Kiev, June 18, 2021

RADIATION SITUATION OF EUROPE, UKRAINE, KIEV, UNIVERSITY CAMPUS TERRITORY

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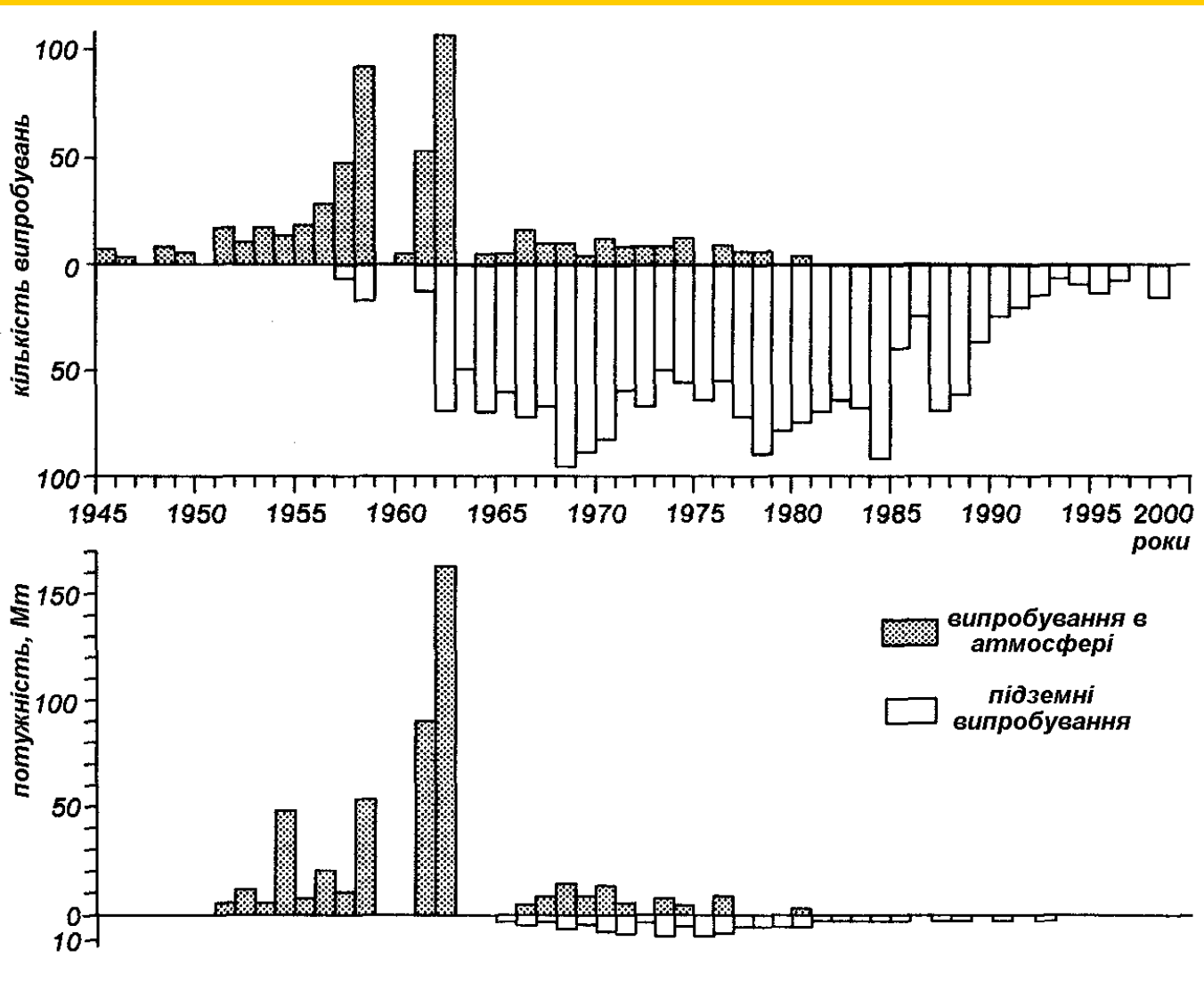
Six main sources are caused radiation situation of environment:

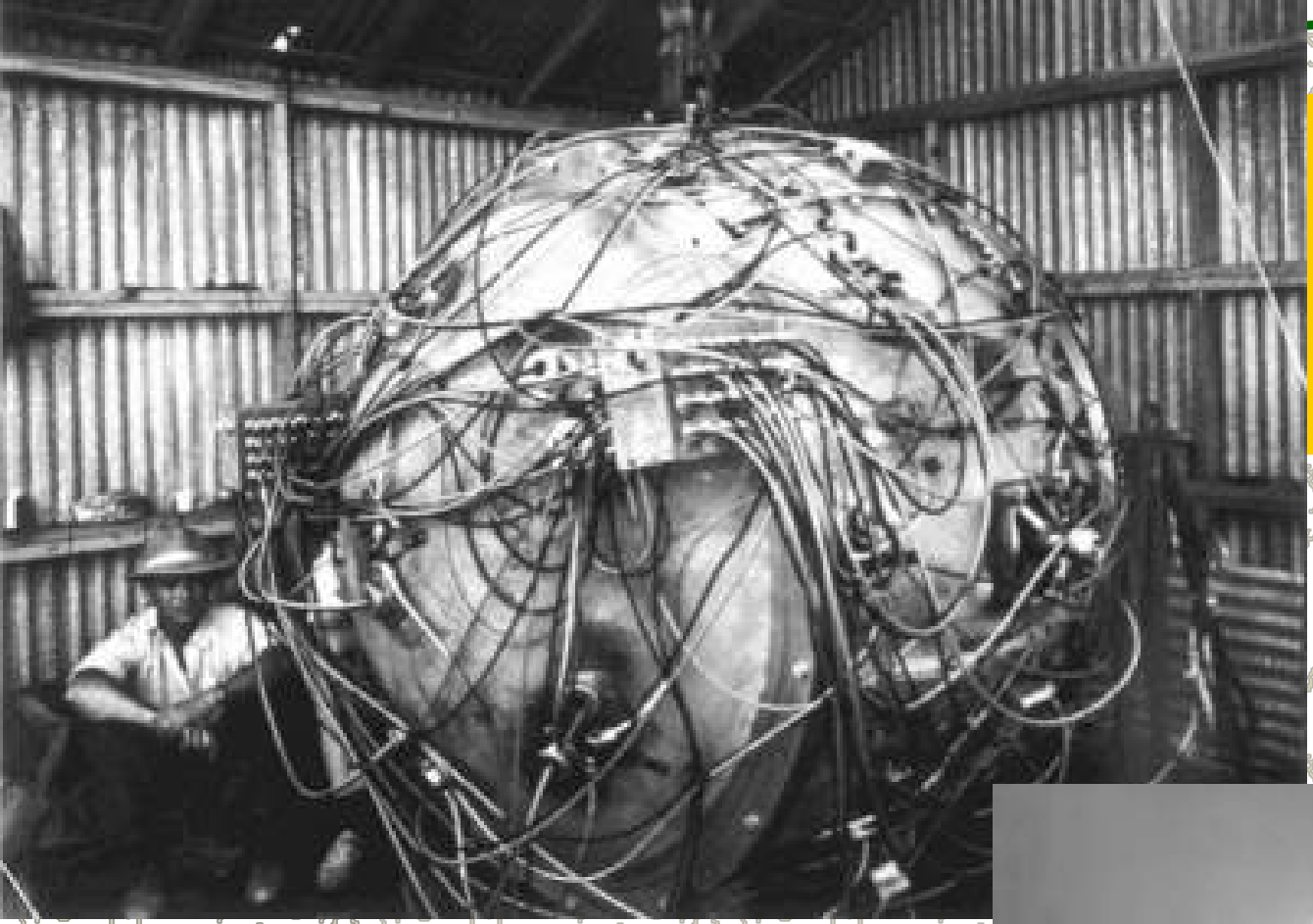
1. Natural radioactive isotopes accompanying the extraction all minerals.
2. Thermoelectric power stations (natural radioactive isotopes too).
3. Enterprises of nuclear fuel cycle (state faults of natural and man-made radioactive isotopes).
4. Every-day accidents of life with radioactive sources (as a rule man-made radioactive isotopes).
5. Global falls of man-made radioactive isotopes (nuclear weapon tests).
6. Accidents at enterprises of nuclear fuel cycle (man-made radioactive isotopes).

The dynamics of nuclear weapon test realization in atmosphere and under ground (upper) and their sum power (below)

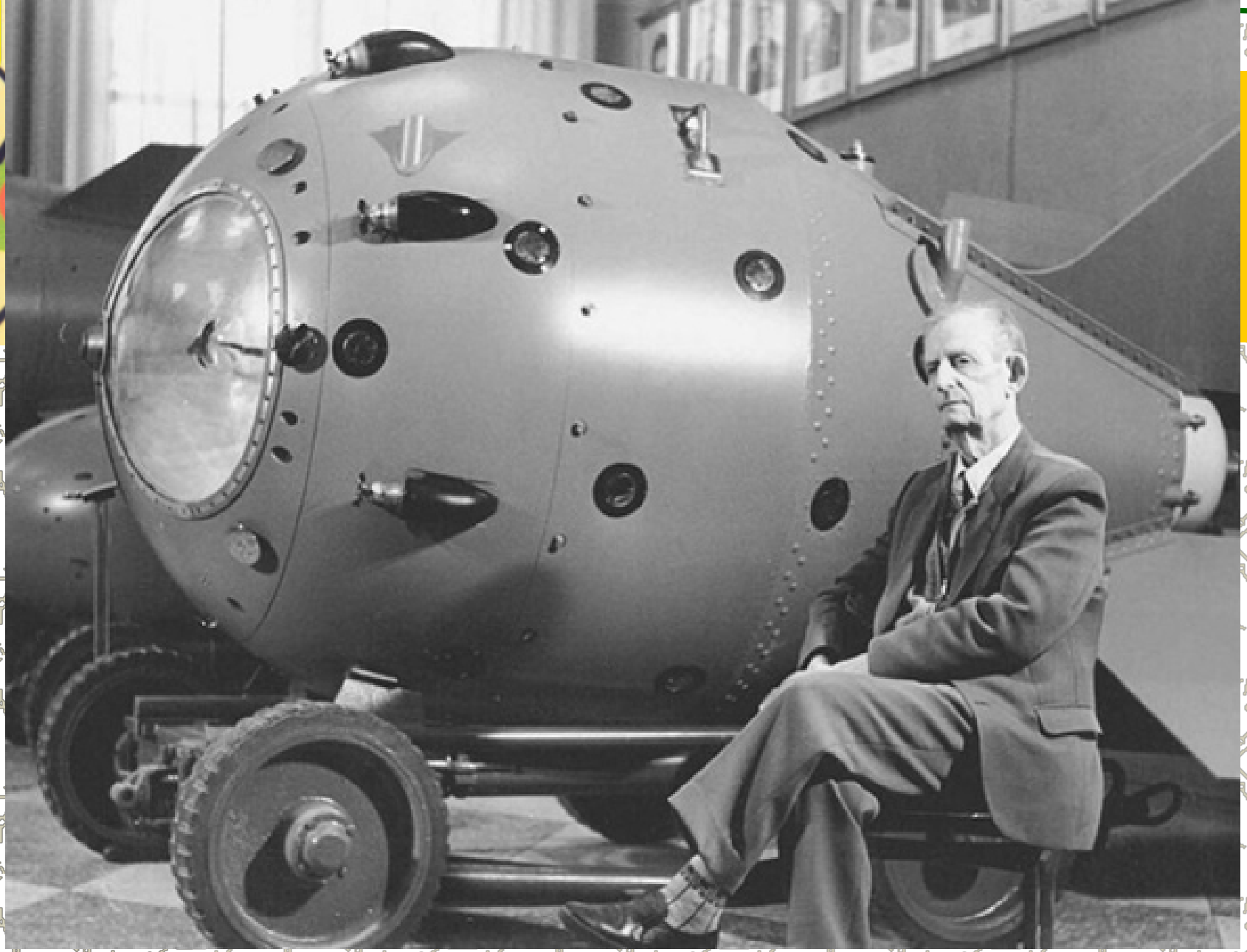
About 2500 atomic bombs were exasperated in atmosphere, water, space during 1945-1999.

In 1963 the Agreement about prohibition of atomic tests in atmosphere, water and space was sign in Moscow.





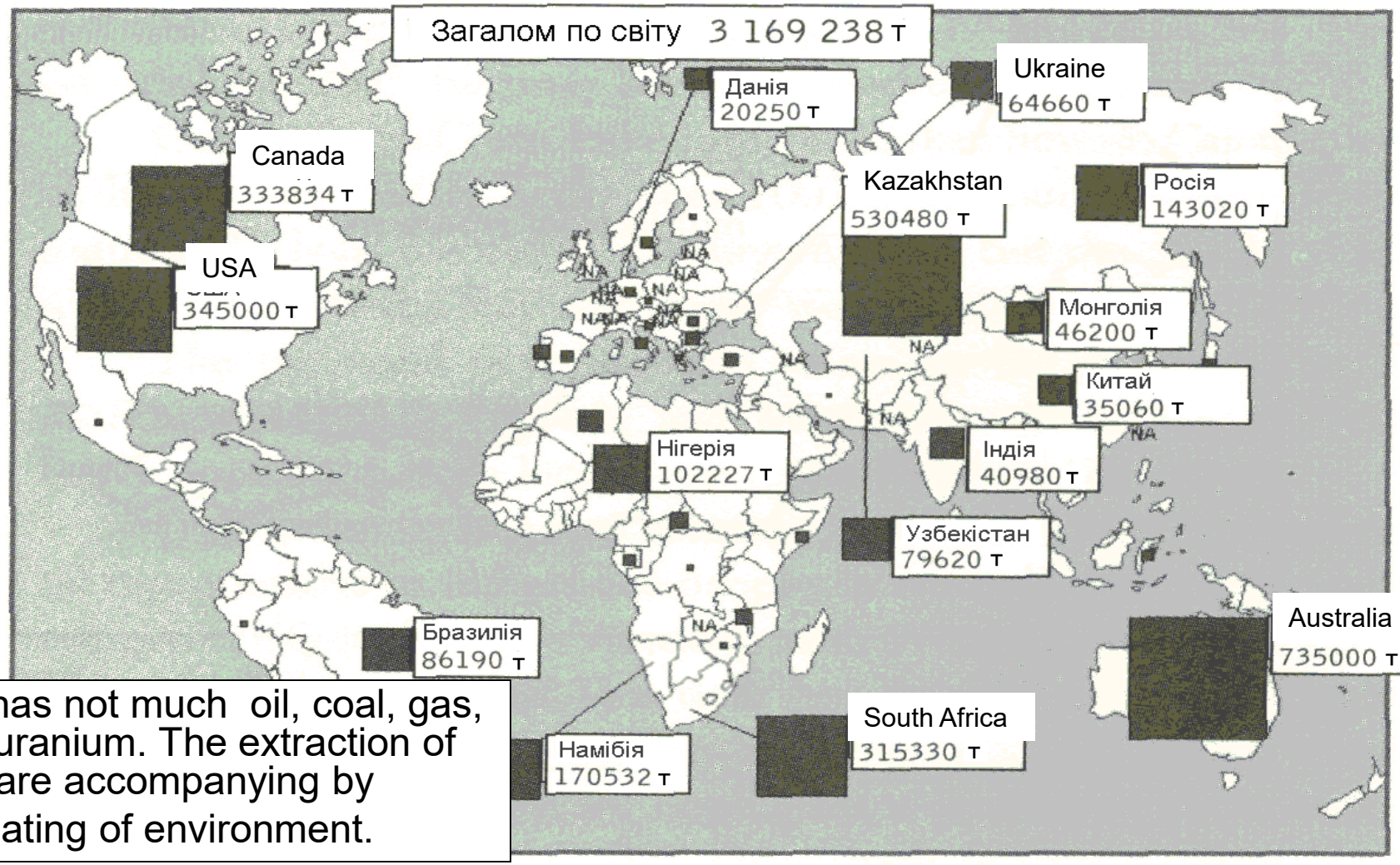
The first atomic bomb and its explosion in desert of New Mexico state in 1945.



Modern atomic bomb

Atomic explosions

The reserves of uranium in world (Ukraine occupies the first place in Europe and eleventh in world)



Ukraine has not much oil, coal, gas, but has uranium. The extraction of uranium are accompanying by contaminating of environment.

About 445 atomic reactors are working in 193 NPP of 33 countres, which throw out to environment some quantity of man-maid radionuclides.

Quantity of nuclear reactors in separate countries (state on 1.01.2020)

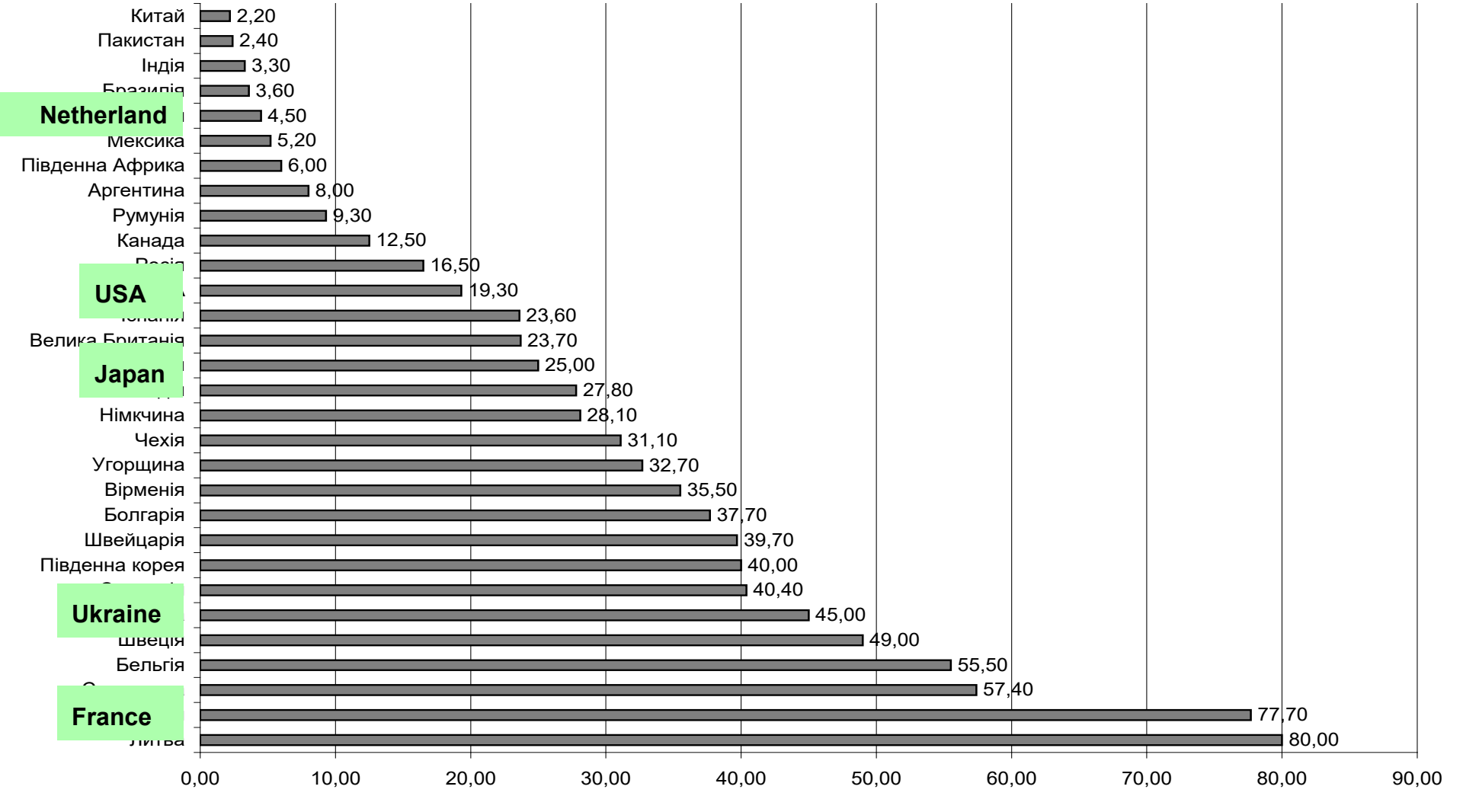
Country	Quantity of reactors		Country	Quantity of reactors	
	working	building		working	building
Argentina	2	1	Korea south	18	2
Armenia	1	-	Lithuania	2	-
Belgium	7	-	Mexico	2	-
Brasilia	2	-	**Netherlands**	1	-
Bulgaria	6	-	Pakistan	2	-
Canada	14	-	Romania	1	1
China	7	22	Russia	30	5
Czech	6	-	Slovakia	6	2
Finland	4	-	Slovenia	1	-
France	59	-	South Africa	2	-
Germany	19		Spain	9	-
Great Britain	31	-	Sweden	11	-
Hungary	4	-	Switzerland	5	-
India	14	7	Taiwan	6	2
Iran	-	2	**Ukraine**	15	2
Japan	54	3	USA	104	-
Korea north	-	1	Total	445	30

Nuclear Power Plant in Ukraine

NPP	Beginning of building	Beginning of exploitation	Number of blocks	Summary power, MWatt
Chornobyl (closed in 2000)	1970	1977	4	3800
Rivne	1973	1980	4	2835
South-Ukraine	1975	1982	3	3000
Zaporizzhja	1981	1984	6	6000
Khmelnitsk	1981	1987	2	2000
Together 4 NPP			**15**	**13835**

The biggest in Ukraine Zaporizzhja NPP (6 energetic blocks)

The part of NPP in production of electric energy in country of world, %



But the main source of radionuclides are the radiation accidents, radiation crashes, emergencies.

Large-scale radiation accidents

Year	Country	Locality	Object	Balls by scale INES
1952	Canada	State Ontario, Chalk-River	NPP	-
1957	USSR	Chelyabinsk region, Kishtym	Repository of radioactive wastes	6
1957	UK	Windscale	NPP	5
1967	USSR	Chelyabinsk region, plant “Mayak”	River Techa, lake Karachay	-
1975	USSR	Leningrad region	NPP	-
1978	USSR	Sverdlovsk region, Beloayrsk	NPP	-
1979	USA	St. Pennsylvania, Three-Mile-Island	NPP	5
1980	France	Sen-Loran-des-Oh	NPP	4
1982	USSR	Kiev region, Chernobyl	NPP	-
1982	USSR	Armenia	NPP	-
1985	USSR	Saratov region, Balakov	NPP	-
1985	USSR	Bay Chaszhma, Pacific	Atomic submarine	-
1986	USSR	Kyiv region, Chornobyl	NPP	7
1993	Russia	Tomsk region	Radiochemistry plant	-
1999	Japan	Tokaimura	NPP	4
2006	Belgium	Florus	NPP	4
2011	Japan	Fukushima	NPP	7
2013	Japan	Fukushima	NPP	3

Kishtym accident

The first of them is so-called Kishtym emergency had place in the South Ural, at the “Mayak” Enterprise in the Chelyabinsk Region, that occurred in 1957, that is exactly 64 years ago. Mayak is mind in English lighthouse. It is big complex of radiochemical plants where produced ^{239}Pu for nuclear weapon. The accident was estimated by scale INES as 6 balls.

Chornobyl and Fukushima accidents

The second accident are occurred 35 years ago at the territory of Ukraine in Chornobyl region at the nuclear power plant. It was estimated as 7 balls.

And third accident had place in Japan 10 years ago. It was estimated as 7 balls too.

We have not photographic illustration of Kishtym accident. This fact was secreted during thirty years. But we have much photographs of Chernobyl and Fukushima accidents.

NPP “Fukushima-1”17 March 2011 in morning (left by diagonal 4, 3, 2 and 1 blocks) and Chernobyl NPP 28 April 1986

^{90}Sr and ^{137}Cs

I want to underline that main long-live products of ^{235}U decay are ^{90}Sr and ^{137}Cs.

Kishtim – ^{90}Sr

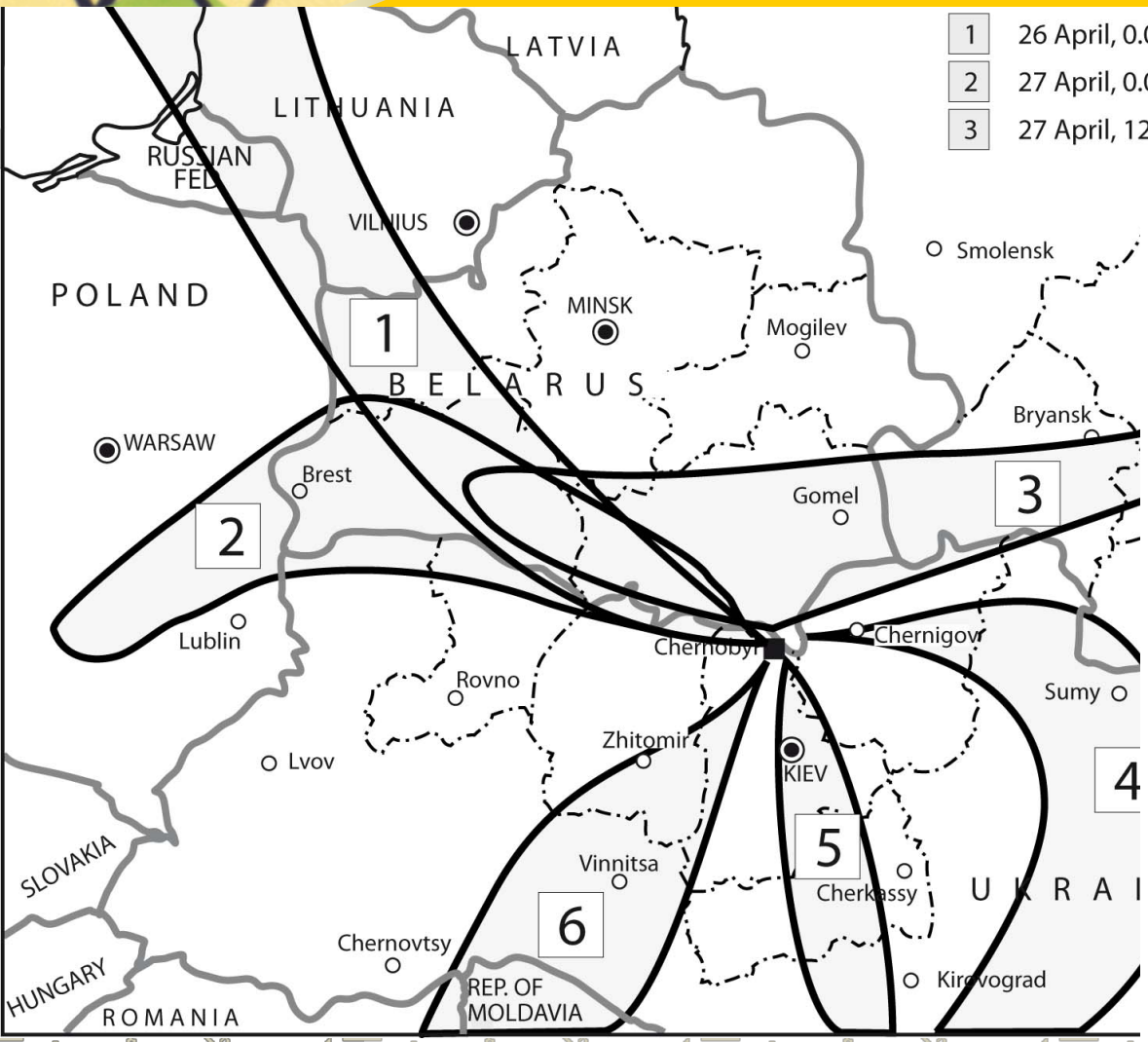
Chornobyl – ^{90}Sr and ^{137}Cs (1:10)

Fukushima – ^{137}Cs

Chornobyl accident

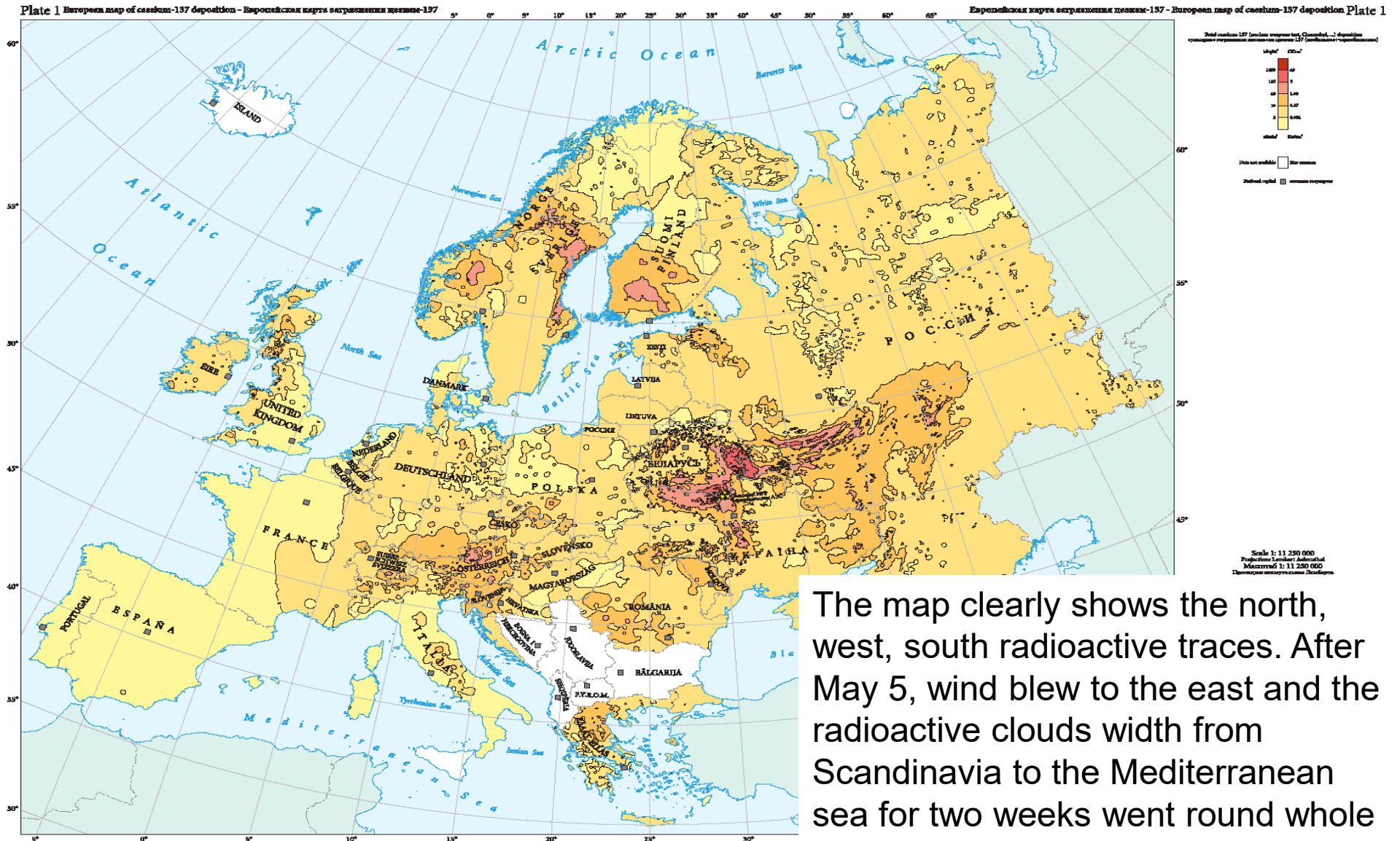
The region of accident in Chornobyl NPP in 1986 is extremely large. Only limited by isoline of density of contamination of **37 kBq·m^{-2}** by ^{137}Cs (conventional border between contaminated and non-contaminated territories) it occupied in former Soviet Union more then 150 thousand km^2, where 6.5 million hectares of agricultural lands, 7.5 million hectares of forests, big system of rivers and lakes, about 9.5 thousand settlements where was lived above 6 million human were placed.

Forming of contamination depending on winds direction



On the day of the accident on April 26, 1986 wind blew from the south to the north-west. And radioactive clouds partially fallen on Belarus and went on, reached Scandinavia in one day. Part of clouds went west, polluting northern regions of Ukraine and Western Europe. On April 28 western wind became stronger and the clouds reached Austria, Switzerland, Germany and other countries. On the night of April 30 to May 1, the wind blew from north to south. And only during that time the territory of Ukraine was heavy polluted.

Contamination of Europe territory by ^{137}Cs



The map clearly shows the north, west, south radioactive traces. After May 5, wind blew to the east and the radioactive clouds width from Scandinavia to the Mediterranean sea for two weeks went round whole northern hemisphere.

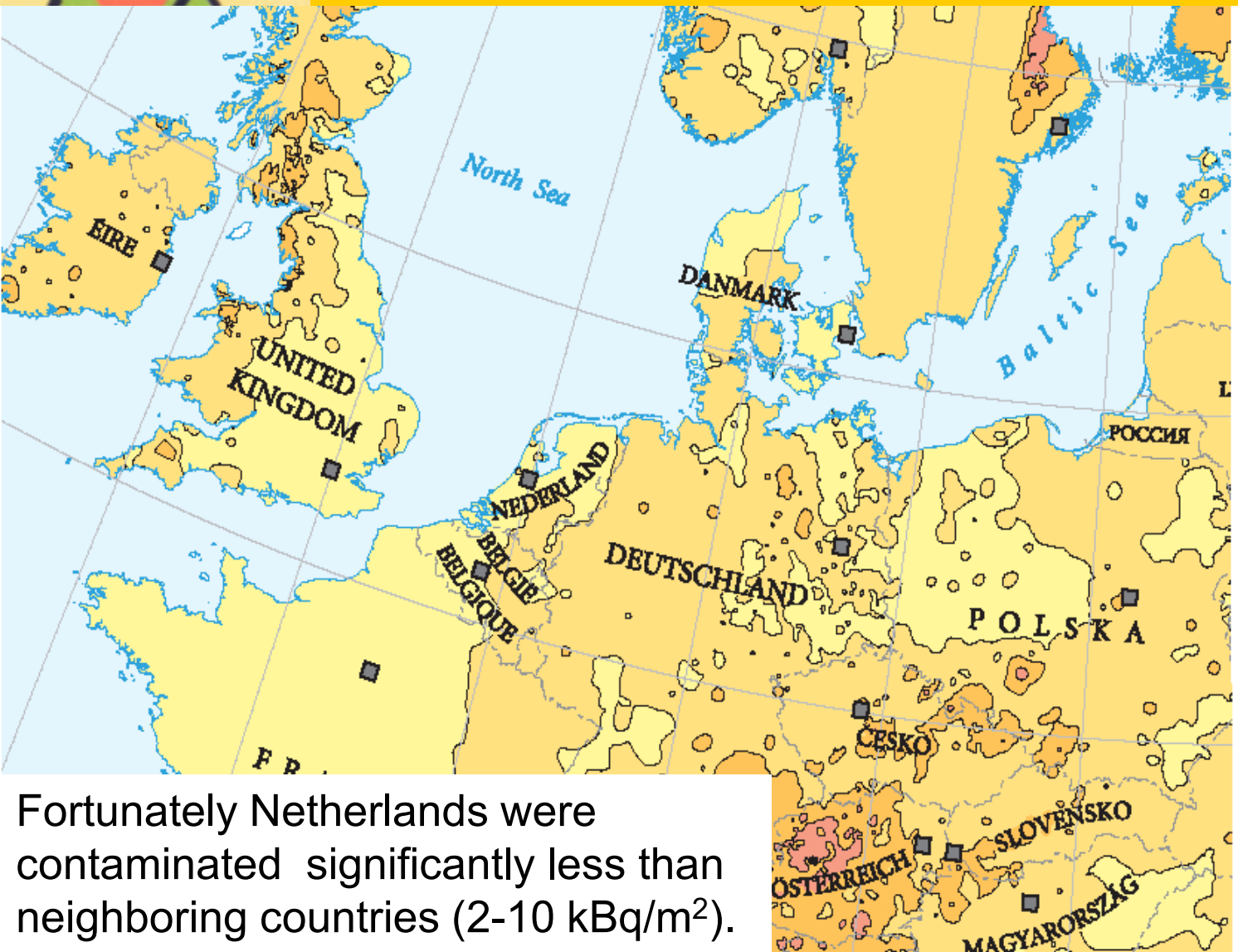
The area of territories of European countries (thousands km^2) contaminated by ^{137}Cs *(>37 kBq/m^2)*

(10.05.1986)

Not only Soviet Union was contaminated by the Chornobyl radionuclides – up to 20 countries has territories which were contaminated by ^{137}Cs more than 37 kBq/m^2 – besides these – Turku (Asia).
(red - strongly, orange - middling, white – weakly)

№	Country	Area
1	Russia	59.8
2	Belorussia	46.1
3	Ukraine	38.2
4	Sweden	23.4
5	Finland	19.0
6	Austria	11.1
7	Norway	7.2
8	Italy	1.4
9	Greece	1.2
10	Romania	1.2
11	Switzerland	0.7
12	Slovenia	0.6
13	Poland	0.5
14	Germany	0.3
15	Great Britain	0.2
16	Czech	0.2
17	Georgia	0.2
18	Serbia	0.15
19	Croatia	0.15

Contamination of Netherlands and surrounded countries by ^{137}Cs



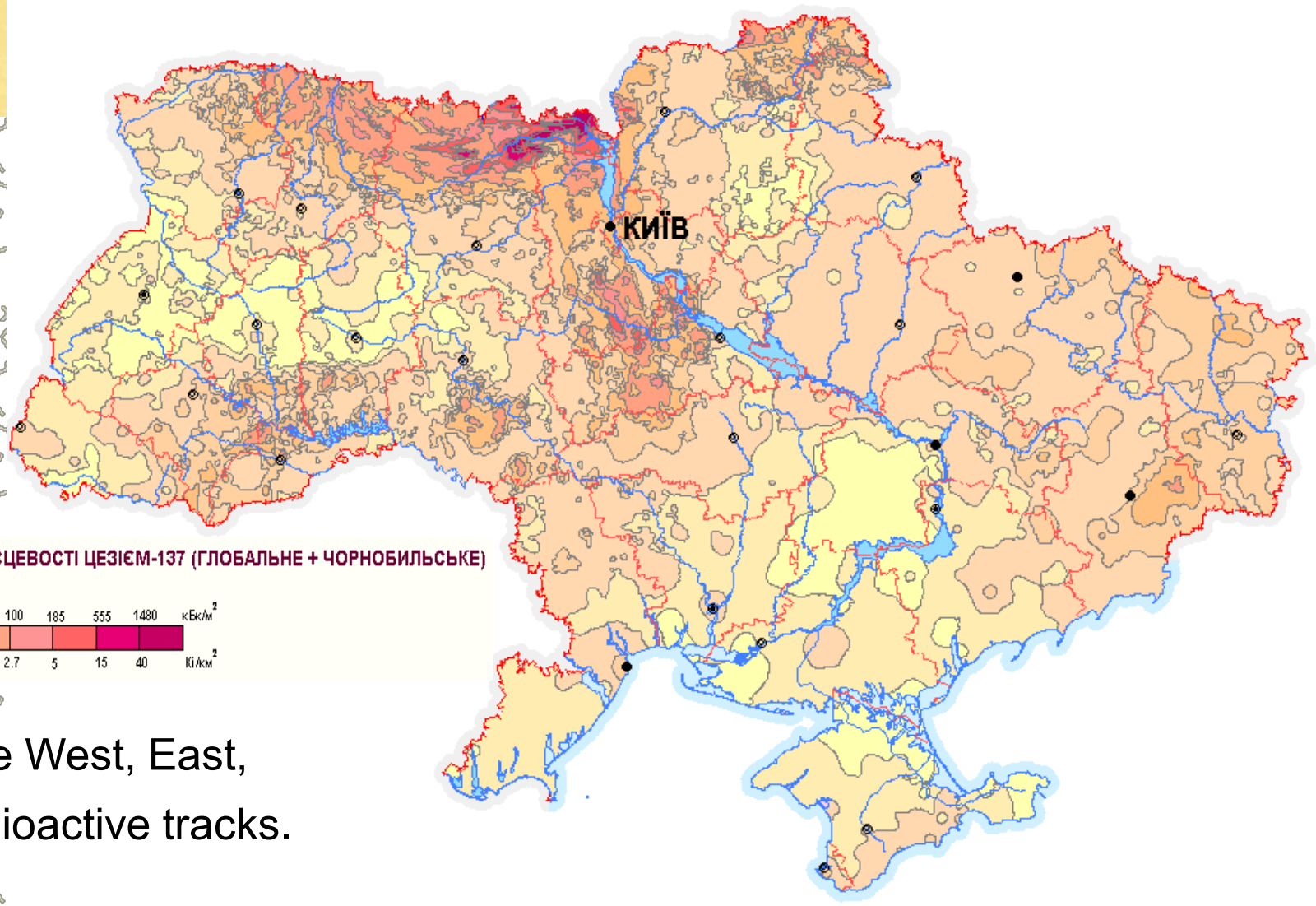
Fortunately Netherlands were contaminated significantly less than neighboring countries (2-10 kBq/m^2).

Main long-lived radionuclides now

Radio-nuclide	Irradiation	$T_{0.5}$ half-life, years	T_b half excretion
^{137}Cs	$\gamma + \beta$	30	25–70 days
^{90}Sr	β	29	35–60 years
^{239}Pu	α	24 100	~200 years
^{241}Am	α	433	~100 years

During the accident, the environment was emitted dozens of radioactive isotopes decay products of uranium. Most of them were short and medium periods of half-life from seconds to several years. At present for 35 years, its practically disintegrated. Still long-lived, periods half-life which measured by tens and thousands of years. These ^{90}Sr, ^{137}Cs and some isotopes of transuranic elements, which in turn should provide ^{239}Pu and ^{241}Am.

Contamination of Ukrainian territory by ^{137}Cs

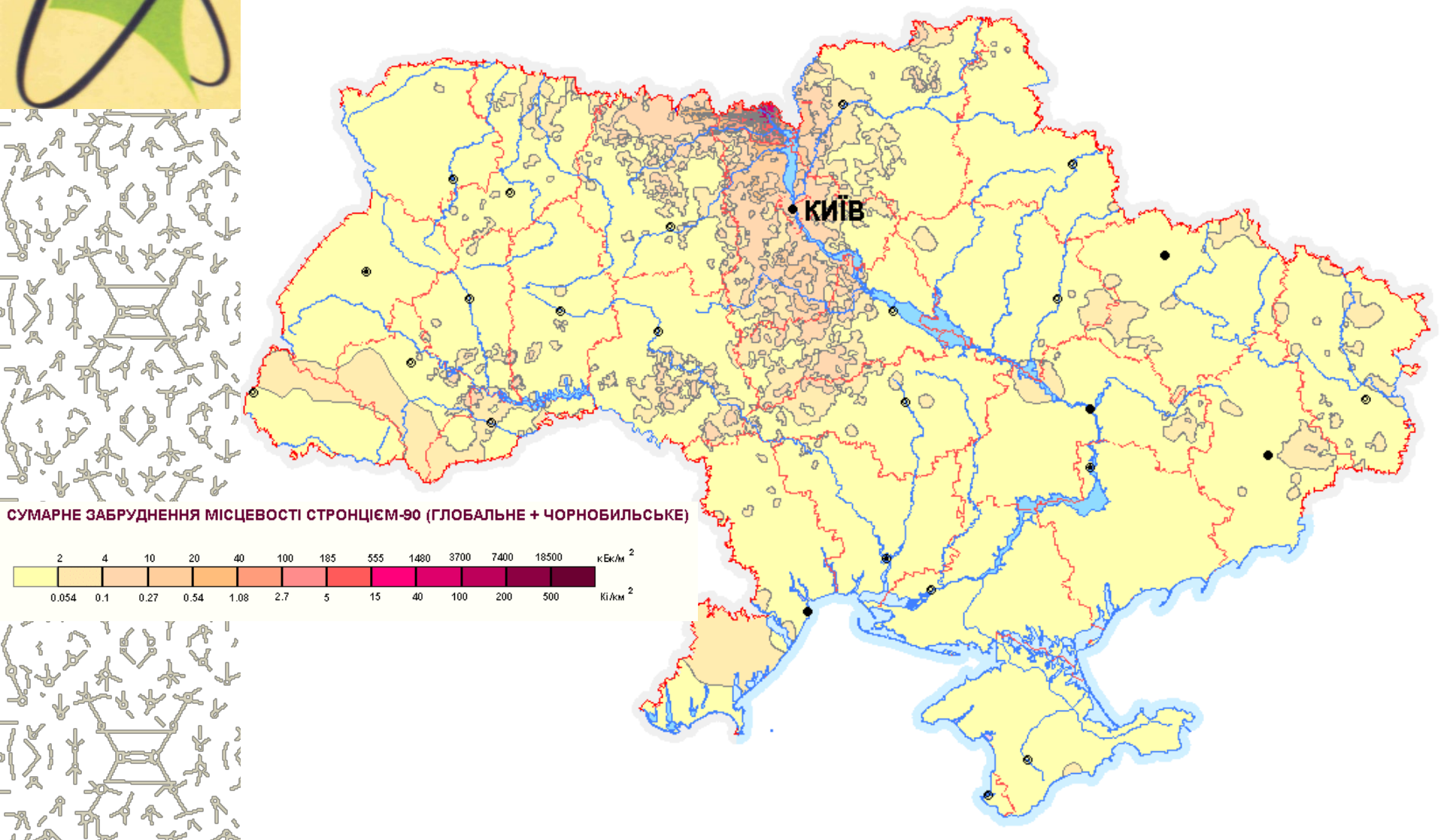


You see West, East,

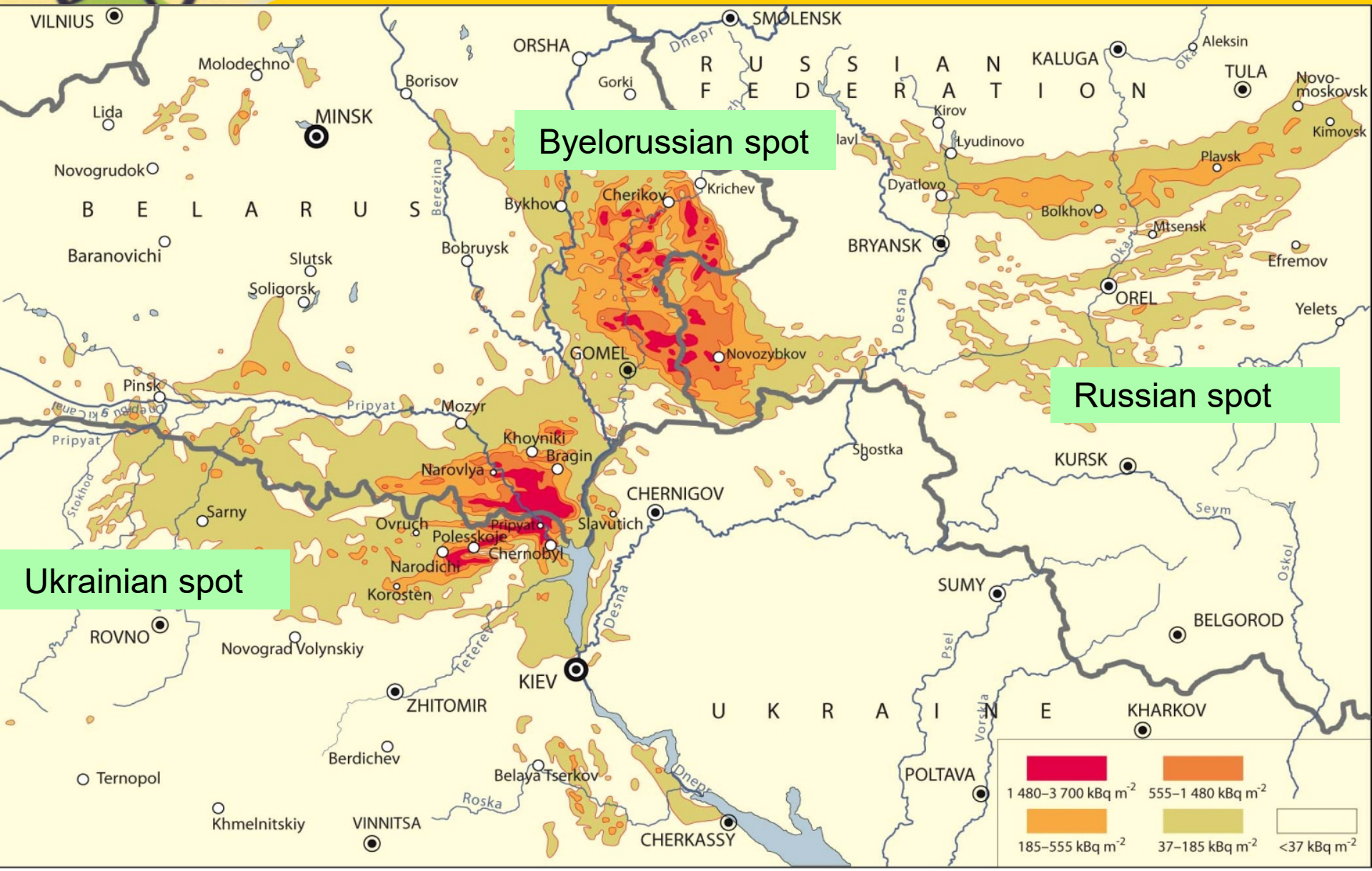
South radioactive tracks.

You see West, South and East tracks too.

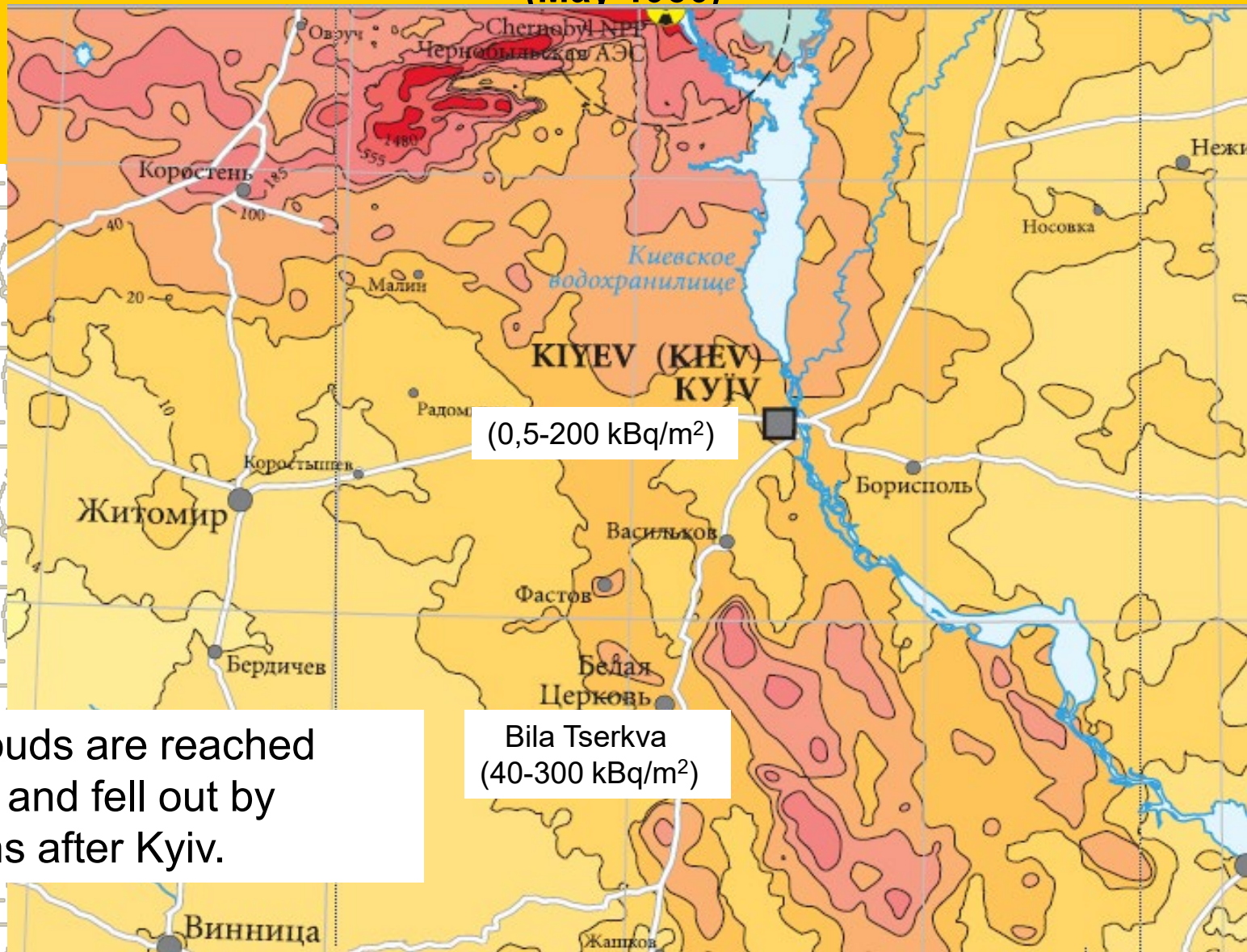
Contamination of Ukrainian territory by ^{90}Sr



Map of ^{137}Cs diffusion in centre of accident



Contamination of Kyiv region by ^{137}Cs (May 1986)



(0,5-200 kBq/m^2)

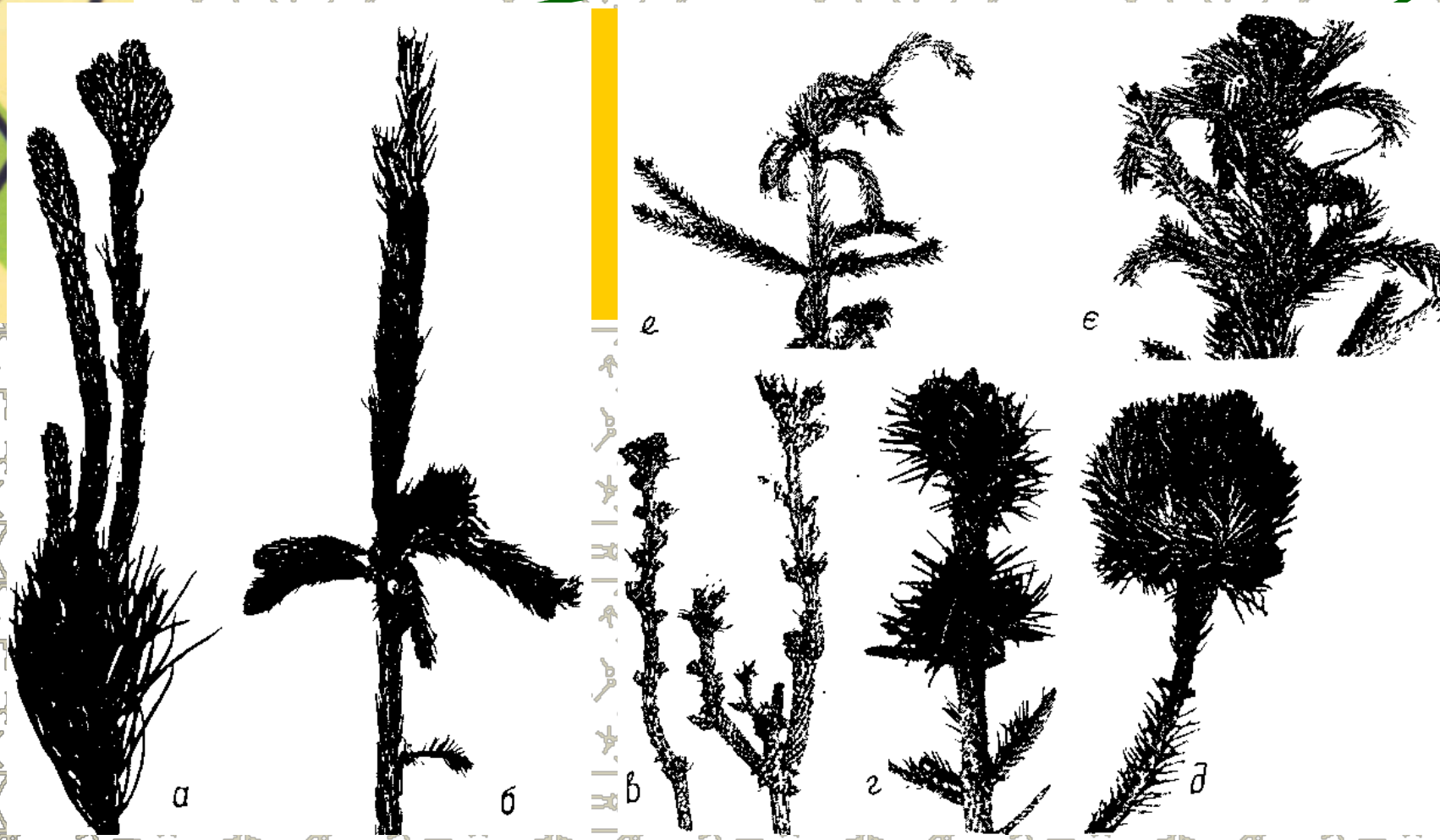
Bila Tserkva
(40-300 kBq/m^2)

Radioactive clouds are reached Kyiv, “stopped” and fell out by radioactive rains after Kyiv.

Main ecological, demographical and social consequences of accident in Chernobyl NPP

Consequences	Qualitative indices		
	Ukraine	Russia	Byelorussia
Total area of contaminated territories (^{137}Cs > 37 кBq.m^{-2})	**42.8 thousand km^2** (7% all territory; 12 oblasts from 25, 73 regions, 2 293 settlements)	**102.6 thousand km^2** (0.6 % all territory, 15 oblasts and republics, 4 540 settlements)	**47.7 thousand km^2** (23 % all territory, ї, 5 oblasts from 6, 27 regions, 2 697 settlements)
Area of contaminated arable lends	**0.955 million hectares**	**2.8 million hectares**	**2.57 million hectares**
Area of contaminated forests	**0.834 million hectares** (40% of total forest area)	**About 1 million hectares**	**About 2 million hectares** (25 % of total forest area)
Quality of population lived in contaminated placesi	**2 151 811 persons** (5% of population), including 373 846 children	**1 788 600 persons** . (about 1% of population)	**2.1 million persons** (20% of population)
Quality of victims in consequence of accident	**2 254 471 persons** (6% of population), including 498 409 children	**About 2 million persons**	**1.6 million persons** (15% of population), including 344 thousand children
Quality of accident liquidators	**260 807 persons**	**About 200 000 persons**	**107 810 persons**

Our investigations in exclusion zone

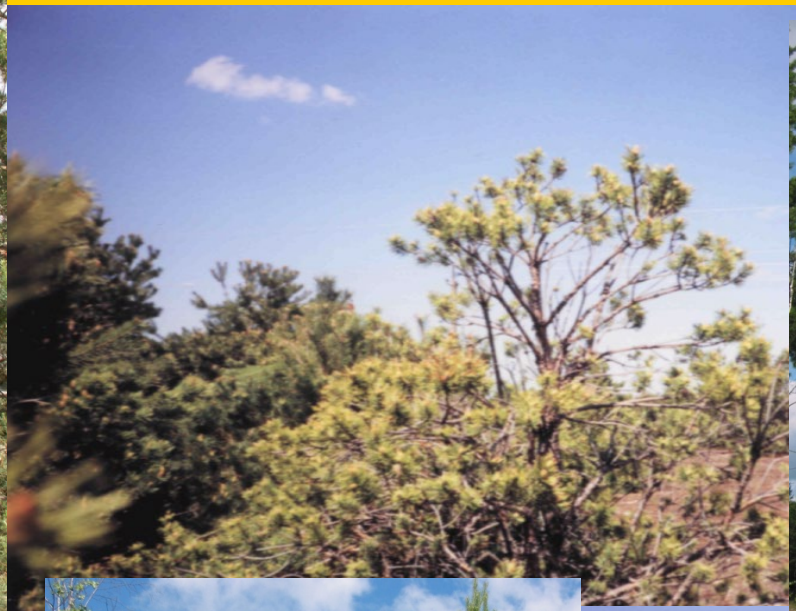


Abnormal shoots of pine (а,б) and fir (в–є), formed in1986–1987 at zone of Chornobyl NPP accident

Radiomorphoses on the shoots of fir (arising the long needles look liked at pine needles, change of color)

Radiomorphoses

Denudation of tree tops and trunks



Chlorophyll mutations (*albina* and *xantha*)

Taking down of apical dominance
- destruction of apical bud

Consequences of taking down of apical dominance in pine

The bush-like form of pine

Consequences of apical dominance taking down – branch outing of trunk (2010)

General view of «Red Forest»
(autumn 1986)

«Grave-diggers» of «Red Forest»

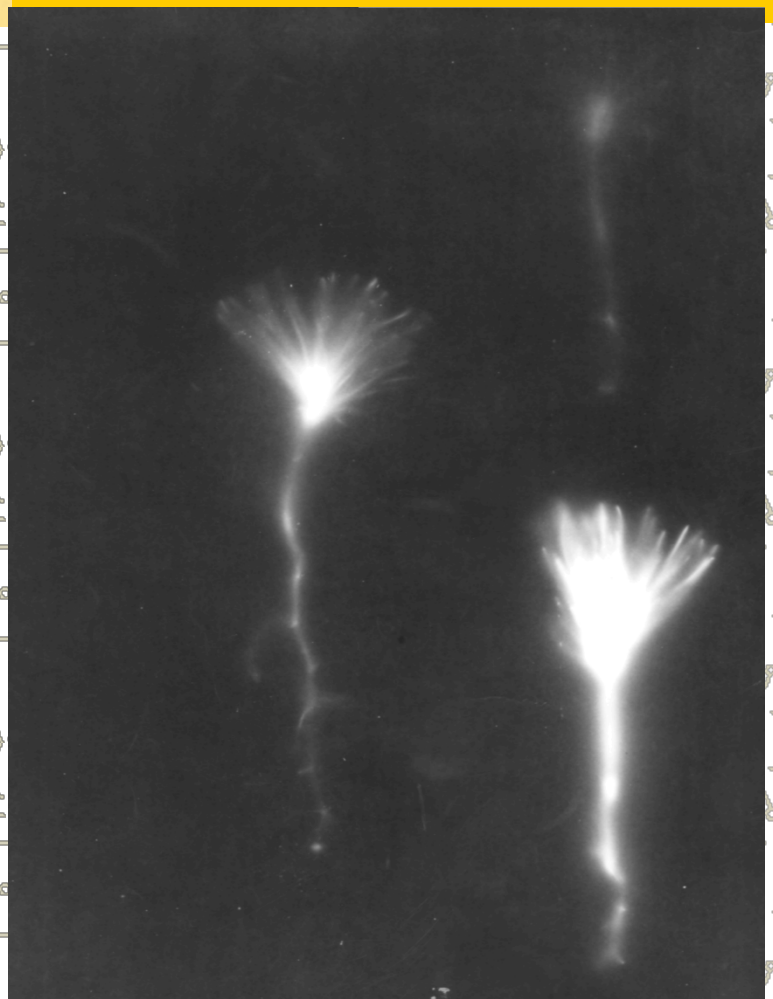
On place of former “Red Forest” (May 2009; these pines are 22-year old)

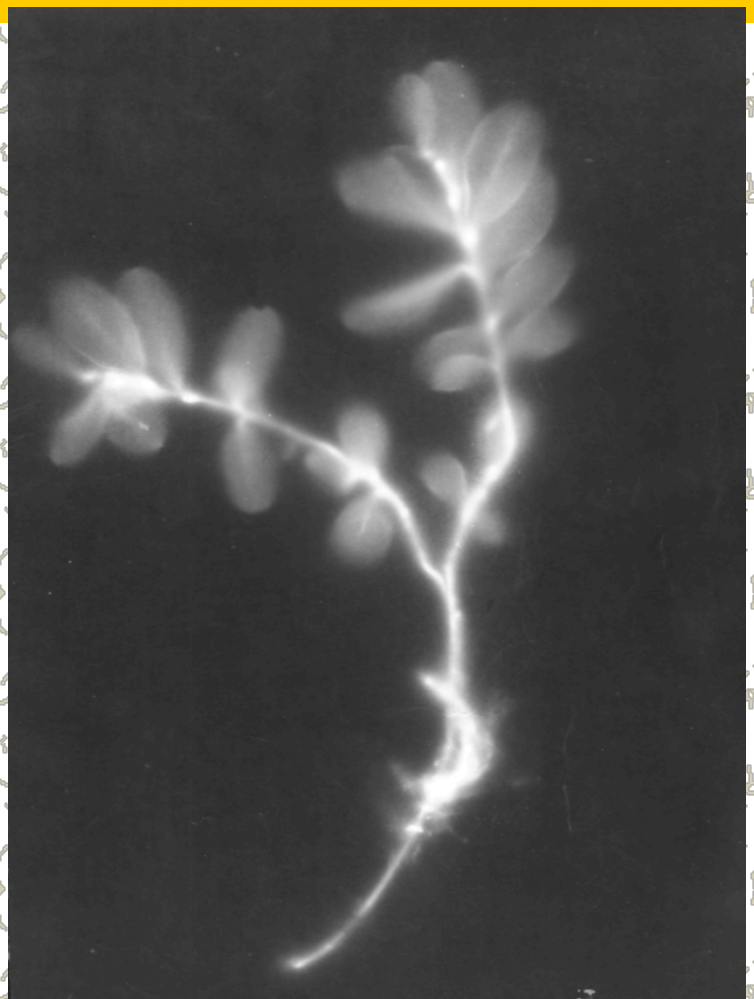
“Red Forest” (April 1987 and 2018)

Sample selection of pine needles in exclusion zone on territory of former “Red Forest” (June 2012)

Radioautograph of ordinary radioactive particles (radioactive dust) and “hot particles” (small pieces of nuclear fuel) on pine needle

Radioautographs of pine and cowberries seedlings growing on territory of former “Red Forest”





Disappearing species of plants


Plantago major


Arrhenatherum elatius


Plantago lanceolata


Vicia cracca


Trifolim repens


Vicia villosa


Melandriyum album


Asarum europaeum


Dactylis glomerta


Viola matitina


Taraxacum officinalis


Rumex confertus

Mutation of wheat in 25 years after accident

(D. Grodzinsky et al., 2012)

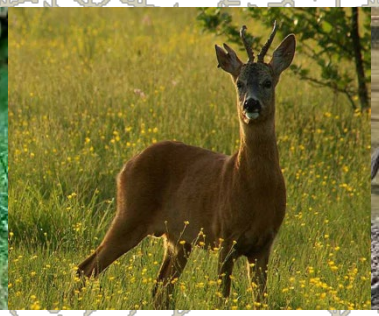
Quantity of wild animal at the territory of Exclusion zone of Chornobyl NPP (2600 km^2) (I. Gudkov, V. Gaichenko, S. Gaschak, 2015;

very approximate data based on compilation, calculation and expert estimations)

Spices	Before the accident	Now
Wild boar	700-800	1000-1500
Brown bear	0	5-6
Fox	400-500	700-1000
Beaver	200-300	1500-3000
Wolf	20-30	70-100
Deep	20-40	1000-1500
Lynx	2-6	100-150
Elk	100-200	1500-2500
Roe	500	800-1000
Hare	500-1000	1000-1500
Badger	50-100	300-400
Otter	20-30	150-250
Raccoon	500	1000-1500
Przhevalsky horse	22 (1998)	80-100

Absorbed dose from different kind of irradiation of big animals at Exclusion zone polygon “Koshovka”, sGy (1996)

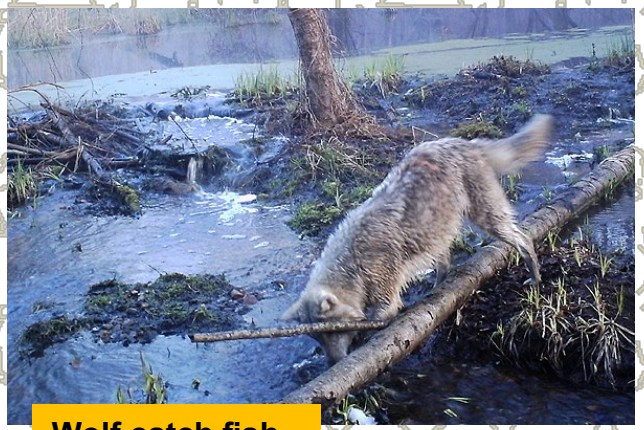
Irradiation	Hare	Roe	Wild boar	Elk
Internal	0.61	**10.5**	0.16	2.13
External	1.31	1.31	1.40	0.79
^{137}Cs in muscles, Bq/kg	1.78	**24.8**	2.18	0.37

Animals in Exclusion zone today
(S. Gaschak)

Dr. Sergey GASCHAK

Wolfs after hunting



Wolf catch fish

The pack of wolfs in night hunting

Roe-female with twins

Lynx-female with kitten on watering

Animals in Exclusion zone today

Wild pig-female with sucking-pigs

Family of cranes

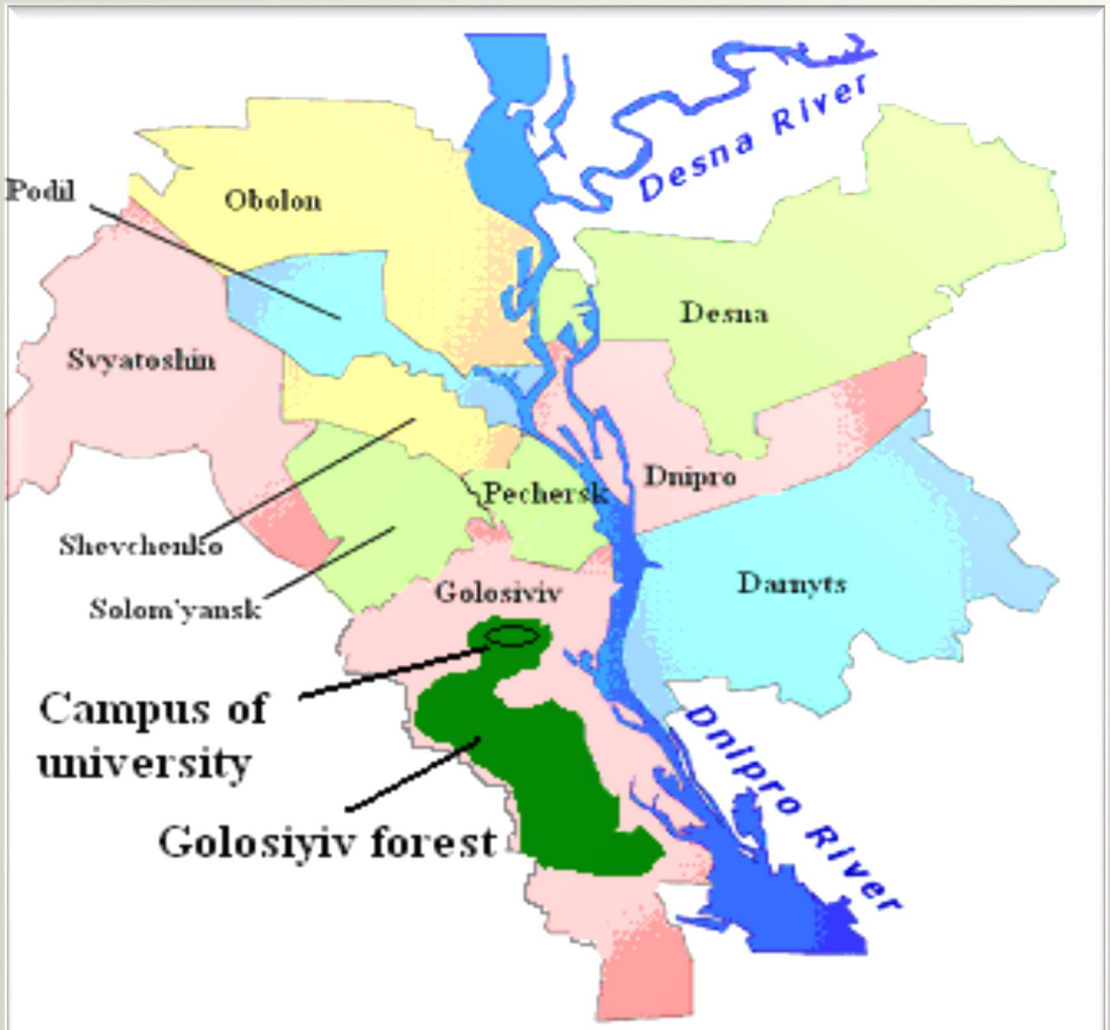
Deer-female with young deer

Red deep on watering

Bald eagle catch fish

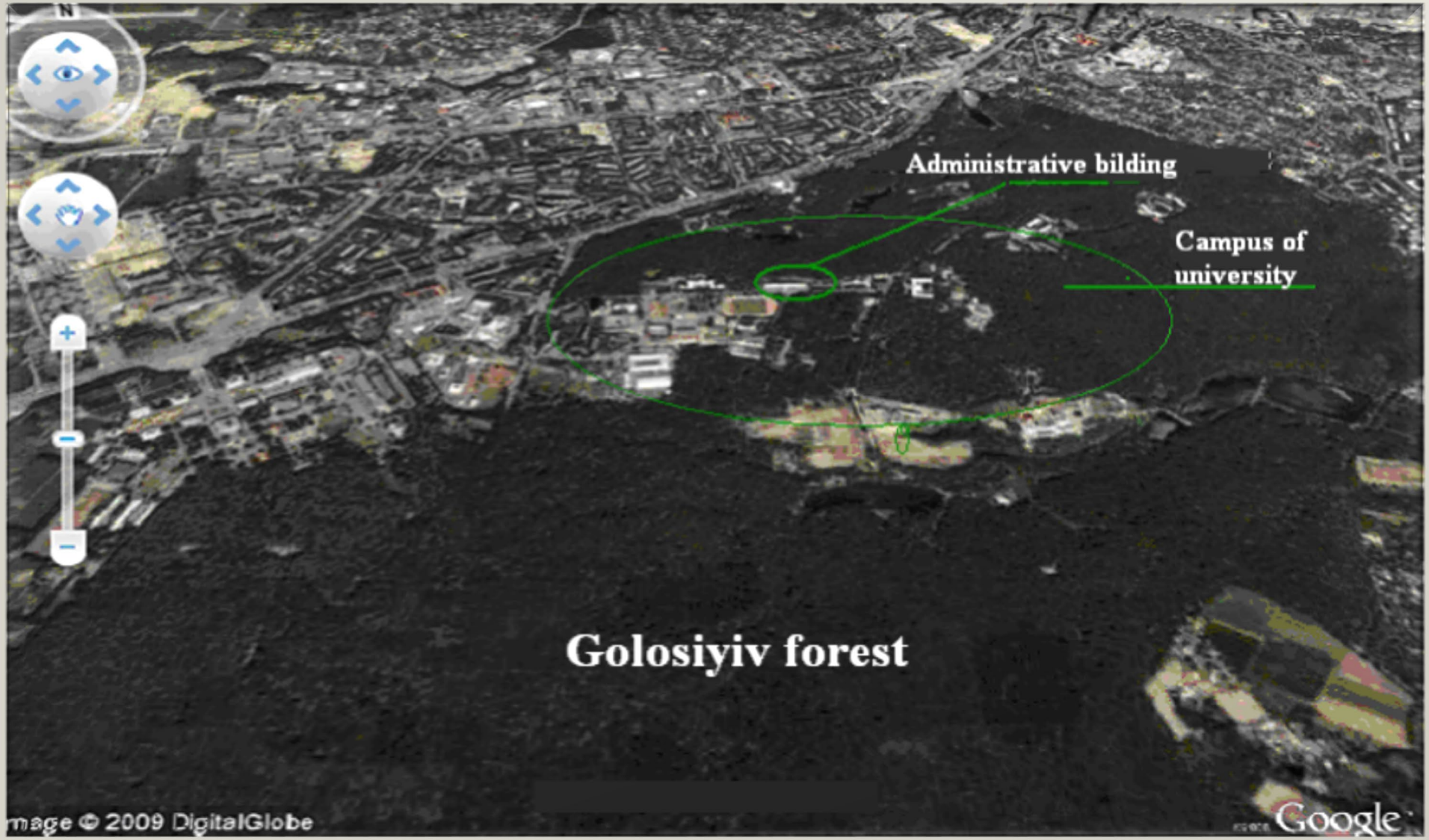
Becoming running wild dog ину

Kyiv

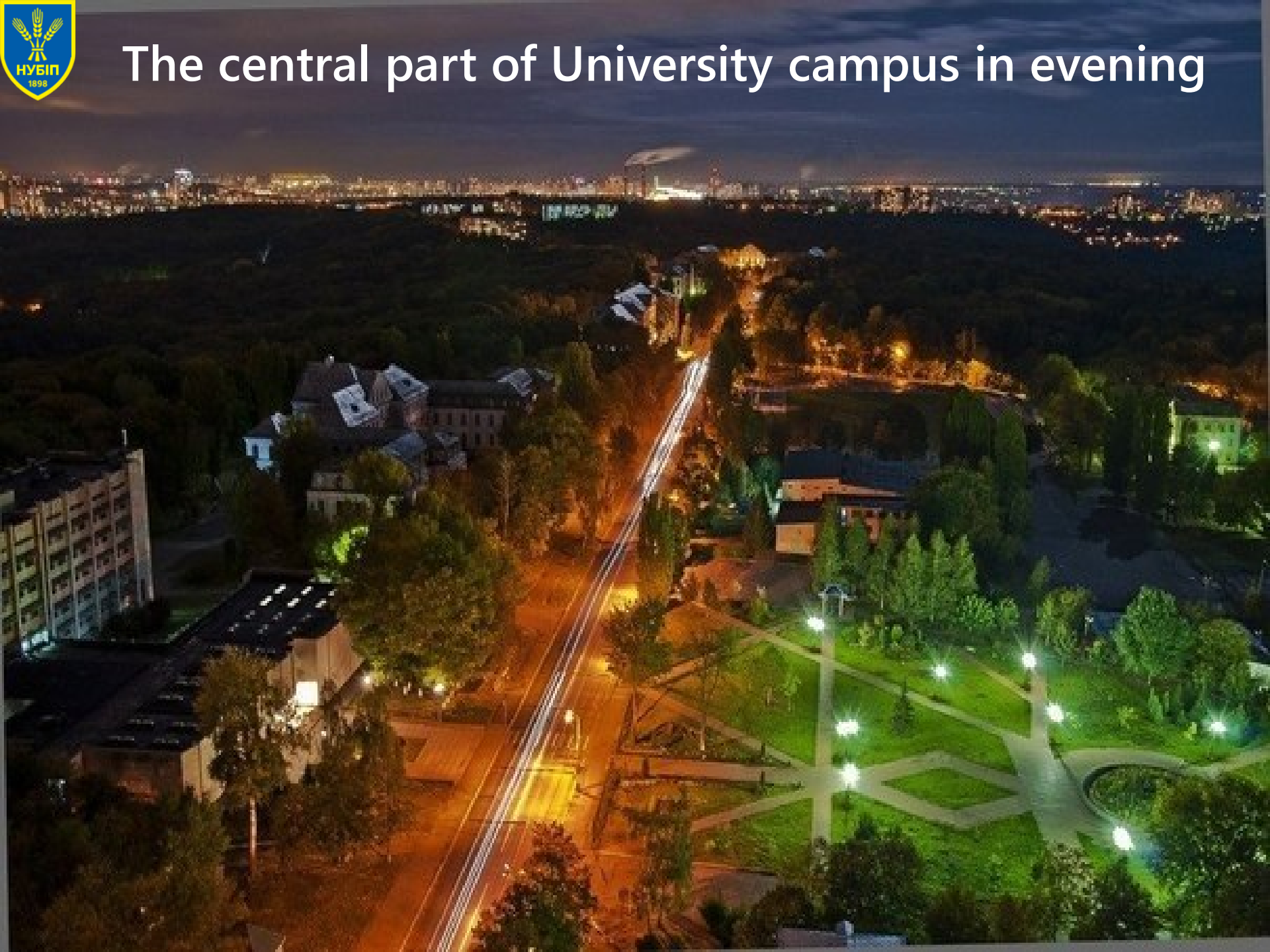


Kyiv is the capital of Ukraine and center of the most populated area. The population of Kyiv is approached to the 3 millions persons. City area is 836 km^2. Kyiv is divided into two parts by a large Dnipro-river (it is third river in Europe after Volga and Danube.

University campus in Golosiyiv forest



The central part of University campus in evening



National Agricultural University of Ukraine, Kiev (one of seventeen educational building)

The area of Golosiyiv forest is 1052 ha

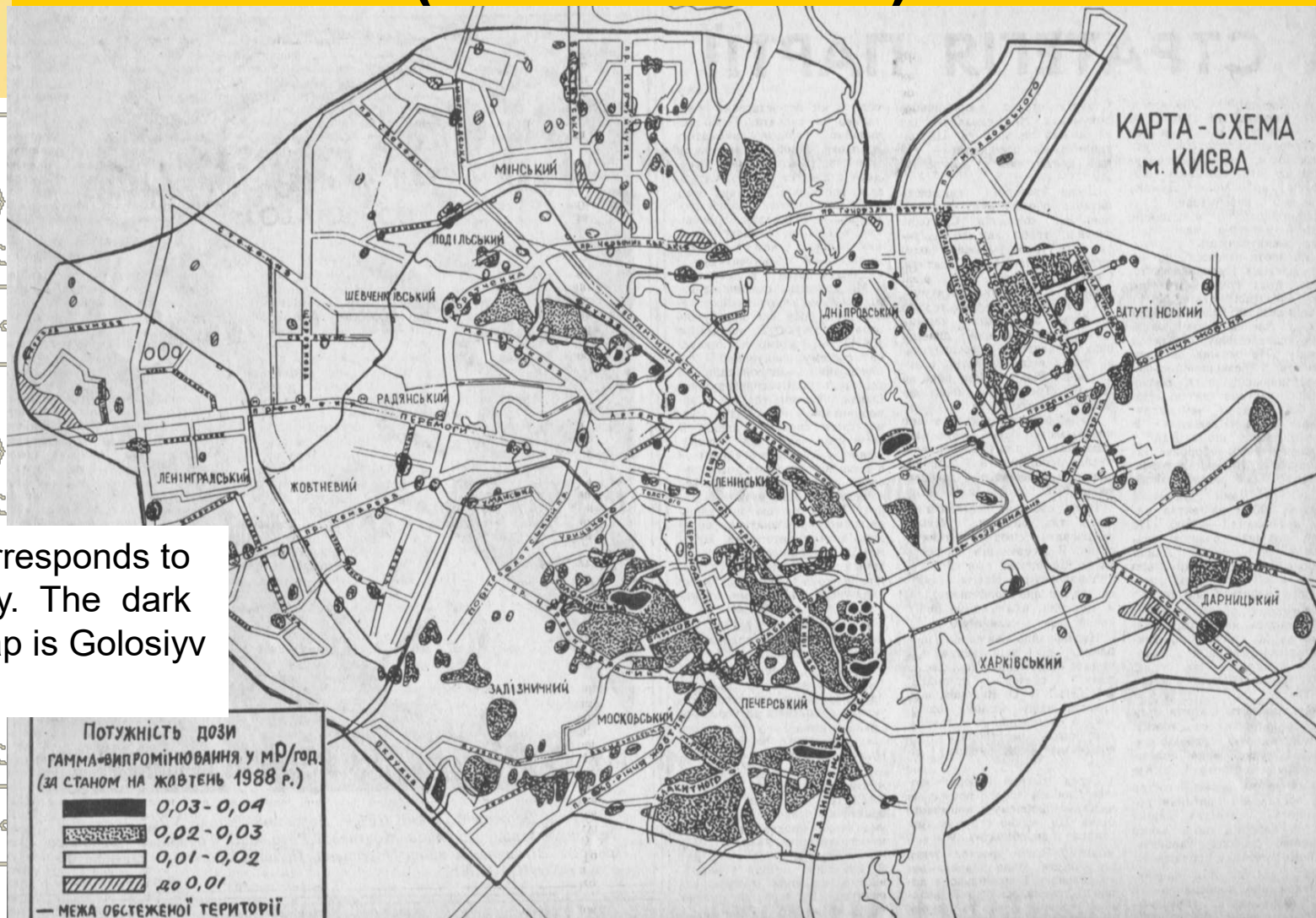
It is biggest forest tract in European capital.

Representative of a big amount of lakes in Golosiyivo

One of Golosiyiv forest's nooks

Near the lake

“Radiation map” of Kyiv (October 1988)



The dark color corresponds to strong radioactivity. The dark stain below of map is Golosiyv forest.

Educational training research farms

Four educational training research farms are included in structure of our University. Two farms – Forest Experimental station and Animal farm are being in zone of radiation influence of accident in Chornobyl NPP – zone 4 – zone of abnormally high radioecology control. Students-bachelors, students-masters and post-graduate student are fulfilled very interesting investigations about migration of radionuclides in environment, incorporation in different kinds of plants, animal organism, products.

Educational training practices

Our students have many educational training practices in Golosiyiv forest and Botanic garden: botany, zoology, dendrology, geology, soil science, including the practice in radioecology.

Golosiiv forest, as anyone forest, is conservative biogenosis and are kept a sufficient for definition quantity of radionuclides in soil, plants, trees fallen in 1986 during quite period of accident in Chornobyl NPP even in 35 years.

Educational training practices in radioecology

Selection of soil and plant samples

Evaluation of radiation background on campus territory

open place – 0.10-0.12 mcSv/h

in forest – 0.12-0.15 mcSv/h

The work in laboratory

Radiation background in Kyiv

(dose-rate γ-radiation)

Before accident – 8–10 mcR·h^{-1}

or 0.08-0.1 mcSv·h^{-1}

1–2 May 1986 – 1000–3000 mcR·h^{-1}

Including Golosiyiv forest 2000–2500 mcR·h^{-1}

Now – 9–16 mcR·h^{-1} or 0.09–0.16 mcSv·h^{-1}

Radioactive contamination of Kyiv territory in summer 1986

By $^{134+137}Cs$ – 0.5 to 200.0 $kBq \cdot m^{-2}$

(Border – 37 $kBq \cdot m^{-2}$ = 1 $Ci \cdot km^{-2}$)

by ^{90}Sr – 0.185 to 29 $kBq \cdot m^{-2}$

(Border – 0.02 $kBq \cdot m^{-2}$ = 0.15 $Ci \cdot km^{-2}$)

(in fact, up to 2000 Kyiv was of the 4th zone of radioactive contamination)

Radioactivity of leaves

The total activity of radionuclides of Chornobyl origin in late July 1986 in Kyiv in leaves of horse chestnut about was **300 000 Bq·kg^{-1}**, in leaves of small-leaved lime reached **400 000 Bq·kg^{-1}**, common birch – **100 000 Bq·kg^{-1}** in needles of Scots Pine – **70 300 Bq·kg^{-1}** (Permissible levels [PL-2006] for medicinal plants by ^{137}Cs are **200 Bq·kg^{-1}**, and for vegetables, including leafy – **40 Bq·kg^{-1}**).

Soil radioactivity in open parts of Kyiv now (2017)

Specific radioactivity

by ^{137}Cs – 55–110 $Bq \cdot kg^{-1}$

by ^{90}Sr – 27–40 $Bq \cdot kg^{-1}$

Surface radioactivity, accordingly

10–26 $kBq \cdot m^{-2}$ and 5–10 $kBq \cdot m^{-2}$

***I remind,* the border is 37 $kBq \cdot m^{-2}$ (1 $Ci \cdot km^{-2}$).**

Soil radioactivity in green zones now

Specific radioactivity

by ^{137}Cs 60–270 $Bq \cdot kg^{-1}$

by ^{90}Sr – 30–60 $Bq \cdot kg^{-1}$

Surface radioactivity, accordingly,

12–50 $kBq \cdot m^{-2}$ and 5–19 $kBq \cdot m^{-2}$

Border is 37 $kBq \cdot m^{-2}$ (1 $Ci \cdot km^{-2}$).

Radioactivity in Golosiyiv forest now (2018)

Radiation background – 8–15 mcR·h^{-1}

Soil: by ^{137}Cs – 18–140 kBq·m^{-2}

by ^{90}Sr – 6–15 kBq·m^{-2}

Plants: by ^{137}Cs – 3–73 Bq·kg^{-1} (PL 200 Bq·kg^{-1})

by ^{90}Sr – 60–330 Bq·kg^{-1} (PL 100 Bq·kg^{-1})

Mushrooms (fresh) by ^{137}Cs – 200–500 Bq·kg^{-1}

(500 PL Bq·kg^{-1})

Radioactive contamination of some species of plants in Golosiyiv forest

Plant	Bq·kg^{-1}	
	^{137}Cs	^{90}Sr
Cancerwort (*Taraxacum offecinale* Webb)	110 ± 22	211 ± 56
White clover (*Trifolium repens* L.)	87 ± 21	123 ± 32
Touch-me-not (*Impatiens noli-tangere* L.)	46 ± 29	460 ± 80
Wood geranium (*Geranium silvaticum* L.)	24 ± 4	560 ± 60
Goutweed (*Aegopodium podagraria* L.)	3 ± 2	280 ± 60
Stinging nettle (*Urtica dioica* L.)	7 ± 4	60 ± 8
Snake flower (*Lamium album* L.)	73 ± 4	500 ± 65
Greater plantain (*Plantago major* L.)	24 ± 3	320 ± 51
Permissible levels (PL-2006)	200	100

Radioactivity of reservoirs in Golosiyiv forest

Water: 0.08–0.20 $Bq \cdot l^{-1}$ (PL 2 $Bq \cdot l^{-1}$)

Silt:

by ^{137}Cs – 34–110 $Bq \cdot kg^{-1}$ and by ^{90}Sr – 18–35 $Bq \cdot kg^{-1}$

Plants: by ^{137}Cs – 7.6–61 $Bq \cdot kg^{-1}$ (PL 200 $Bq \cdot kg^{-1}$)

by ^{90}Sr – 5.2–23.7 $Bq \cdot kg^{-1}$ (PL 100 $Bq \cdot kg^{-1}$)

Fish: by ^{137}Cs – 1.5–2 $Bq \cdot kg^{-1}$ (PL 150 $Bq \cdot kg^{-1}$)

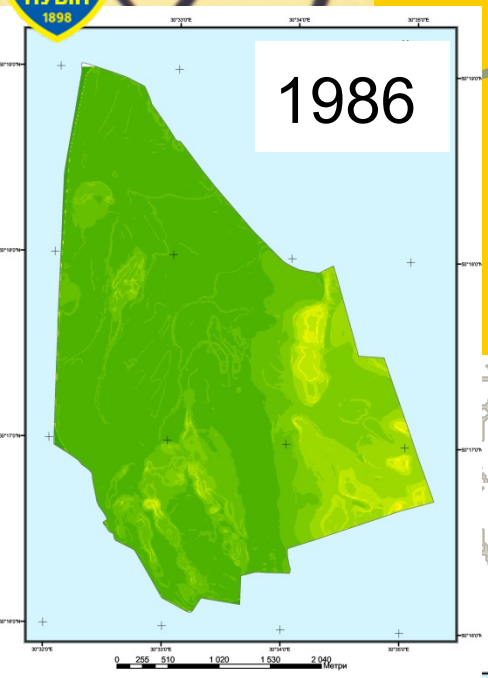
by ^{90}Sr – 3.2–10 $Bq \cdot kg^{-1}$ (PL 35 $Bq \cdot kg^{-1}$)

Radiation situation in Ukraine and in Kyiv became significantly better during 35 years.

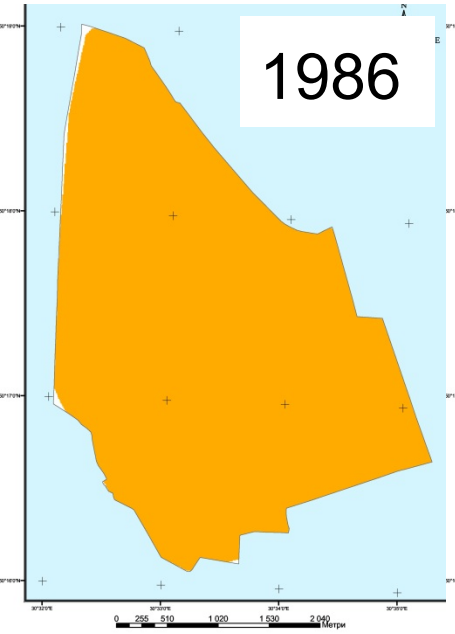
Change of radionuclide activity since account of nature decay up 1986 to 2021

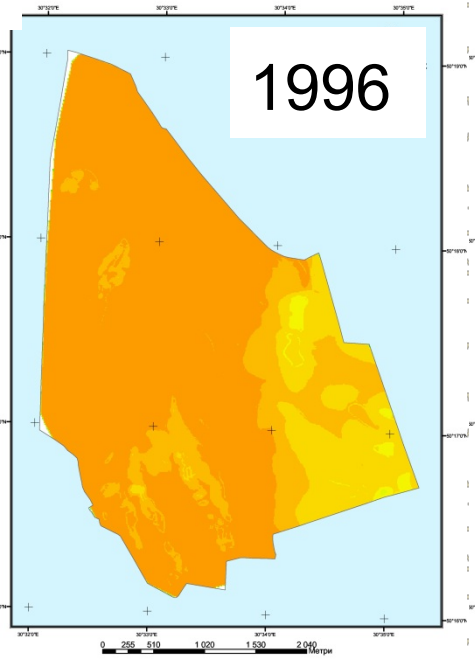
Radionuclide	The activity during 35 years after accident are
^{131}I	decreasing practically to zero
^{137}Cs	decreasing more then in 2 time
^{90}Sr	decreasing more then in 2 time
^{240}Pu	non change practically
^{241}Pu	decreasing in 4 times
^{241}Am	increasing in 25 times account of decay ^{241}Pu

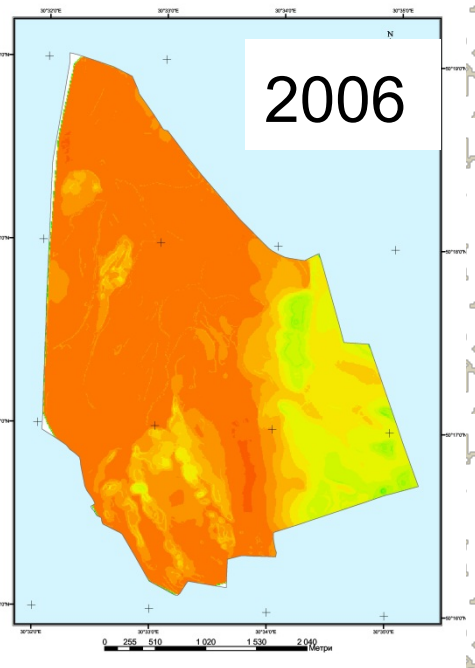
The dynamic of redistribution of soil ^{137}Cs contamination depend on relief from 1986 to 2013

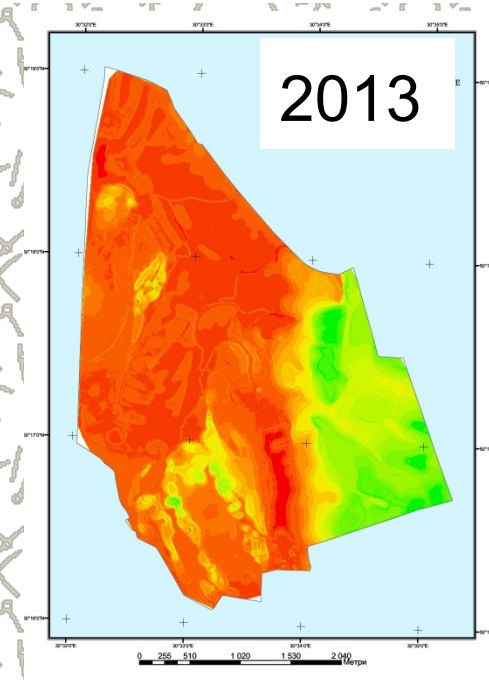


The radioactive substances are washing away with high places to low places and to Dnipro-river, to Black Sea and to World Ocean.

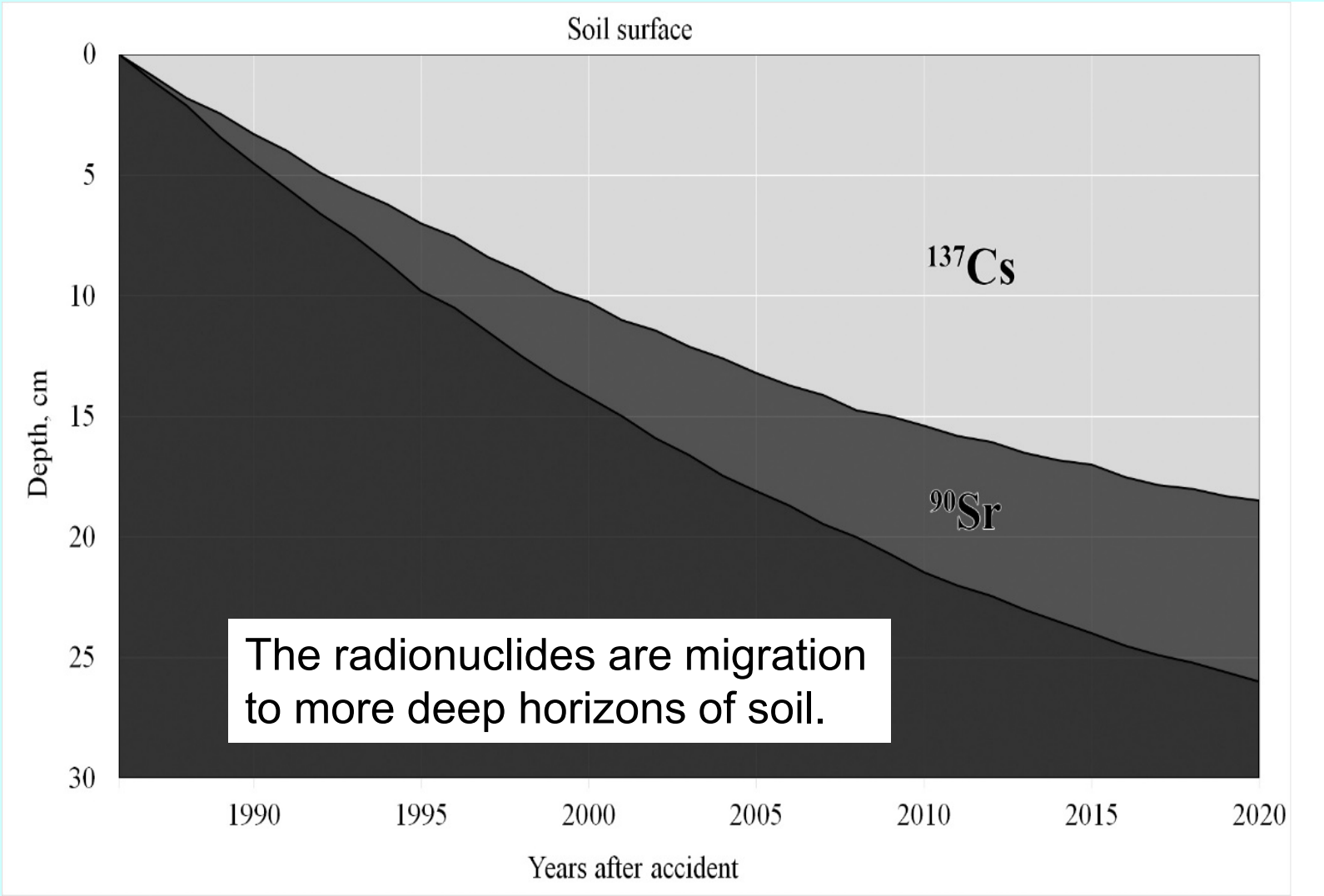








The dynamic of vertical radionuclide migration in soil



The radionuclides are migration to more deep horizons of soil.

Spontaneous phytodesactivation of soil

Phytodesactivation is biotechnology of cleaning soils from radioactive substances with the help of plants.

During 35 years the agricultural soils was cleaned account of take out of radionuclides by crops – approximately 1-2% per in year.

Such we “eated” up to half (33×1-2~50%) radioactivity with plant-breeding production.

The square of radionuclide contaminated territory of Ukraine in 1986 and 2016, *thousand km²*

Radionuclide	Year	kBq/m²					
		<2	2–10	10–40	40–185	185–555	>555
^{137}Cs	1986	20.4	371.9	168.6	37.5	3.7	1.6
	2016	130.1	367.4	84.7	18.4	2.0	1.1

Radionuclide	Year	<2	2–4	4–10	>10
^{90}Sr	1986	400.8	147.6	53.9	1.4
	2016	540.0	40.9	21.8	1.0

The area of contaminated territory is decreased.

Number of settlement attributed to zones of radioactive contamination (1991) and now

№	Oblast (region)	Zones of radioactive contamination				
		1	2	3	4	Total
1	Zhitomir	7	63	301	363	734
2	Kiev	69	20	33	438	560
3	Rivne		1	273	65	339
4	Chernigiv		2	61	190	253
5	Volin			166	0	166
6	Cherkasi			4	99	103
7	Vinnitsa				89	89
8	Chernivtsi			1	13	14
9	Sumi			2	9	11
10	Ternopil				10	10
11	Kymelnitsk				9	9
12	Ivano-Frankivsk				5	5
	Total	76	86	841	1290	2293 (510)

The number of contaminated settlements are decreased.

The number of contaminated cites are decreased too.

Cites of Ukraine on radionuclide contaminated territories

[1991 (27) and now (10), border – 37 kBq/m^2]

Oblast' (region)	City	Population, x 10^3	^{137}Cs, kBq/m^2	Oblast' (region)	City	Population, x 10^3	^{137}Cs, kBq/m^2
Kiev	Bila Tserkva	200.1	13	Zhitomir	Korosten'	67.5	184
	Boguslav	17.1	55		Malin	29.4	19
	Boyarka	36.0	11		Ovruch	18.3	72
	Vishgorod	22.9	24	Cherkassy	Zvenigorodka	22.7	60
	Irpin'	38.9	21		Kaniv	29.7	72
	Mironovka	16.1	12		Talne	17.0	34
	Slavutich	20.0	67	Rivne	Dubrovitsa	10.7	80
	Tarashcha	14,4	27		Kuznetsovsk	31.7	28
	Uzin	16.9	85		Sarni	22.6	23
	Fastiv	54.4	39	Vinnica	Ladizhin	20.2	22
Chernigov	Korukivka	14.5	16		Tulchin	14.6	33
	Oster	8.4	19	Ternopol'	Zaleshchiki	10.7	9
	Semenivka	10.5	41		Chortkov	28.5	22
				Volin'	Kamin'-Kashirski	10.3	9

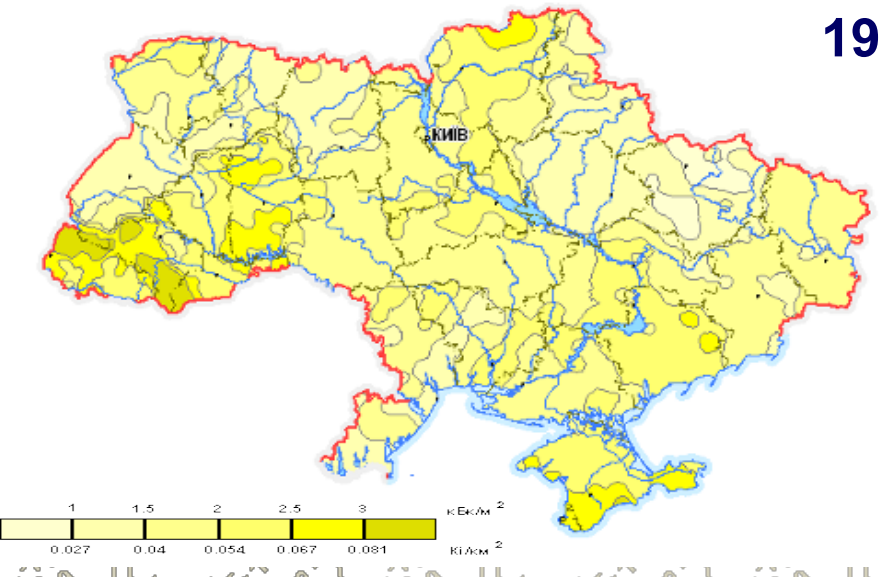
Comparison of ecological, demographical and social consequences of accident in Ukraine

Indices	Year		Decrease in 2011	Decrease in 2017 (approx.)
	1986	2016		
Total area of contaminated territories	53.5 thousand km^2	42.8 thousand km^2	20.0%	25%
Area of contaminated arable lends	1.13 million hectares	0.955 million hectares	15.5%	20%
Area of contaminated forests	1.23 million hectares	0.83 million hectares	32.5%	35%
Quality of population lived in contaminated placesi	2 315 900 persons (5% of population), including 499 500 children	2 151 811 persons including 373 846 children	7.1% 25.2%	8% 30%
Quality of victims in consequence of accident	3 361 870 persons (7% of population), including 1 264 330 children	2 254 471 including 498 409 children	23.0% 2.5 times	25% 3 times
Quality of accident liquidators	350 894 persons	260 807 persons	25.7%	33%

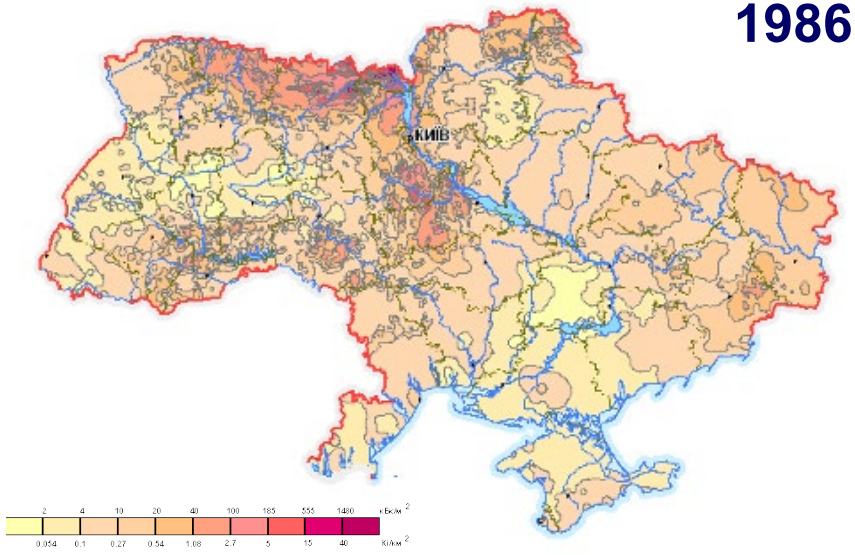
The yellow color corresponds to global radioactivity from explodes an atom bombs. You see that yellow color is a little more.

The changes of Ukraine territory contamination by ^{137}Cs

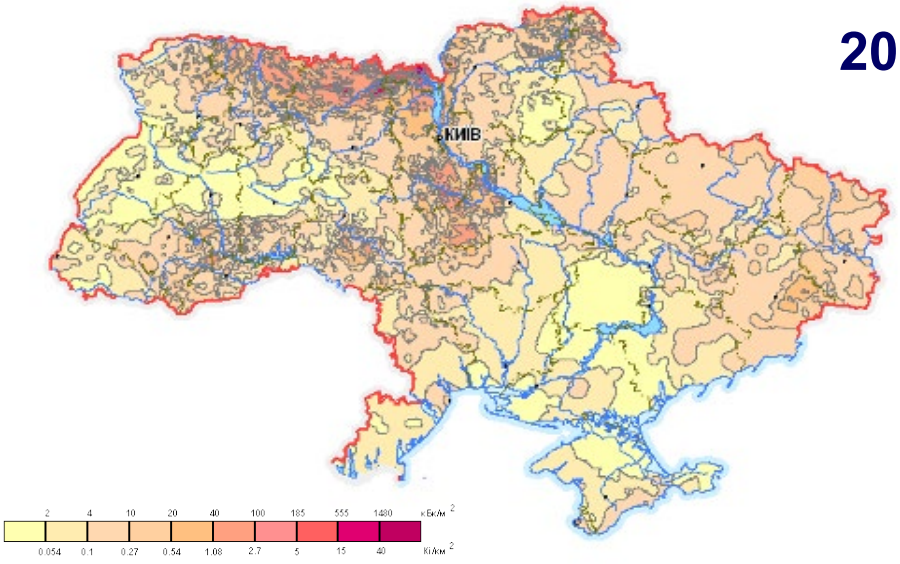
1985



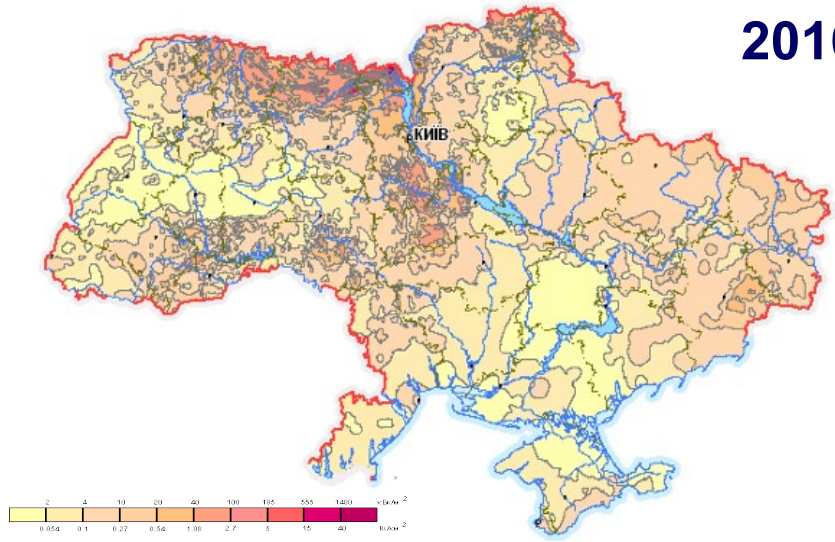
1986



2006

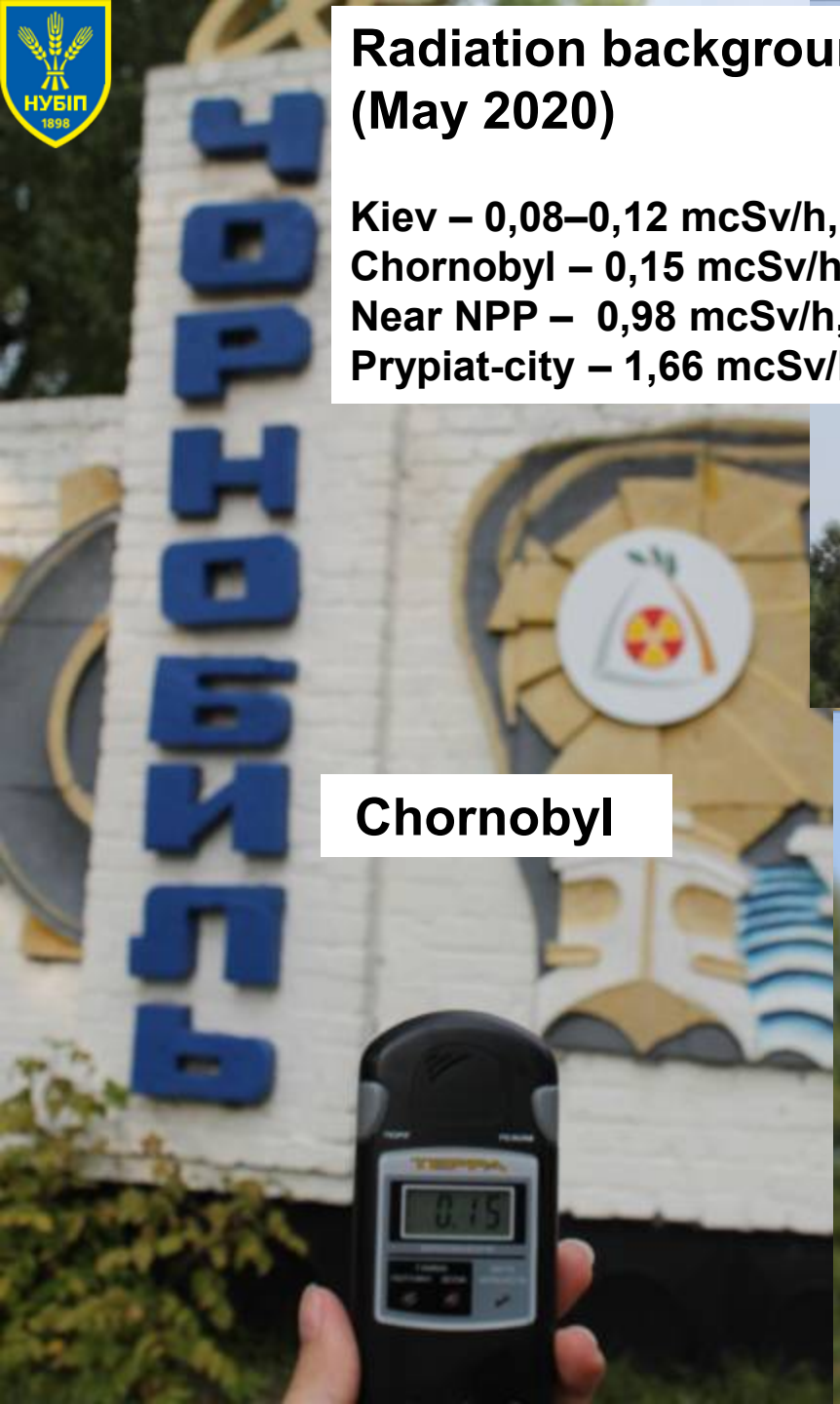


2016



Radiation background (May 2020)

Kiev – 0,08–0,12 mcSv/h,
Chornobyl – 0,15 mcSv/h,
Near NPP – 0,98 mcSv/h,
Prypiat-city – 1,66 mcSv/h



Chornobyl

Near ChNPP

Prypiat-city

The radiation background in airport Kiev-Boryspol (Sikorsky) and after some hours in airplane in higher 10 km (0,08 i 2,56 mcSv/h) today

You see that radiation background in airplane higher than in Prypiat-city

Population, living in the contaminated territories, gets above of 90% ionizing radiation dose through the incorporated radionuclides entering the body with food, products.

That is why the use of specific techniques that minimize the transfer of radionuclides from soil to plants, including fodder for animals and feed in livestock production and technology of production, should be considered the main way of protection from human exposure.

The levels of contamination of main products by ^{137}Cs

Product	Bq/kg or l			
	Permissible levels in Ukraine (PL-2006)	The levels accepted by EC, Euratom	Real levels in Kyiv today	Middle levels in Ukraine today
Milk	100	370	5-10	15
Meat	200	600	10-20	25
Potato	60	600	10-20	20
Vegetable	40	600	2-10	20
Bread	20	600	2-4	5
Fruits	70	600	5-10	15
Fish	150	600	2-20	25
Drinking water	2	37	0.05	0.05
Children-feeding	40	370	2-5	4

It is compare. You see, that Ukrainian levels are more lover then European levels.

Now a production produced in Ukraine completely corresponds to own and international requirements of radionuclides contain.

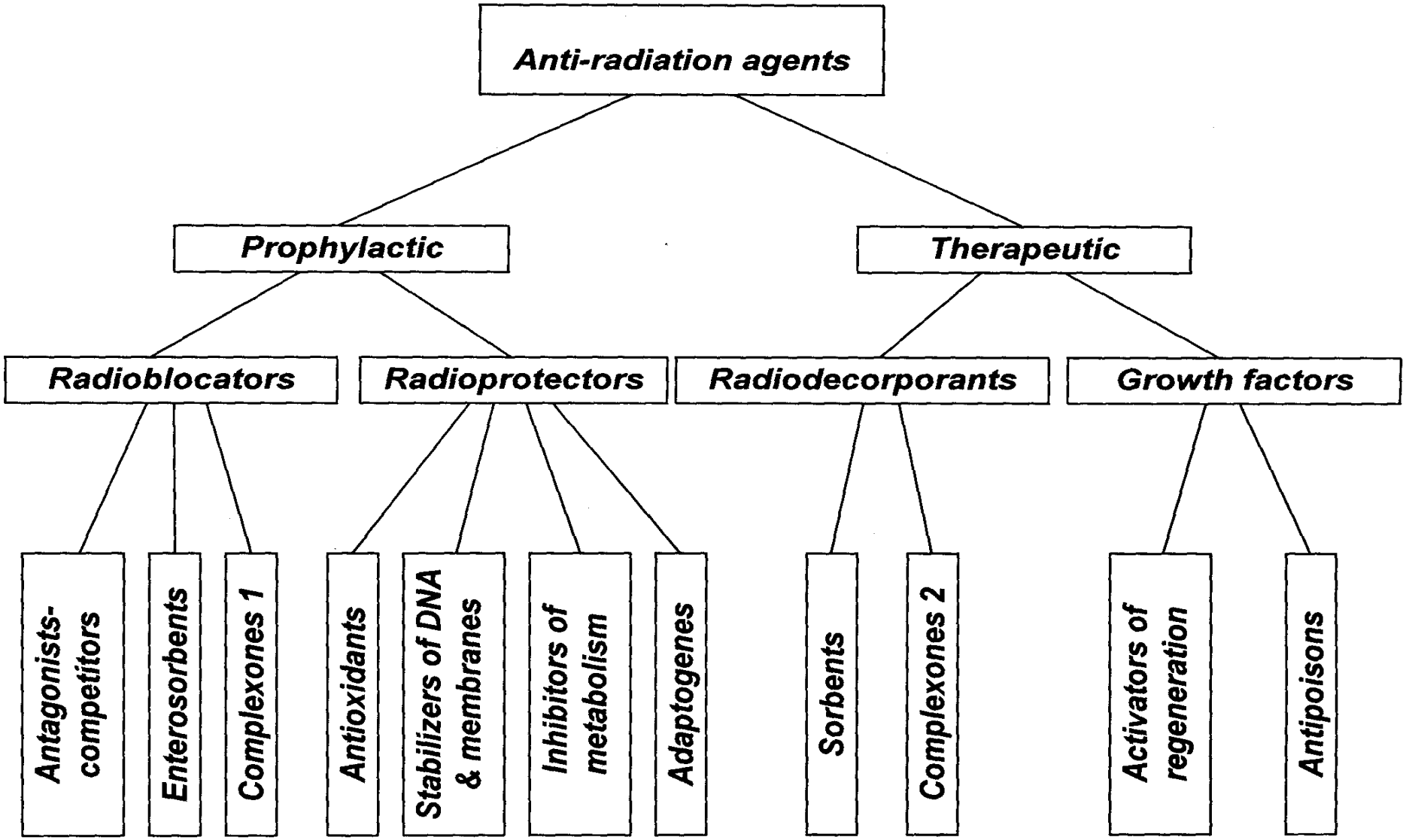
But we must remember - ionizing radiation is invisible contemporary and companion of our life. It is intrude in our mode not only consequences of atomic explosions or accidents in nuclear power plants.

See to this table

Radiation accidents at enterprises of non-nuclear industry and every-day accidents of life too

yea	Country	Cause of accident	Consequences
1961	Switzerland	Pouring out of the dye-stuff with tritium in factory	1 worker was lost
1962	Mexico, Mexico-City	Losing the radiographic source	4 persons from inhabitants were lost
1963	China	Irradiator of the seeds	2 persons from inhabitants were lost
1964	Germany	Pouring out of the dye-stuff with tritium in factory	1 worker was lost
1975	Italy, Breshia	Irradiator of the foodstuffs	1 worker was lost
1978	Algiers	Losing the radiographic source	1 person from inhabitants were lost
1981	USA, Oklahoma	Industrial radiography	1 worker was lost
1982	Norway	Radiation sterilizer of instruments	1 worker was lost
1983	Mexico	Losing the medical source	Uncertainty
1984	Morocco	Losing the radiographic source	8 persons from inhabitants were lost
1987	Brasilia, Gojania	Losing the medical source	250 persons were irradiated, 4 were lost
1998	Russia	Theft of the uranium	
1999	Moldova	Theft of the radioactive cobalt	Irradiation of thief
1999	Russia, Murmansk	Theft of the californium	Uncertainty
1999	Russia, Chelyabinsk oblast	Market of the game contaminated by radioactive substances	Uncertainty
1999	Russia, Grozny	Theft of the container with radioactive substances	2 persons were lost
2000	Georgia	Theft of the uranium	Uncertainty

Anti-radiation agents



Radioprotetive products

Product	Radioprotective substances			
	Radio-blocator	Radio-protector	Radio-decorporant	Radio-repairer
Cabbage	+	+++	+	+
Carrot	+	+++	+	+
Black currants	+	+++	+++	++
Curd	++	+++		+
Fish and meat	+	+++		
Pumpkin	++	+	++	
Apple	+		++	
Leaf vegetables	+	+	+	+
Green and phytoteas		+	++	
Sea products	++	+	++	+

One of the main conclusions –
Radiation situation in Kyiv and in University campus is normal today and absolutely safe.

Welcome to Kyiv!
Welcome to our University!


Thank you for
your attention!


НУБіП
1898