РОССИЙСКАЯ АКАДЕМИЯ НАУК
Институт проблем безопасного развития атомной энергетики

RUSSIAN ACADEMY OF SCIENCES
Nuclear Safety Institute (IBRAE)

Nuclear Legacy – Integrated and Long-Term Environmental Safety Aspects

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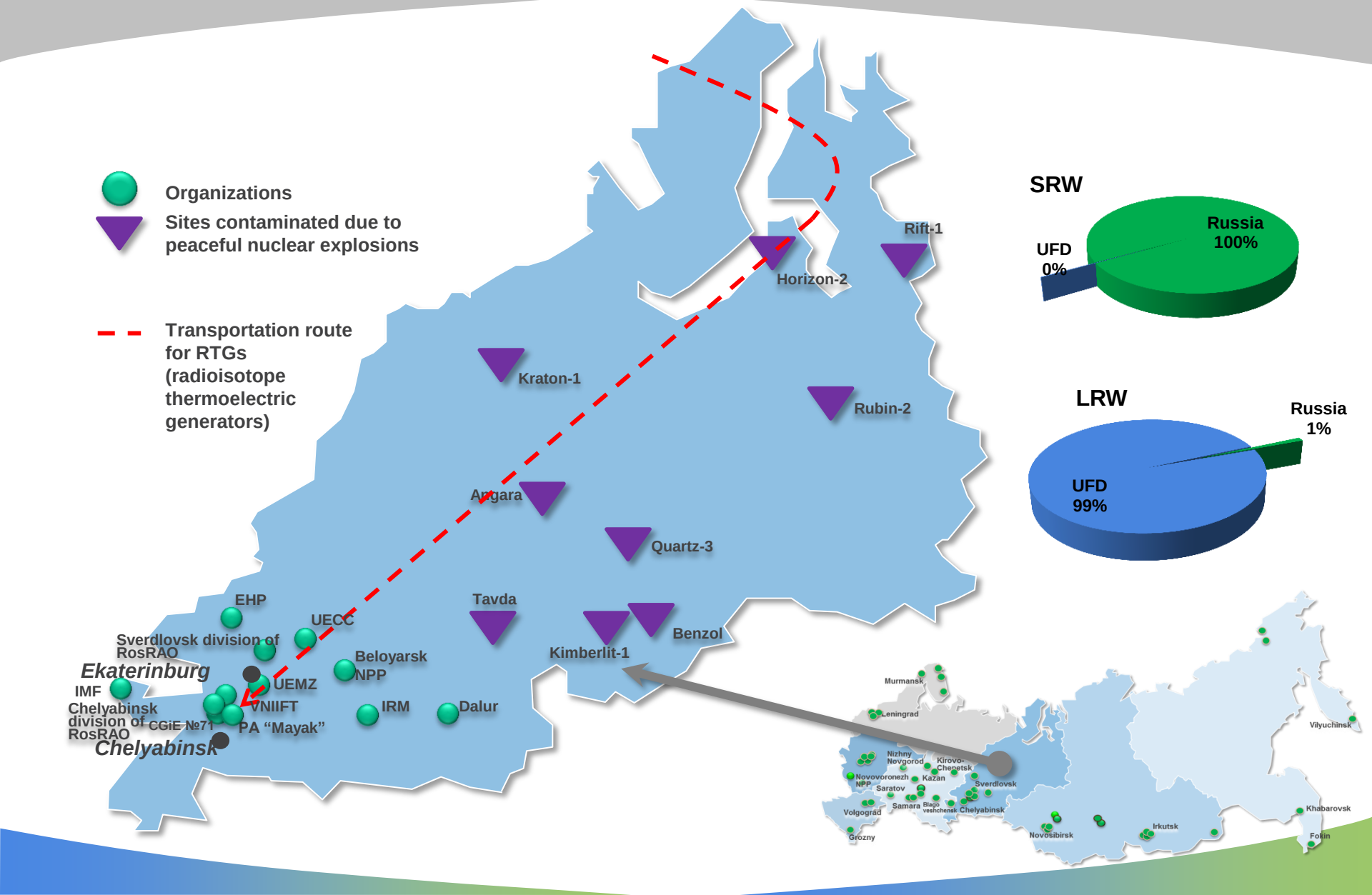
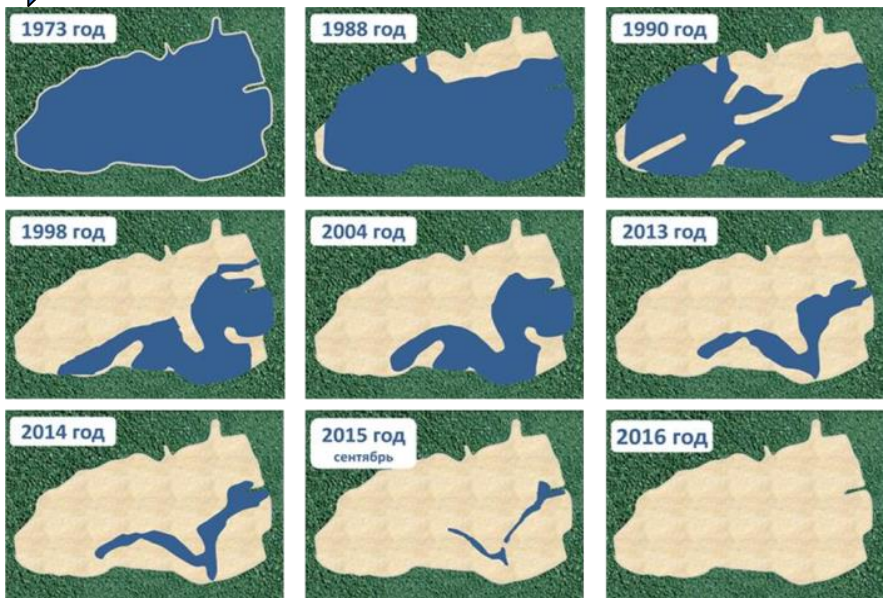
Nuclear Legacy



Decreasing Risks from LRW Stored at FSUE “PA “Mayak”

Facility	Facility state in 2007	Facility state in 2015
TCR	Strong dependency on natural impacts (1,09E+23)	Risk of dam failure causing radioactive contamination of adjacent area was fully eliminated. Management controls enabled
V-17	Operation	Termination of RW discharges, predecommissioning efforts
V-9	High risk of radionuclide spread due to tornados and subsequent ground water contamination (1,70E+25)	100% of water surface was capped, lens of contaminated ground water was confined.

Staged water surface capping at V-9 reservoir (lake Karachay)



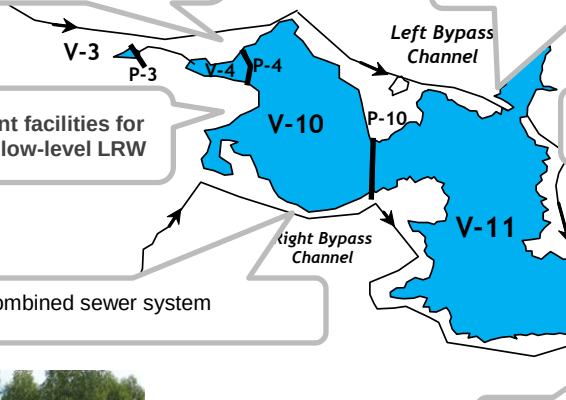
Progress at the Techa Cascade of Water Reservoirs

Before the FTP NRS:
Inevitable dam failure resulting in a major radiation accident

- 30,000 ha – flooded areas;
- 10,000 ha – forest lands;
- 20,000 ha – framlands;
- 200 km of roads;
- Over 62,000 people residing in the flooded zone;
- Estimated cost > 10 bln RUB.

Endurance tests at facilities treating TCR water and non-process LRW discharged into TCR

Weir sills at bypass channels



Treatment facilities for process low-level LRW

Upgrading hydroengineering structures

Combined sewer system

Reconstruction of the terminal dam

Tech River Remediation, SEP 2008-2011

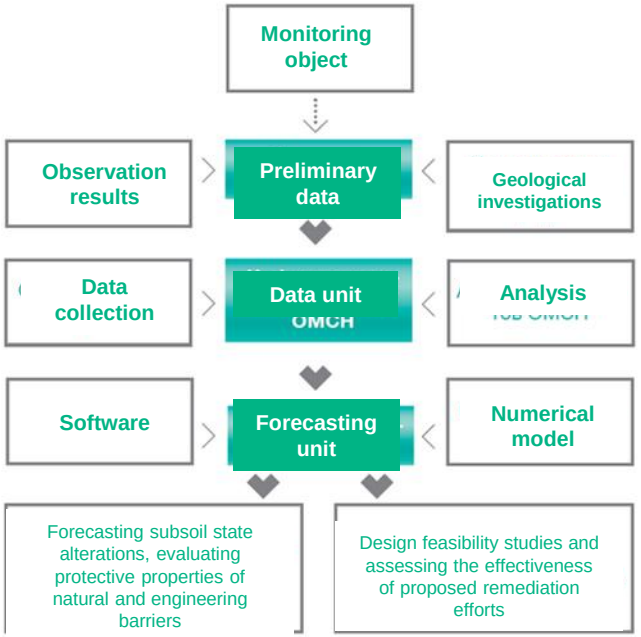
Muslumovo village

- Cleanup activities covering 4 areas inside the floodplain (2 km)
  - Contaminated floodplain was confined with the use of clayey and capillary intercepting layers;
  - River bed stabilization using quarry fill thus excluding flooding in case of extreme flood conditions;
  - tree and shrubbery plantings.

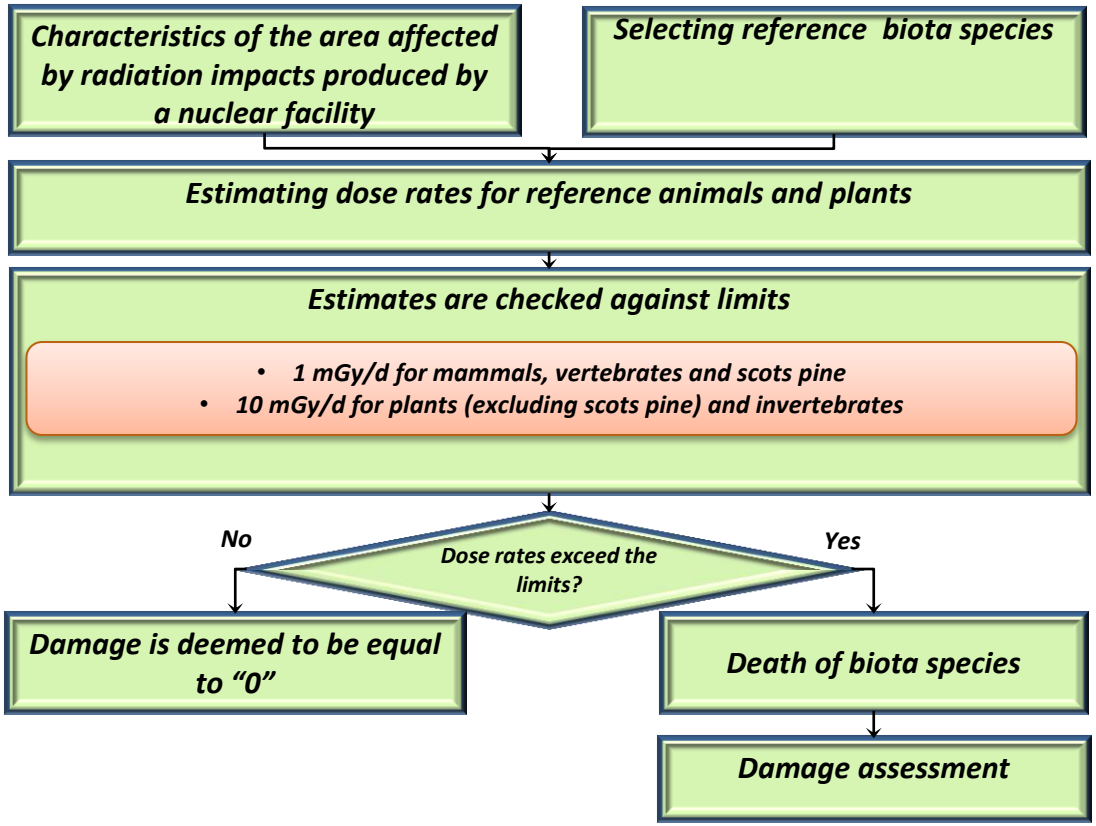
- Resettlement of 603 households
- Area clean-up (850 buildings and structures, 32 km of networks, household waste disposal)
- The area was given the status of “reserve lands”

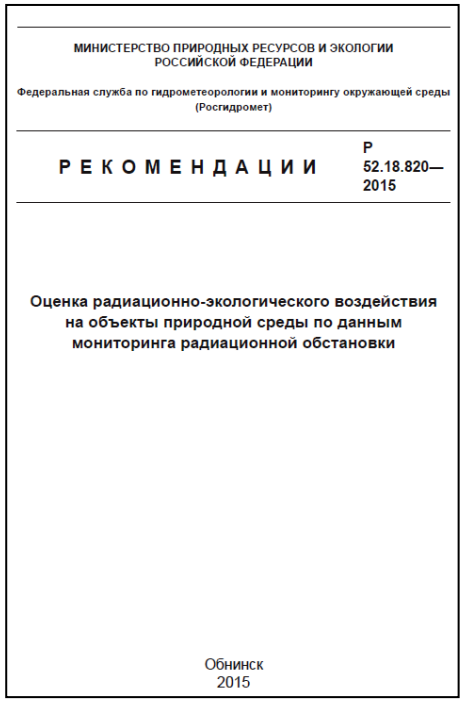
Scientific Justification

1. System for facility-level subsurface monitoring (OMSN) covering industrial sites and the adjacent areas of FSUE “PA “Mayak” and JSC “UECC” run by FSUGE «Hydrospetzgeologiya»
2. Evaluation of environmental impacts produced by facilities
3. Integrated assessment of nuclear legacy facilities (KIRO)
4. Assessing radiation induced impacts on the environment
5. Inventorying nuclear and radiation hazardous facilities and performing RW initial registration



Conservative Estimates for the Overall Potential Environmental Damage due to RW in Situ Disposal





МИНИСТЕРСТВО ПРИРОДНЫХ РЕСУРСОВ И ЭКОЛОГИИ РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральная служба по гидрометеорологии и мониторингу окружающей среды (Росгидромет)

Р Е К О М Е Н Д А Ц И И

Р 52.18.820—2015

Оценка радиационно-экологического воздействия на объекты природной среды по данным мониторинга радиационной обстановки

Обнинск
2015

The study showed that environmental damage at "PA "Mayak" site was not equal to 0 in two cases only, namely, the lake Karachay and lake Staroe Boloto. Radiation impacts associated with other facilities produce no environmental damage!

Environmental Damage: Lake Karachay Case Study

- In 2015, integrated environmental assessment was completed for lake Karachay which preceded the capping campaign and involved zooplankton and phytoplankton studies.

Findings: high levels of radioactive and chemical contamination found in lake did not cause the extinction of biological communities

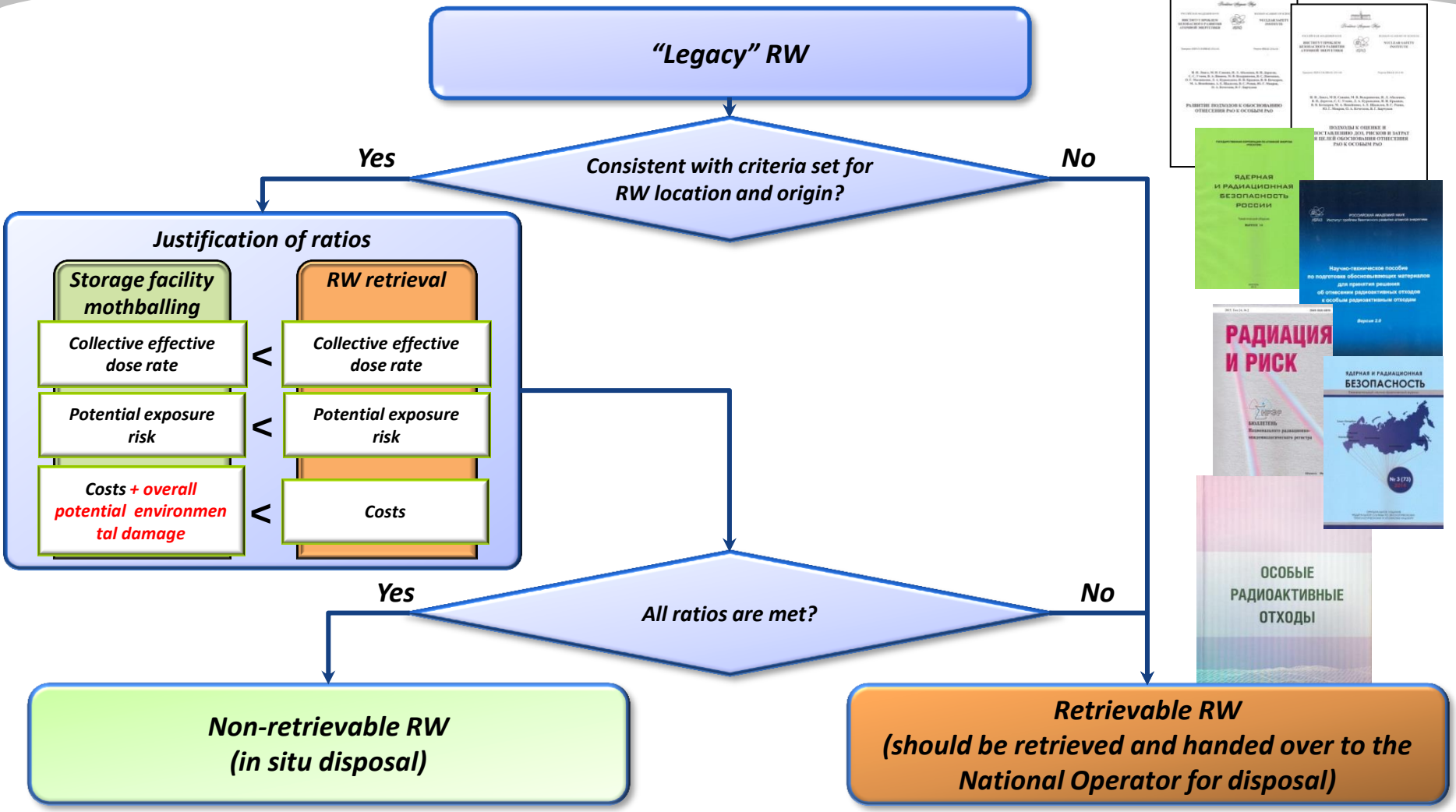
- Damage assessment for riverside biota:

Reference biota species	Safe level, mGy/day	Dose rate, mGy/day
Earthworm	10	0.01-75
Mouse	1	0.2-210
Duck	1	0.01-72
Frog	1	0.01-100
Flying insect	10	0.02-76
Snake	1	1-340
Tree/pine	1	0.05-43
Grass	10	0.02-52

Findings: Environmentally safe levels set for biota exposure were exceeded at V-9 shoreline (lake Karachay) of up **30-50 m** width.

Surface area covered in research - 6-10 ha, damage cost estimates **< 65 mln RUB**.

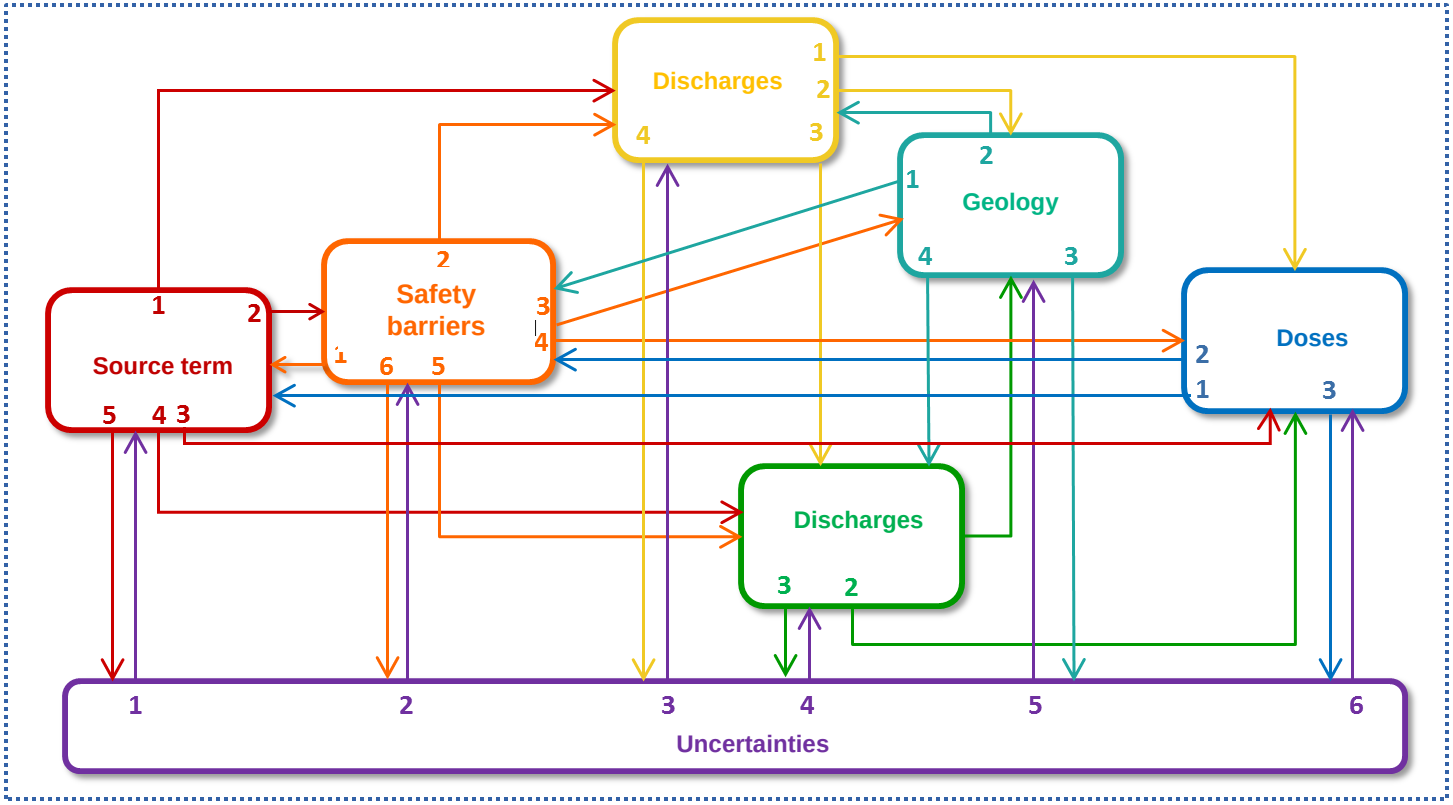
Decision on the Final State and the Strategy for its Attainment: RW



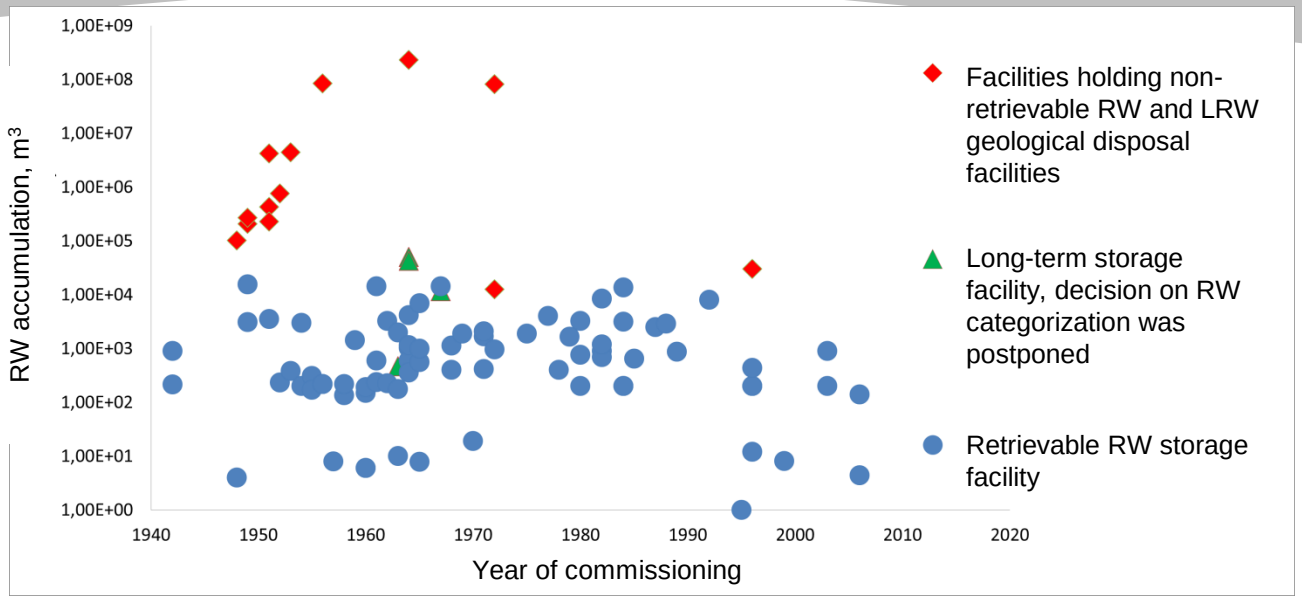
Evaluation of Long-Term Safety for Public

Meeting the dose criterion: $\max_{t\in[0;T]}\left(E_{pub.t}\right) \leq 10\,\frac{\mu Sv}{year}$

- SSR-5 “Disposal of Radioactive Waste” Specific Safety Requirements, IAEA, 2011.
- Specific Safety Guide No. 14 "Geological Disposal Facilities for Radioactive Waste". IAEA, Vienna, 2011.
- Specific Safety Guide No. 23 "The Safety Case and Safety Assessment for Disposal of Radioactive Waste", IAEA, Vienna, 2012.

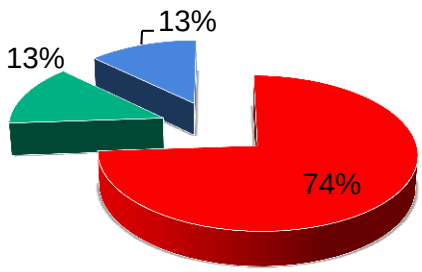


RW Initial Registration in UFD: Results



	Total	Non-retrievable	Postponed decision	Retrievable RW
Number of RW Storage Facilities	110	13	4	93
%	100	99.94	0.04	0.03
		FSUE "PA "Mayak"	UECC, Ozersk Branch of Biophysics Institute, Rezhevsk Administration (Ozerny)	

SRW



- Retrievable RW
- Postponed decision (RW are held in long-term storage facilities)
- Pending retrieval and disposal

Conclusions

1. Wide use of modern radiation risk and environmental damage assessment methodologies, as well as application of radiation risk management methods and radiation monitoring systems can be considered as a key element of successful implementation of UFD activities performed under NRS federal target programs (state customer-coordinator – the State Corporation “Rosatom”).

2. The next step is taking the stock of lessons learnt during the implementation of federal target programs activities and other efforts associated with environmental restoration, environmental damage evaluation and mitigation in UFD and other regions of the Russian Federation.

- Thank you for your attention!