

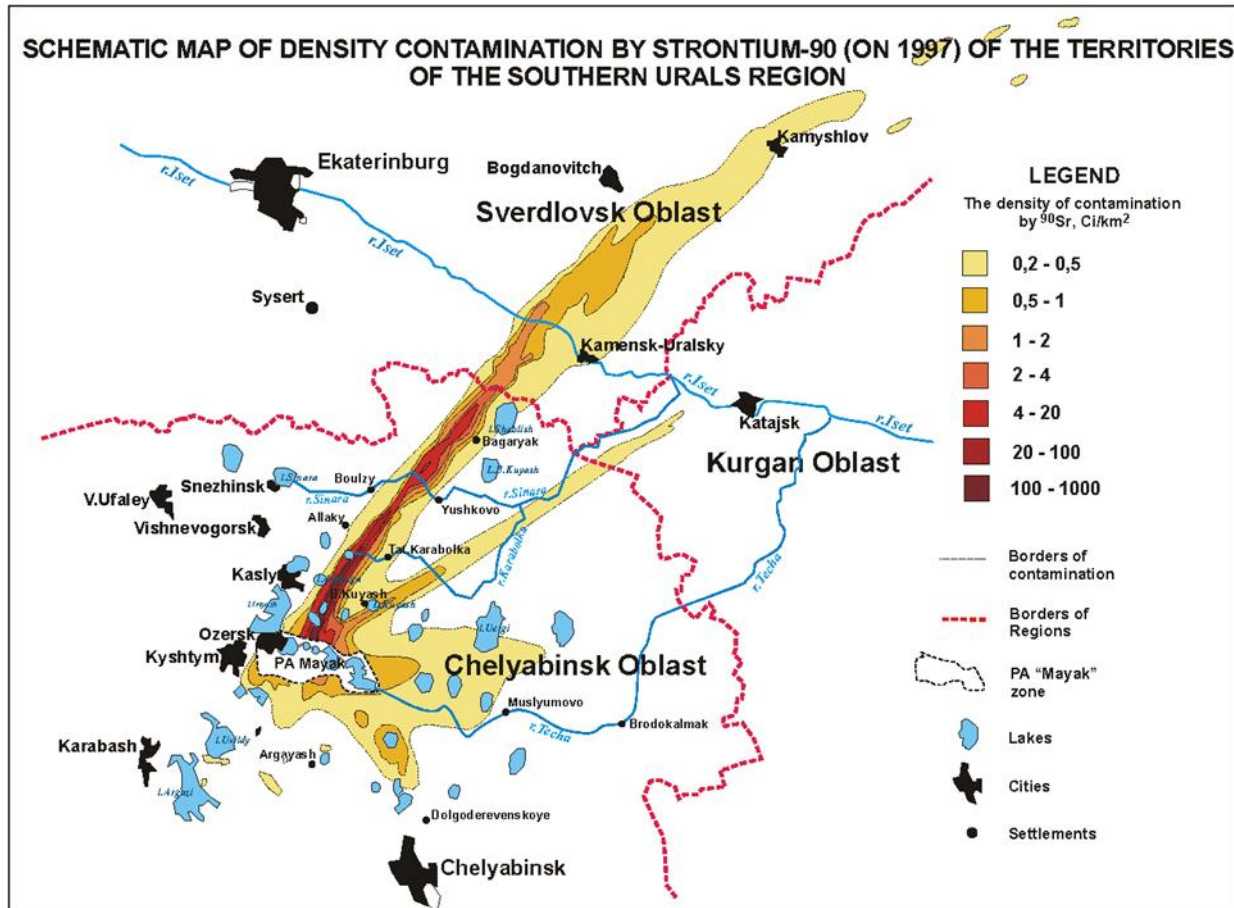


# Federal Medical Biological Agency Urals Research Center for Radiation Medicine

Evolution of the Research Performed in the  
Urals Research Center for Radiation  
Medicine of the FMBA of Russia within the  
Framework of the U.S.-Russian Agreement

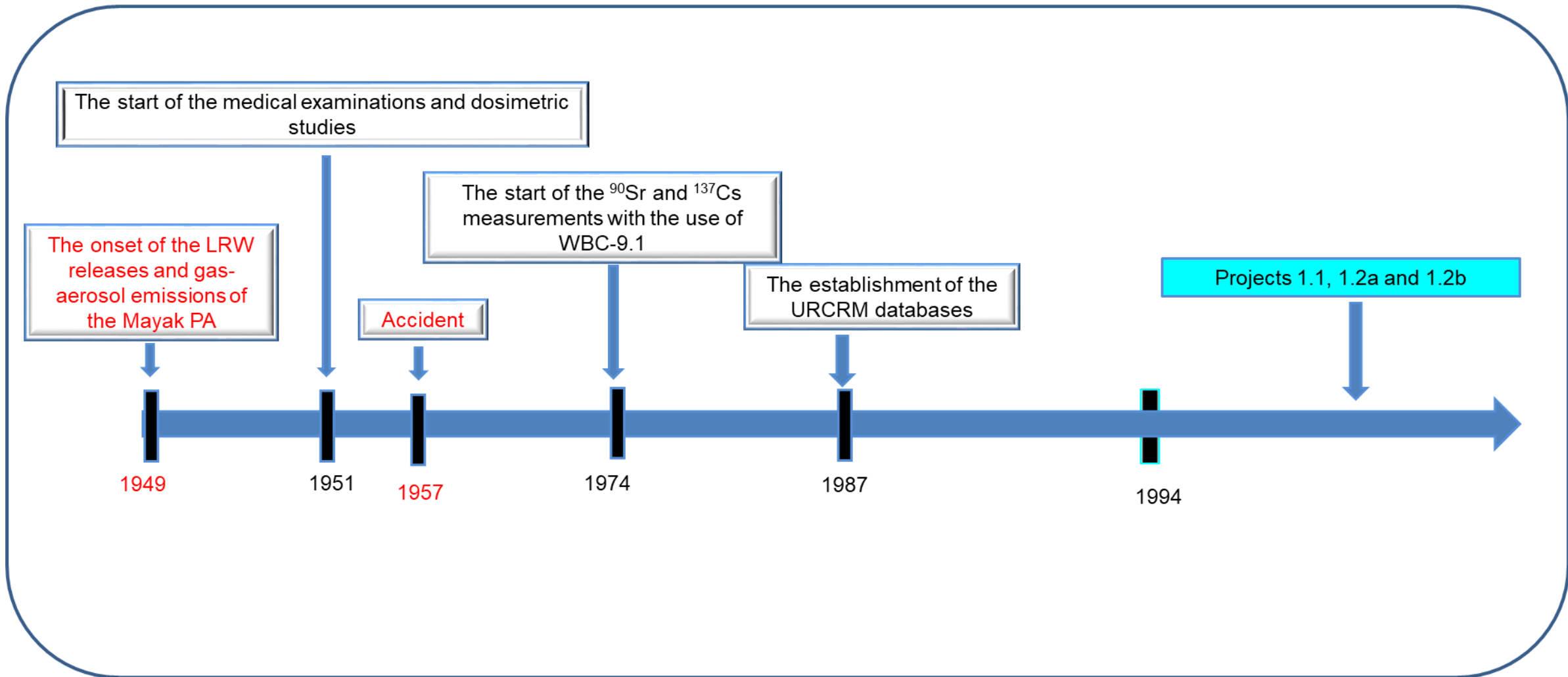
**A.V. Akleyev**

# Sources of the Population Exposure in the Urals Region



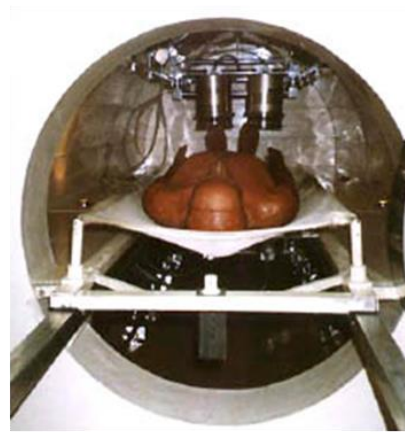
- The Techa River— 115 PBq, 1949 - 1956
- 1957 accident - 800 PBq
- Gas-aerosol emission of the «Mayak PA» ( $^{131}\text{I}$ ) — 38 PBq

# Historical Account of the Studies



# Monitoring of $^{90}\text{Sr}$ and $^{137}\text{Cs}$ Content in a Human Body

Technique	Measurement period	Number	Usage
<b>Post-mortem</b>			
Radiometry of tissue samples and radiochemical analysis of the bone samples ( $^{90}\text{Sr}$ )	1951–1989	> 1 200	Internal dose reconstruction
<b>In vivo</b>			
Radiometry of excreta (faeces and urine)	1951–1958	> 10 000	$^{90}\text{Sr}$ intake reconstruction
Radiochemical analysis of the urine ( $^{90}\text{Sr}$ )	1962–1979	> 2 900	Monitoring
Tooth-beta counting( $^{90}\text{Sr}$ )	1957–1997	> 23 500	$^{90}\text{Sr}$ intake reconstruction
WBC measurements ( $^{137}\text{Cs}$ и $^{90}\text{Sr}$ )	since 1974	> 30 000	Internal dose reconstruction



# Epidemiological Study of the Mayak and Techa River Cohorts in the Russian Federation (1995-1998)

## **Project PI:**

- Dale Preston (RERF)
- M.M. Kosenko (URCRM) and N.A. Koshurnikova (SUBI)

**The aim of the project:** improvement of the data base data quality

## **Tasks:**

- Identification of cohort members
- Establishment of the on-going follow-up of the vital status
- Unification of the data on the disease cases and deaths
- Formation of the comparison groups
- Improvement of dosimetry
- Preliminary analysis of cancer and leukemia radiation risk

# Project 1.2a «Physical Preservation of the Existing Data» (1997-2005)

## **Principal Investigators:**

- N.V. Startsev, URCRM
- D.L. Cragle, Institute for Science and Education, Oak Ridge (ORISE)

**The aim of the project:** provision of the physical preservation of paper medical and other records of the URCRM archive

## **Tasks:**

- Formation of a record register
- Determining the appropriate methods of preserving each type of record
- Developing a plan for systematic archiving of the records (microfilming or making magnetic-optical copies)
- Scanning and indexing of the medical histories and outpatient records of persons examined in the URCRM Clinic over the period from 1951 through 2022 (In total, 102 000 records, 1.5 mln. pages)
- Document microfilming (> 650 thousand pages)

# Project 1.1 «Dose Reconstruction for the Population Subjected to Radiation» (1995-2022)

## **Principal investigators**

- M.O. Degteva
- L. Anspaugh, B. Napier

**The aim of the project**: reconstruction of absorbed organ doses from all sources of exposure

## **Tasks:**

- Development of the Techa River Dosimetry System (TRDS)
- In-depth analysis of the available data on the LRW releases into the Techa River and the emission in 1957
- Development and testing of dosimetric models including modelling of the radionuclide transport along the river system, biokinetic and dosimetric models for  $^{90}\text{Sr}$  in a human body and fetus
- Validation of model-based dose calculations
- Dose uncertainty estimation

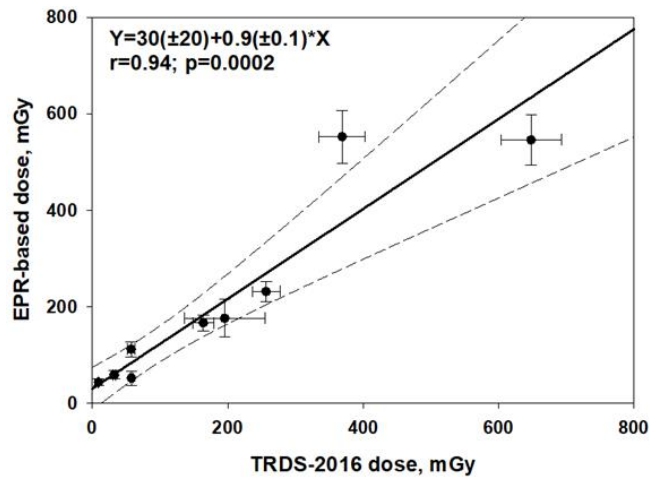


# Evolution of the Dosimetry System

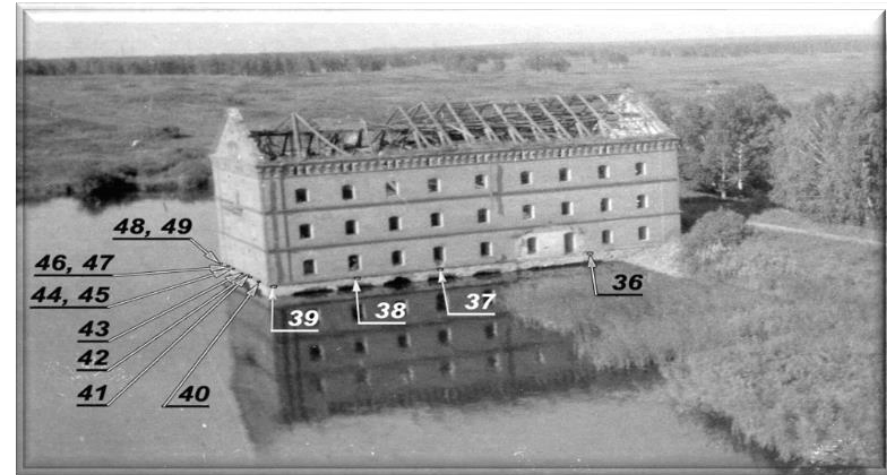
Characteristics	TRDS-2000	TRDS-2009	TRDS-2016
Information on LRW releases into the Techa River	Year-averaged approximate estimates of releases	<b>Detailed estimates of the release dynamics</b>	Refined detailed estimates of the release dynamics
Additional sources of exposure (other than the Techa River)	No	<b>EURT</b>	<b>EURT</b> <b>Routine gas-aerosol emissions</b>
Radionuclides, considered in dose calculation	$^{90}\text{Sr}$ , $^{89}\text{Sr}$ , $^{137}\text{Cs}$ , $^{95}\text{Zr}$ , $^{95}\text{Nb}$ , $^{144}\text{Ce}$ , $^{103}\text{Ru}$ , $^{106}\text{Ru}$	$^{90}\text{Sr}$ , $^{89}\text{Sr}$ , $^{137}\text{Cs}$ , $^{95}\text{Zr}$ , $^{95}\text{Nb}$ , $^{141}\text{Ce}$ , $^{144}\text{Ce}$ , $^{103}\text{Ru}$ , $^{106}\text{Ru}$	$^{90}\text{Sr}$ , $^{89}\text{Sr}$ , $^{137}\text{Cs}$ , $^{95}\text{Zr}$ , $^{95}\text{Nb}$ , $^{141}\text{Ce}$ , $^{144}\text{Ce}$ , $^{103}\text{Ru}$ , $^{106}\text{Ru}$ , $^{131}\text{I}$
Number of organs	9	<b>23</b>	23
Period of exposure	1950 – 1960	<b>1950 – 1980</b>	<b>1950 – 2009</b>
Parameters of the individualization of external and internal exposure doses	Techa River residence history, age, endpoint of dose accumulation	Techa River and EURT residence history, age, sex, endpoint of dose accumulation, <b><math>^{90}\text{Sr}</math> body burden</b>	Techa River and EURT residence history, age, sex, endpoint of dose accumulation, $^{90}\text{Sr}$ body burden, <b>location of individual households</b>



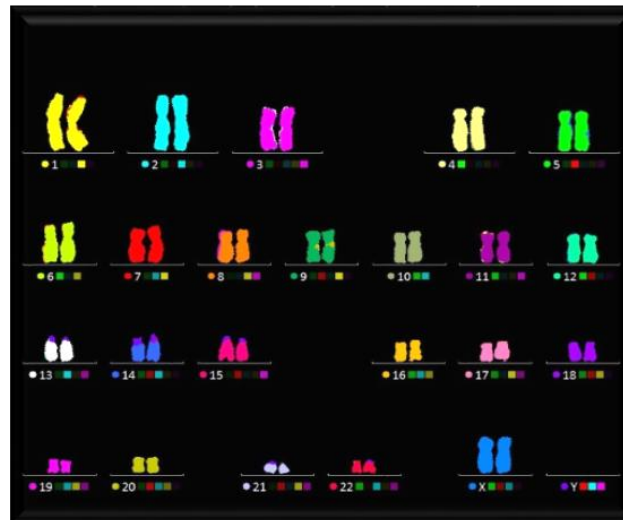
# Validation of the Estimated Doses



FISH together with Leiden University (Leiden, the Netherlands) and Public Health England (Chilton, Didcot, UK) in the framework of SOUL and SOLO projects



EPR together with the Helmholtz center Munich (Munich, Germany), Istituto Superiore di Sanita (Rome, Italy) and Institute of Metal Physics (Ekaterinburg, Russia) in the framework of SOUL and SOLO projects



TLD – together with the Helmholtz center Munich (Munich, Germany), in the framework of SOUL and SOLO projects

# Project 1.2b «Stochastic Effects of Environmental Radiation Exposure in Population Living near the PA “Mayak” (1995-2022)»

## **Principal investigators:**

- D. Preston (1995-2024), E. Ron (1995-1996), T. Thomas (1995-2000), D. Hoffman (1995-2002), F. Davis (2003-2015), D. Stram (2015-2024)
- M. Kosenko (1995-2001), L. krestinina (2001-2022), and A. Akleyev (2001-2022)

**The aim of the project:** to estimate carcinogenic risk in case of chronic low dose rate human exposure

## **Tasks:**

- Arrangement of the data and improvement of the quality of data on the follow –up and collection of residence history, vital status, incidence and mortality data for the cohort members
- Extension of the follow-up period to include the year 2019 and expansion of the catchment area
- Estimation of cancer and leukemia radiation risk in accidentally exposed population of the Urals

# The Evolution of the Project Was Based on

- The use of improved dose estimates
- Increase in the cohort size from 26.5 thousand members in the Original Techa River Cohort at the start of the study to 63 thousand persons in the “SUPER” Cohort
- Improved completeness and quality of data on the places of residence, incidence cases and causes of death
- Expansion of the catchment area
- Extension of the health status follow-up period for the exposed individuals from 1983 through 2019

# The Evolution of the Studied Cohorts

Parameter	TRC (1997)	ETRC (2013)	Combined Cohort (2018)
Size	26 485	29 730	47 951
Follow-up period	1950-1989	1950-2007	1950-2016
Person-years	641 304	927 743	1 392 394
Deceased (total)	9 307	17 307	25 723
Known cause of death, %	70%	91%	91%
Solid cancers, deaths	969	2 303	3 783

# Project Managers

- B. Fountos
- G. Fowler
- C. Gianino
- L. White
- J. Zhou
- A.Yu. Garbuzova
- V.P. Gritsenko
- N.S. Kotova
- A.A. Kruglyak
- E.M. Zhidkova

# Scientific Review Group

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- B. Boecker
- S. Davis
- B. Fountos
- M. Goldman
- W. Griffith
- N. Hertel
- G. Howe
- D. Jokisch
- J. Poston
- D. Rush
- J. Samet
- R. Shore
- S. Tolmachev,
- R. H. Withers
- L. Zablotska

## Russian Federation

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- A.P. Birukov
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- L.A. Ilyin
- V.R. Ivanov
- I.B. Keirim-Markus
- E.A. Kramer-Ageev
- B. Kukhta
- Yu. Kvacheva
- N.K. Shandala
- S.P. Yarmonenko

# Project Participants

- A.V. Akleyev
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- W. Bolsh
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- N.G. Bugrov
- D.S. Burmistrov
- D. Cragle
- F. Davis
- M.O. Degteva
- S.B. Epifanova
- P.W. Eslinger
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- O.G. Kazakova
- A.M. Kopelov
- M.M. Kosenko
- V.P. Kozheurov
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- V.A. Krivoshchapov
- T.L. Lukinykh
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- L.N. Maltseva
- L.D. Mikryukova
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- L.A. Nikolaenko
- E.V. Ostroumova
- L.M. Peremyslova
- A.M. Perevyazkina
- I.Ya. Popova
- D. Preston
- E.Yu. Reshetkova
- E. Ron
- N.G. Safronova
- B.C. Schwarz
- N.B. Shagina
- S.A. Shalaginov
- P.A. Sharagin
- E.A. Shishkina
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- S.S. Silkin
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- T.V. Taranenko
- T. Thomas
- T.E. Tokareva
- E.I. Tolstykh
- O.V. Viyushkova
- A.Yu. Volchkova
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