

# Project 1.4: RECONSTRUCTION OF DOSE TO THE RESIDENTS OF OZERSK FROM THE OPERATION OF THE MAYAK PRODUCTION ASSOCIATION: 1948–2002

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*RHSP – Celebrating 30 Years of Scientific  
Achievements*

Bruce Napier

# Goals for Project 1.4

- **Reconstruction of atmospheric releases from the MPA**
- **Atmospheric Transport**
- **Deposition on Vegetation**
- **Transfer to milk and other animal products**
- **Analysis of food production**
- **Historical age-dependent food consumption rates**
- **Uptake via mother's milk**
- **Ingestion doses**
- **Inhalation doses**
- **External dose calculations**
- **Doses from non-iodine radionuclides**
- **Validation using monitoring data**

# Goals for Project 1.4 - Completed

- **Reconstruction of atmospheric releases from the MPA**
- **Atmospheric Transport**
- **Deposition on Vegetation**
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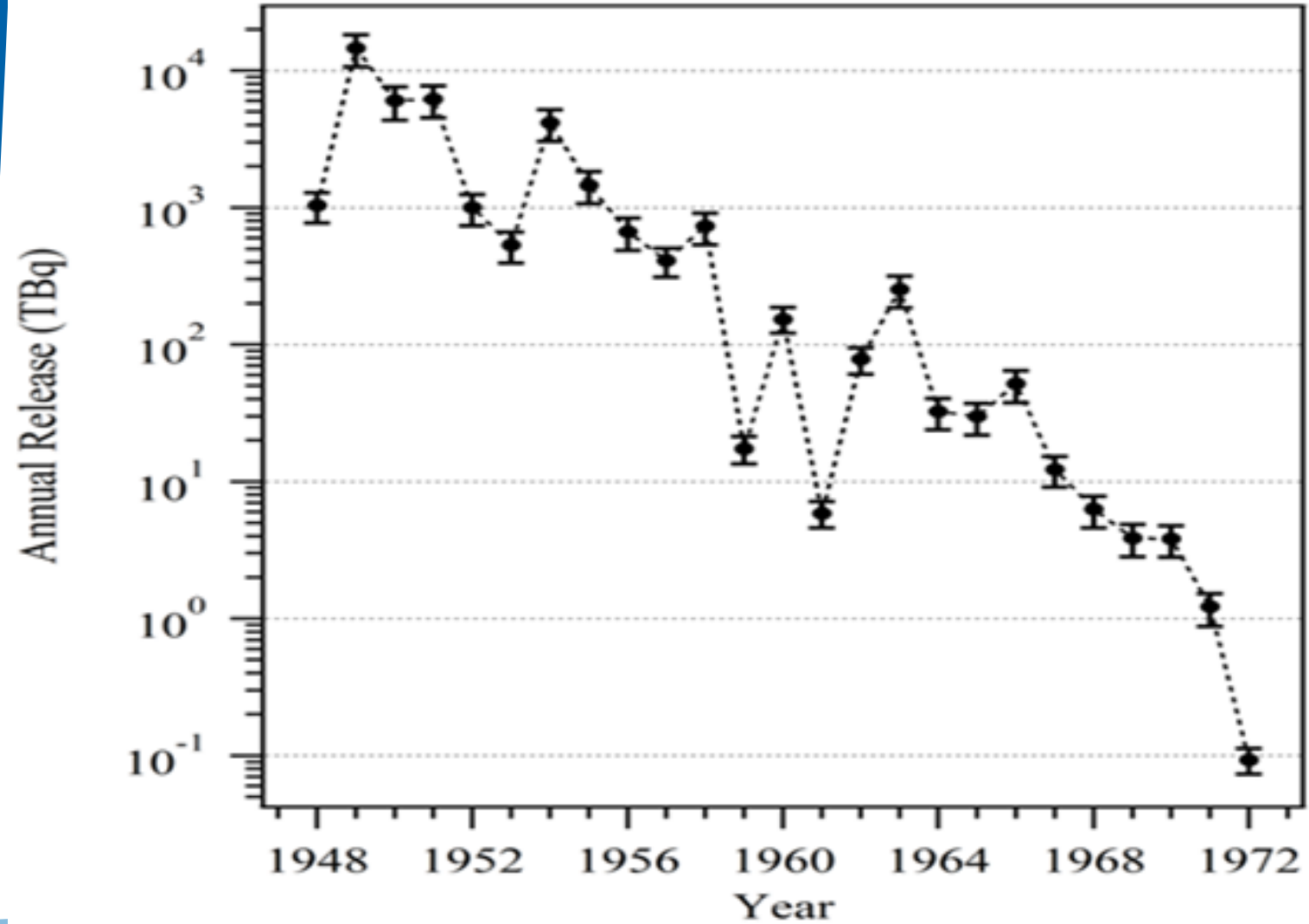
# Atmospheric Releases of $^{131}\text{I}$

Mokrov YuG et al. Reconstruction of Atmospheric Releases of  $^{131}\text{I}$  From Mayak Radiochemical Plant Stacks for the Period from 1948 to 1970,

Part 2: Results of the Reconstruction of  $^{131}\text{I}$  Releases from the Stacks of the Reactor and Radiochemical Plants, Milestone 7

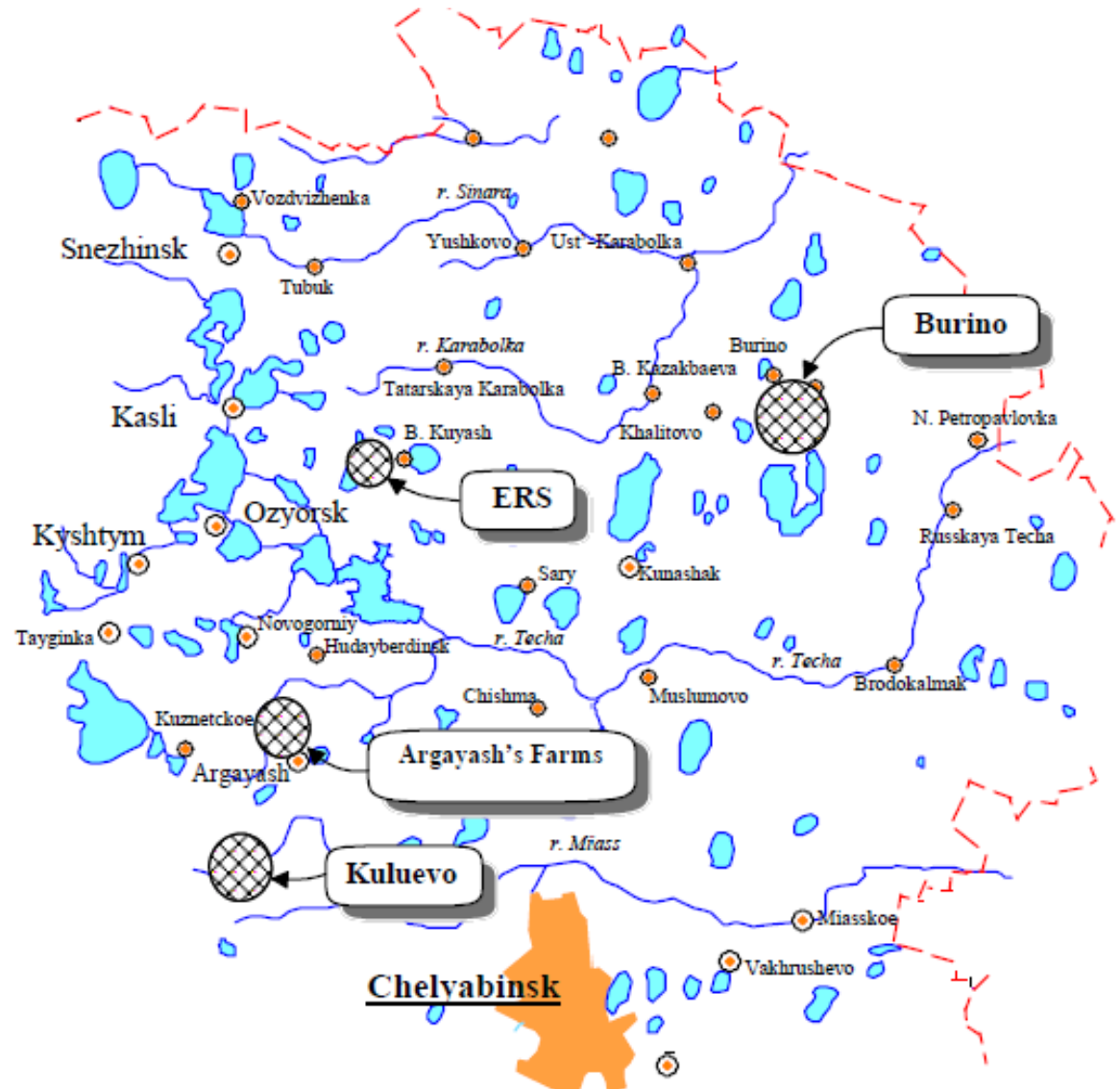
As reported in:

Napier BA et al. Calculations of individual doses for Techa River Cohort members exposed to atmospheric radioiodine from Mayak releases, " Journal of Environmental Radioactivity, DOI:10.1016/j.jenvrad.2017.08.013; 2017



# Local Sources of Food and Milk for Ozersk were Identified

- A few cows and goats supplied milk in the city before 1959
- About 25% of residents had private gardens
- Milk was supplied by four collective farms



Mokrov YuG, et al. 2008. CHANGES IN POPULATION FOOD RATION AND DEMOGRAPHIC PARAMETERS FOR OZERSK IN 1948–2002

Milestone 6

# Doses from Non-iodine Radionuclides

- Primarily Ar-41, plus xenons and kryptons released from air-cover of reactor graphite stacks
- Doses generally <10 mSv, so discounted for Project 1.4 –and 1.1 and 2.4

*Table 8. Specified total (for the whole calculation period) external effective doses in the indicated populated areas due to the release of noble radioactive gases from the reactors.*

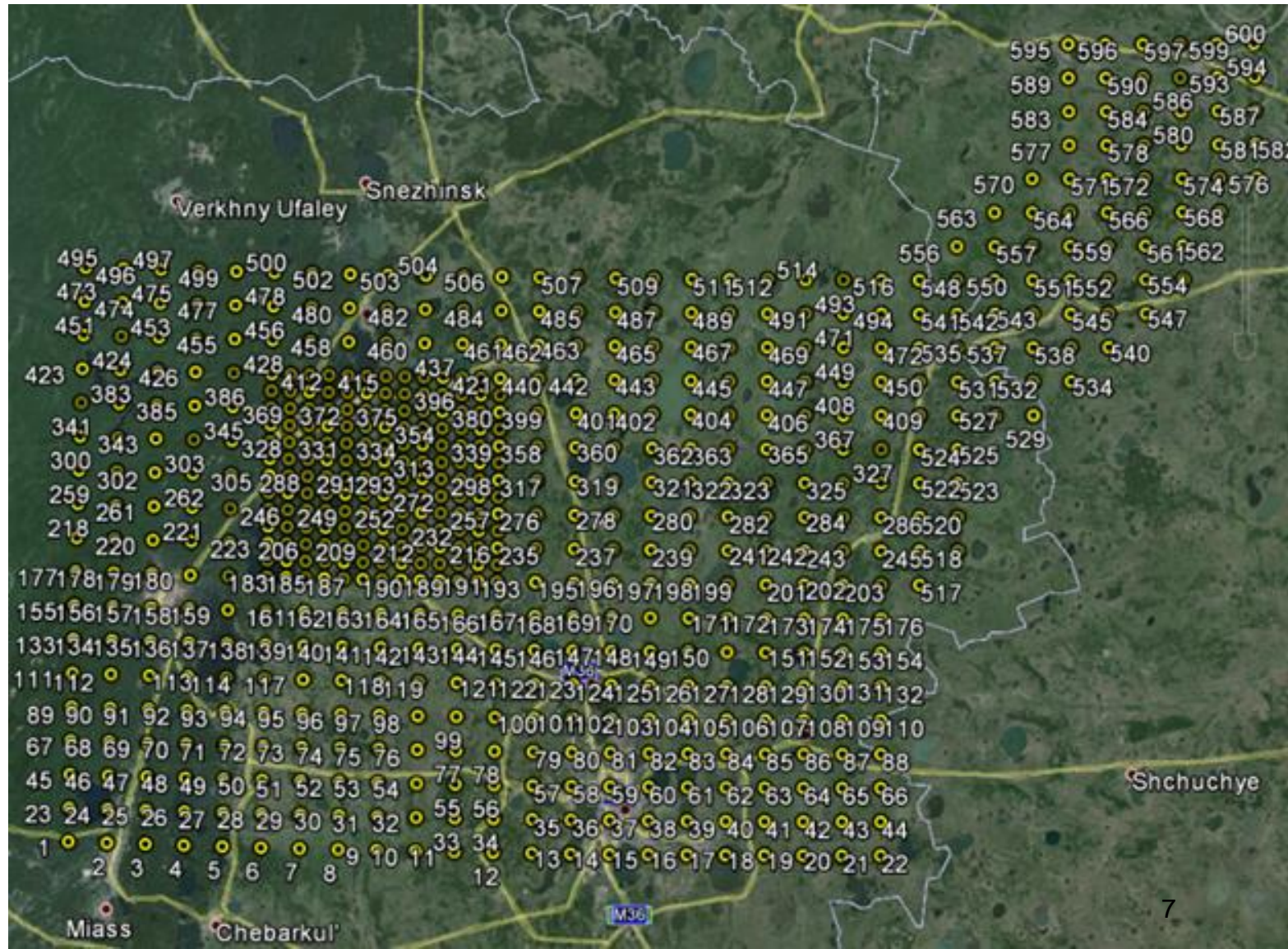
Location	Dose from noble radioactive gases, mSv	
	Location and shielding not taken into account	Staying indoors and shielding properties of buildings are taken into account
Meteostation	14	7.9
CPL	9.1	5.0
Novogorny Settlement	20	11
Metlino Settlement (on the Techa River)	91	50
Kyshtym Town	5.1	2.8
Kasli Town	5.5	3.0
Metlino Settlement (ONIS)	17	9.6
Settlement No. 2	17	9.3
Khudaiberdinsk Settlement	18	10

Mokrov YuG et al. 2009.  
 RECONSTRUCTION OF EXTERNAL DOSE CAUSED BY ATMOSPHERIC RELEASES OF NOBLE RADIOACTIVE GASES FROM THE STACKS OF THE MAYAK REACTORS IN 1948–1989, Mayak Production Association  
 Milestone 10 Part 2



# Atmospheric Dispersion of $^{131}\text{I}$

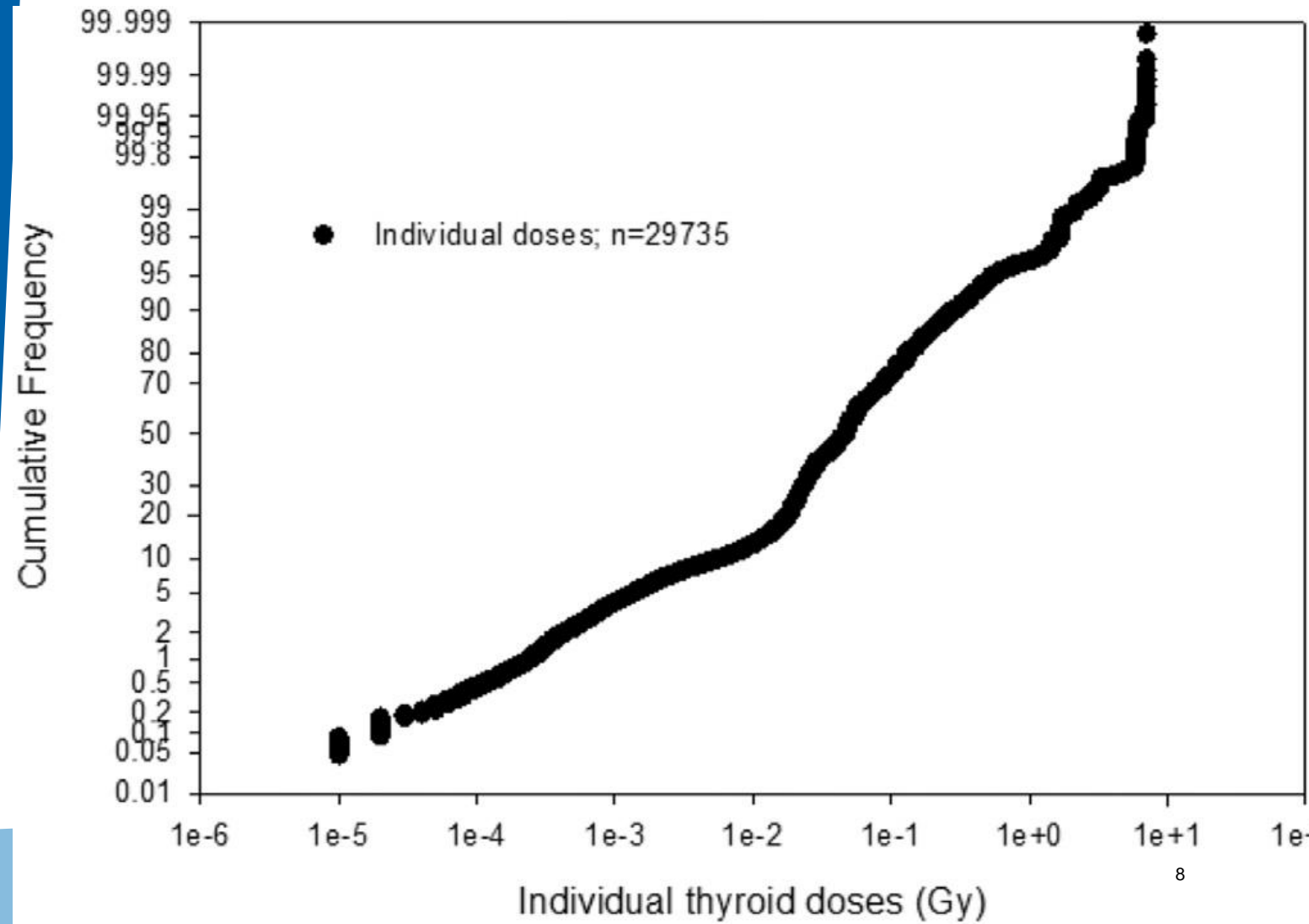
Hourly information on atmospheric conditions was not available; however hourly data from a nearby location in recent years was used as a surrogate and sampled via Monte Carlo techniques to provide a reasonable uncertainty range.



# Thyroid Doses Estimated for Project 1.1

Cumulative distribution of individual best-estimate thyroid doses from  $^{131}\text{I}$  accumulated over the period 1948-1972 for all TRC members

Napier BA et al. Calculations of individual doses for Techa River Cohort members exposed to atmospheric radioiodine from Mayak releases, ." *Journal of Environmental Radioactivity*, DOI:10.1016/j.jenvrad.2017.08.013; 2017





# The Key Objective of Project 1.4 was Not Completed

- **Mayak PA left the project in 2009**
- **Nearly all necessary data had been developed**
- **Modeling of doses for individuals in Ozersk was not done**
- **The subsequent epidemiological studies of the exposed children in Ozersk remain to be done**