EFFICIENT COUNTERMEASURES: THE BASIS OF POST-CHERNOBYL REMEDIATION AND SUSTAINABLE DEVELOPMENT OF THE AFFECTED TERRITORIES OF THE REPUBLIC OF BELARUS

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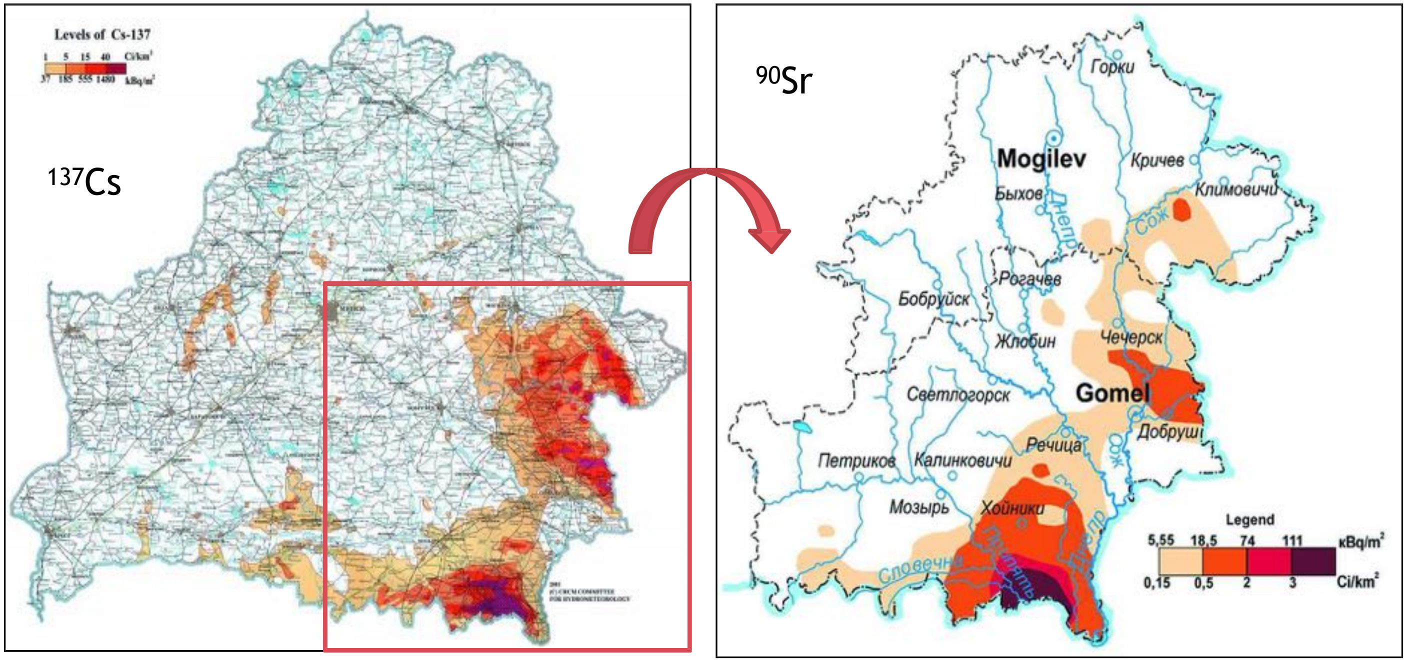
Contamination of Belarus with ^{137}Cs and ^{90}Sr (2001)



23 % of the agricultural land has been contaminated with ^{137}Cs (>37kBq/m^2)

10% - with ^{90}Sr (>5.5kBq/m^2)

2% - with 238,239,241Pu (>0.37kBq/m^2)

Source : Chernobyl consequences: contamination of land, food products and countermeasures in Belarus - I. Bogdevitch

EVOLUTION OF PUBLIC COMMUNICATION SYSTEM

During the first post-Chernobyl years any information relevant to the disaster and its consequences was disseminated in the first place amongst the officials of different national and local levels of governance involved in the post-accident response and recovery actions.

In that period there were other top-priority issues to be urgently addressed and emergency measures to be taken

- Evacuation

- Large-Scale Decontamination

- Development of Radiation Control Systems

- Health and Social Protection

- Development and Implementation of Countermeasures in Agricultural and Forest Sectors

Public outreach and communication with local stakeholders other than authorities or agricultural/medical specialists *was not a priority task in the initial period*.
The major objective back then was *public health safety and protection*.

Decontamination

Decontamination should be **based on dose limits** established for this purpose.

1986 : ambient dose 5-20 mR/h → Evacuation

In the initial period of decontamination in the USSR external radiation dose limits changed over time and depended on the category of personnel involved in the post-accident response actions.

In 1986 a dose limit was established which insured no deterministic effects of exposure. The pre-determined emergency standard was that of 250 mSv. Later it was changed down to 50 mSv, and after that, the life-span dose limit was set at 35 mSv.

Decontamination in Belarus

Object of Decontamination	INTERVENTION LEVELS Gamma Radiation, μR/h, *or* Beta Radiation, particle/min·cm^2	Action
Territories of pre-school facilities, schools and private houses	35-40 μR/h	Removal of 25-cm soil layer
Working office and operational places: - permanent being - temporary being	50 μR/h 100 μR/h	Cleaning with detergents and water
Open areas within settlements (stores, public places)	60 μR/h	Removal of 25-cm soil layer
Inner surfaces of houses; transportation means	20 particle/min·cm^2	Cleaning with detergents and water
Roofs of buildings	40 particle/min·cm^2	Cleaning with detergents and water

Decontamination

500 settlements of Belarus were decontaminated during 1986-1989 period, 60% – in 2-3 stages.

- removal of contaminated soil and "clean" refilling;
- dismantling of objects not subjected to decontamination;
- asphalting of streets, roads and pavements;
- roof replacement;
- waste disposal.

7.3 million m³ of soil **was cut off** and replaced with 1.57 million m³ of clean soil.






Communication and Trust.
Some Facts from the Chernobyl Experience

Chernobyl and Fukushima ➡ similar trust build-up problems

By the end of 1986, a special plan of actions was developed for **extension of radiological knowledge** primarily in the farm sector:

- lectures and meetings of scientists with stakeholders in contaminated areas;
- radio and television broadcasts;
- popular science editions;
- film production;
- distribution of posters and radiology-related printed handouts.

Tasks and Objectives

In the framework of radiation protection and target-oriented implementation of protective measures

Two categories of population should be distinguished when choosing the most appropriate strategy of protective measures for reducing the internal dose *in the long term*

Category 1: Residents of contaminated areas who consume foodstuffs of local production

Objective: **Reduction of individual effective doses** received through the consumption of local contaminated foodstuffs

Category 2: People who live in clean areas, but may consume foodstuffs produced in contaminated areas

Objective: **Reduction of the collective radiation dose** associated with export of foodstuffs produced in contaminated areas

Radiation Control System

is developed and implemented in order to:

Assess the radiation situation and determine the levels of ionizing radiation exposure

Exclude production and storage of foodstuffs and raw materials with radionuclide concentration levels above the specified limits

Evaluate the effectiveness of protective measures, provide their optimal and targeted implementation

Develop a sound *strategy* of recovery actions

Why Radiation Control?

Effectiveness of Agrotechnical and Agrochemical Techniques Towards Reduction of ^{137}Cs Uptake by Agricultural Produce

^{137}Cs uptake REDUCED up to … times

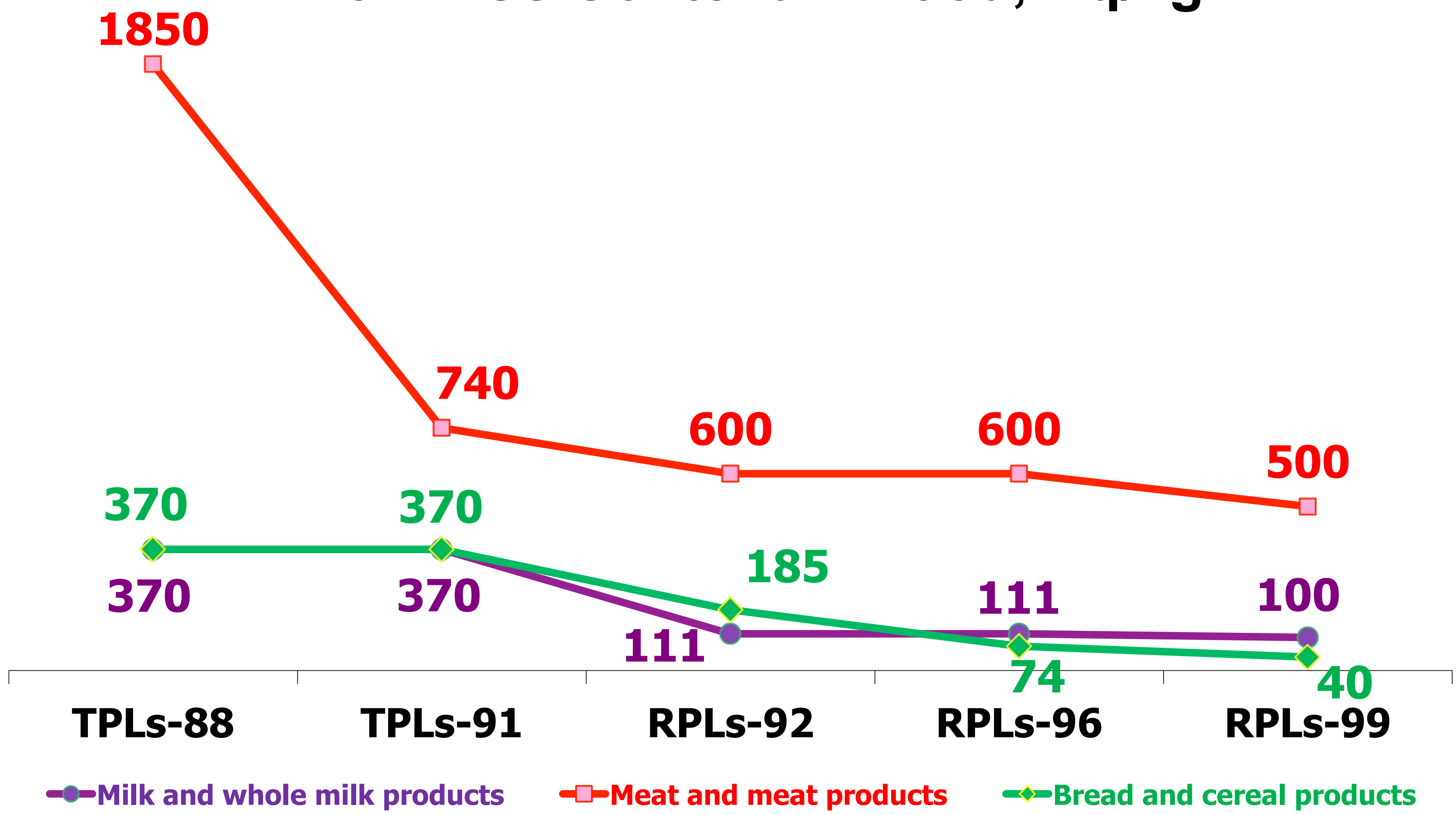
Ploughlands

	During the first 5 years	After the first 5 years
Soil Treatment (real tillage, deep tillage)	5,0	1,5
Lime Treatment (lime rate: 1,5 Hr)	4,0	2,0
Application of organic fertilizers	2,5	2,0
Application of phosphate fertilizers	1,5	0,5
Application of potassium fertilizers	3,5	3,0
Optimization of nitrogen fertilization rates	2,5	1,5
Selection of crop types with minimal uptake ability	30	5,0

Meadows

	During the first 5 years	After the first 5 years
Root improvement	6,0	3,0
Surface improvement	3,0	1,5
Selection of grass mixtures	3,0	2,0

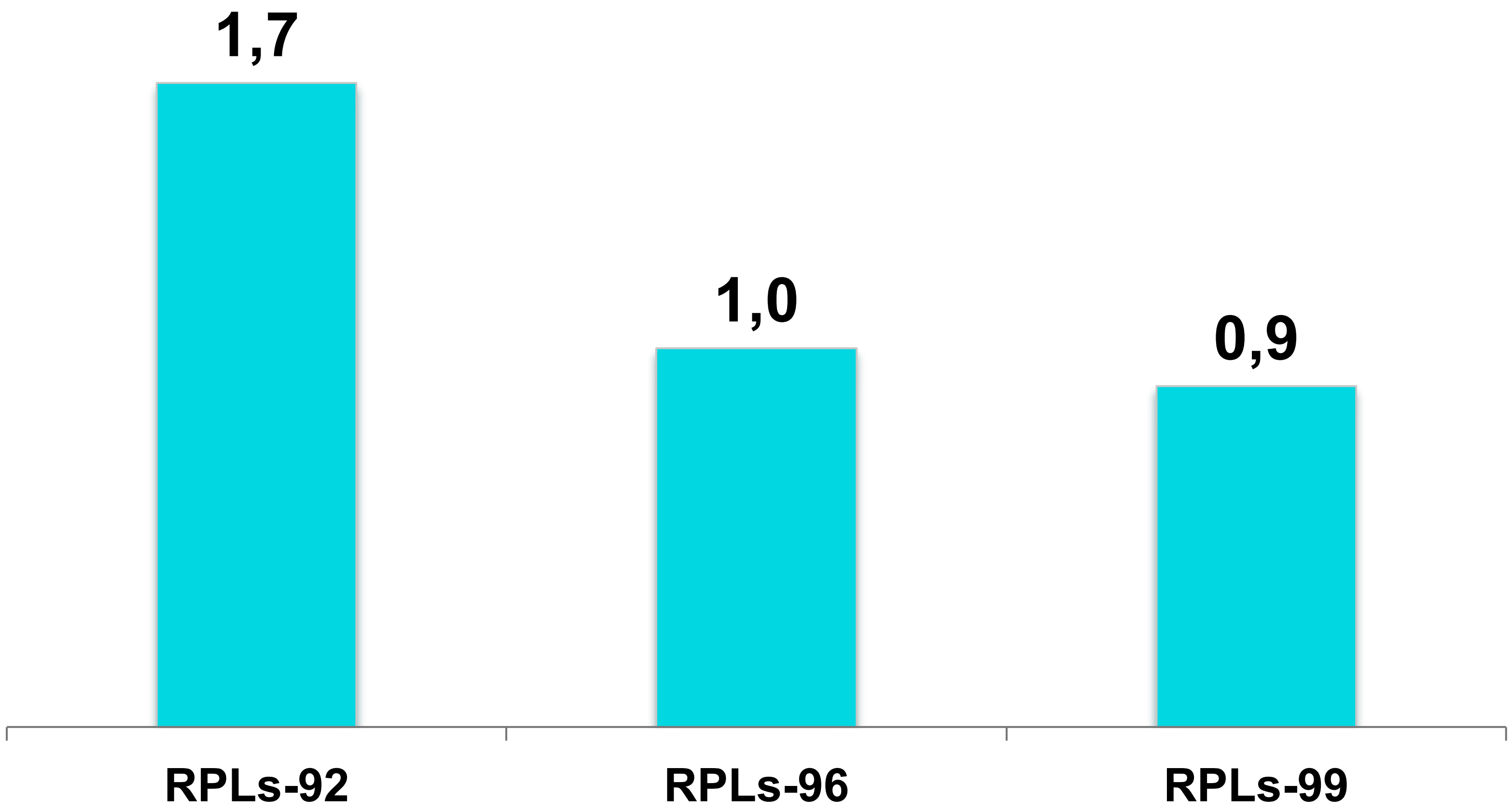
Gradual Revision (reduction) of Permissible Levels for ^{137}Cs Content in Food, Bq/kg



TPLs – Temporary Permissible Levels

RPLs – Republican Permissible Levels (RPLs-99 is a current national standard for ^{137}Cs)

Internal Radiation Doses of the population of Belarus depending on particular RPLs, mZv/year



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Crop Yield Processing and ^{137}Cs Content in the End Products, %