukhachivske-1» tailing ponds is 13.0 μSv/year

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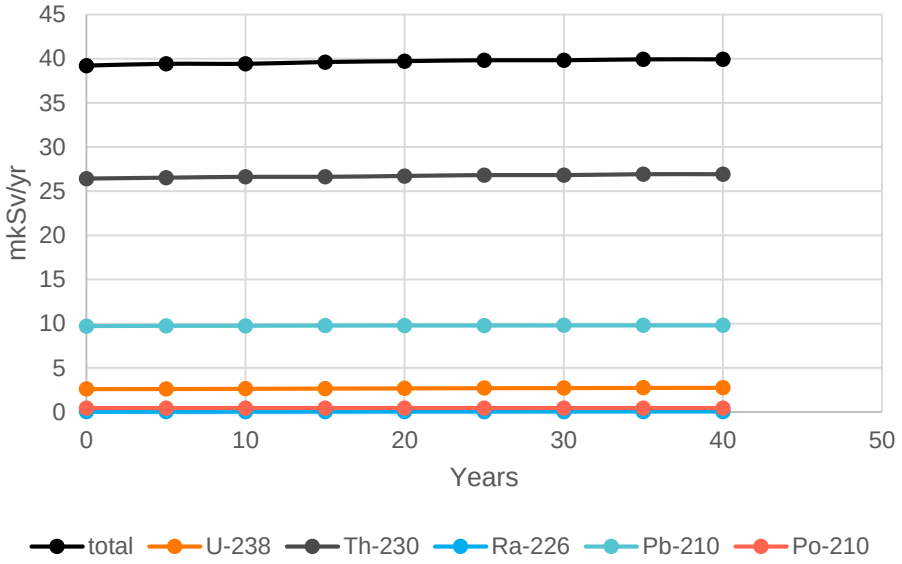
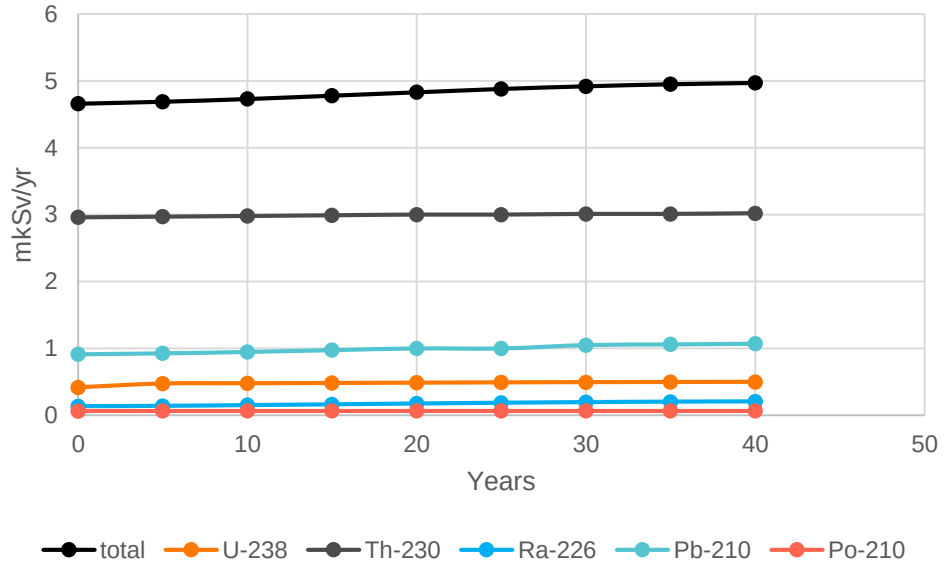
3. Assessment of doses to the public living near the tailings ponds of «Sukhachivske-1» and the storages of «Basa C»

Doses to the public living in Taromske village calculated with MILDOS



Dose to the public from the «Base C» storage facility is 39.9 μSv/year



Dose to the public from the «Sukhachivske-1» tailing ponds is 4.66 μSv/year

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4. Safely Remediation Strategy of the PChP industrial facility site

EC project «Emergency Measures for the Pridniprovskiy Chemical Plant» is being implemented at the former PChP industrial facility since 2017.

The EC project U4.02/16 provides for:

- temporary isolation of contaminated materials and objects
- building controlled areas with the limited access to the most contaminated areas for the staff
- identification and collection of radioactive materials located at the PChP industrial facility sites

5. Conclusions

The assessment results of the annual doses to the public living in Taromske village near the tailing ponds and the storage facilities:

- were obtained using both RESRAD OFFSITE and MILDOS
- demonstrated the feasibility of the codes usage for estimation the dose from uranium objects located in Ukraine
- are associated with the similar results obtained by engineering companies that were involved in the development of remediation documentation

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