



**Research & Production Association “Typhoon”
of Roshydromet, Obninsk, Russia**

**Results of Radioecological Monitoring of the Irtysh-Ob’ River System
and Opportunity of Use in Monitoring and Radioecological
Assessment of Marine/Freshwater Systems Contaminated in Japan
after NPP Fukushima Accident**

ISTC Projects 2558 and 3547

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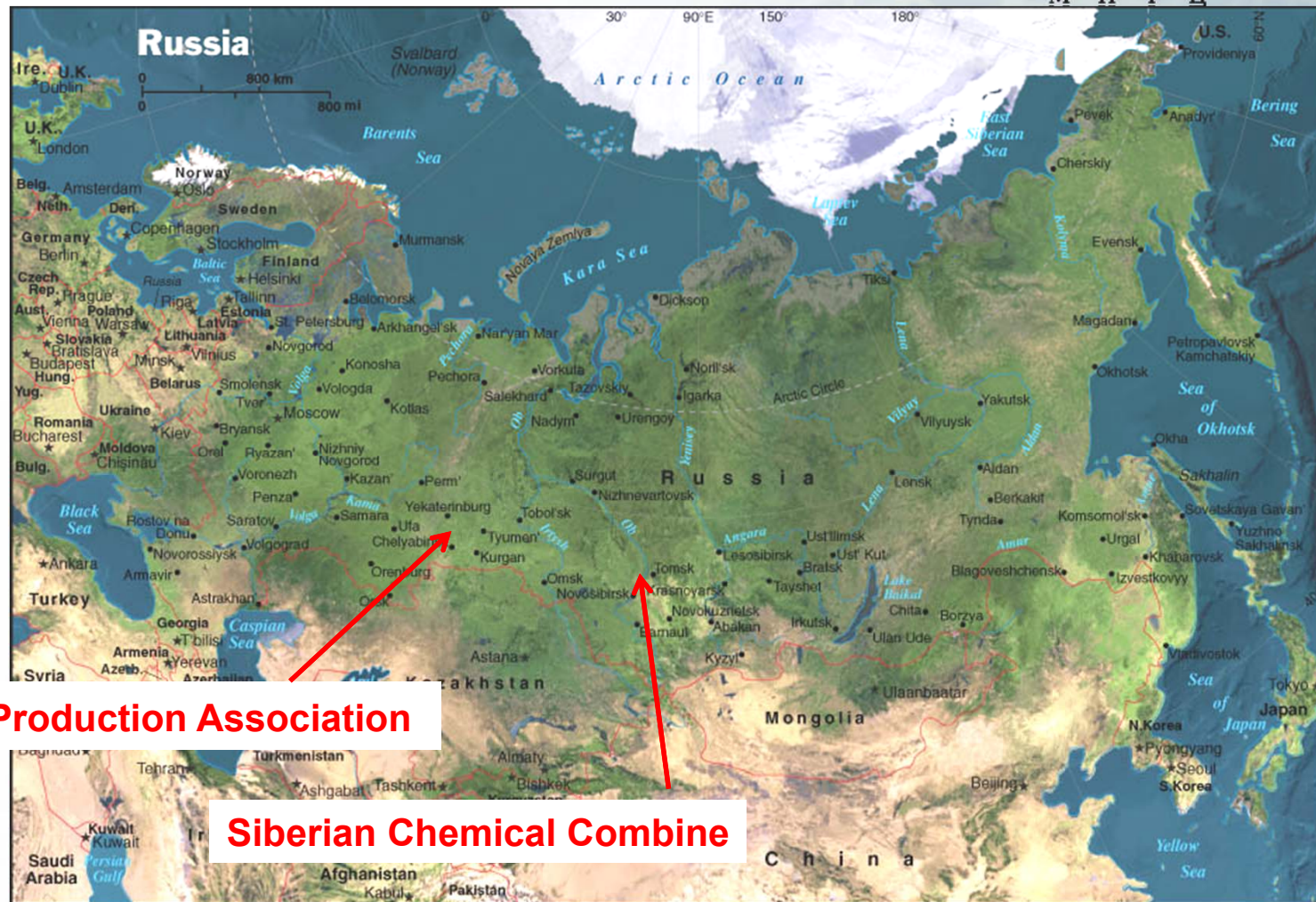
Tokyo, 3-4 February 2012



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Ob-Irtysh river system:

**Location of nuclear industry
facilities**



Mayak Production Association

Siberian Chemical Combine



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Main topic of presentation

Radioecological monitoring and development of a database on radioactive contamination of:

- **Techa-Iset-Tobol-Irtysh-Ob rivers, in the areas influenced by discharges from the Mayak Production Association (project 2558)**

- **Tom and Ob rivers, in the areas influenced by discharges from the Siberian Chemical Combine (SCC) (project 3547)**



Methodological approach for field studies:

combining boat radioecological surveys of the whole river system with regular water sampling in one of the critical regions throughout the hydrological cycle, with measurement of man-made radionuclides (^{137}Cs , ^{90}Sr , Pu isotopes and tritium)

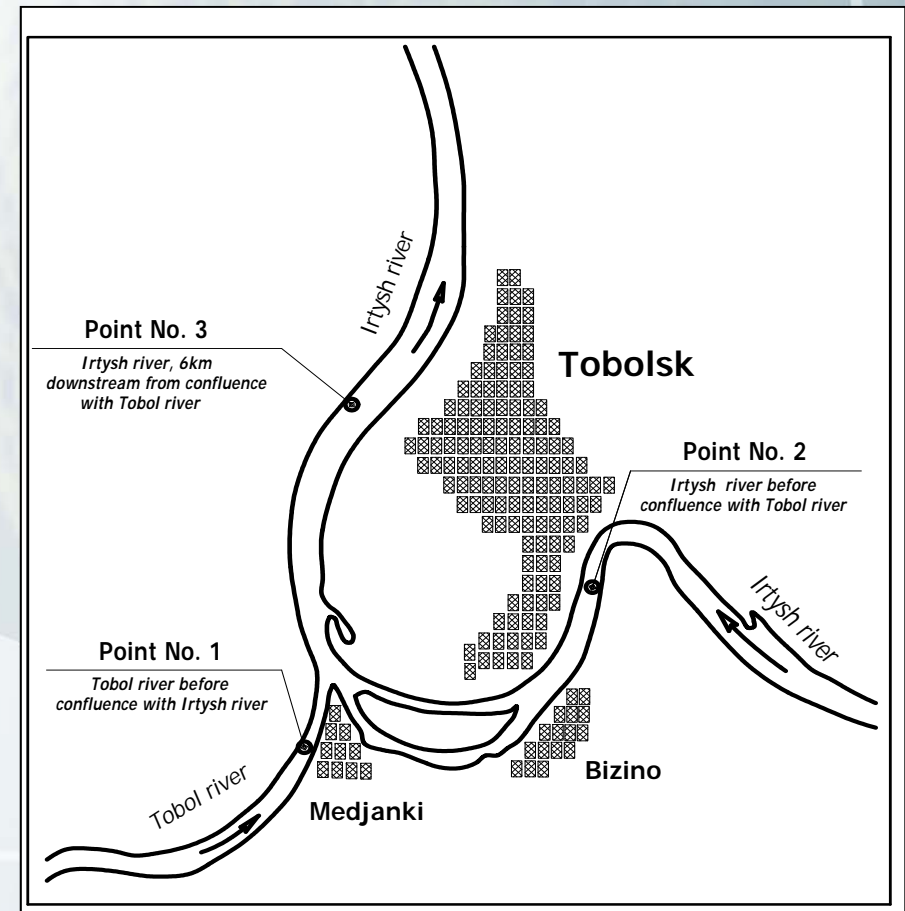


ISTC project 2558

Main region for round-the-year monitoring:

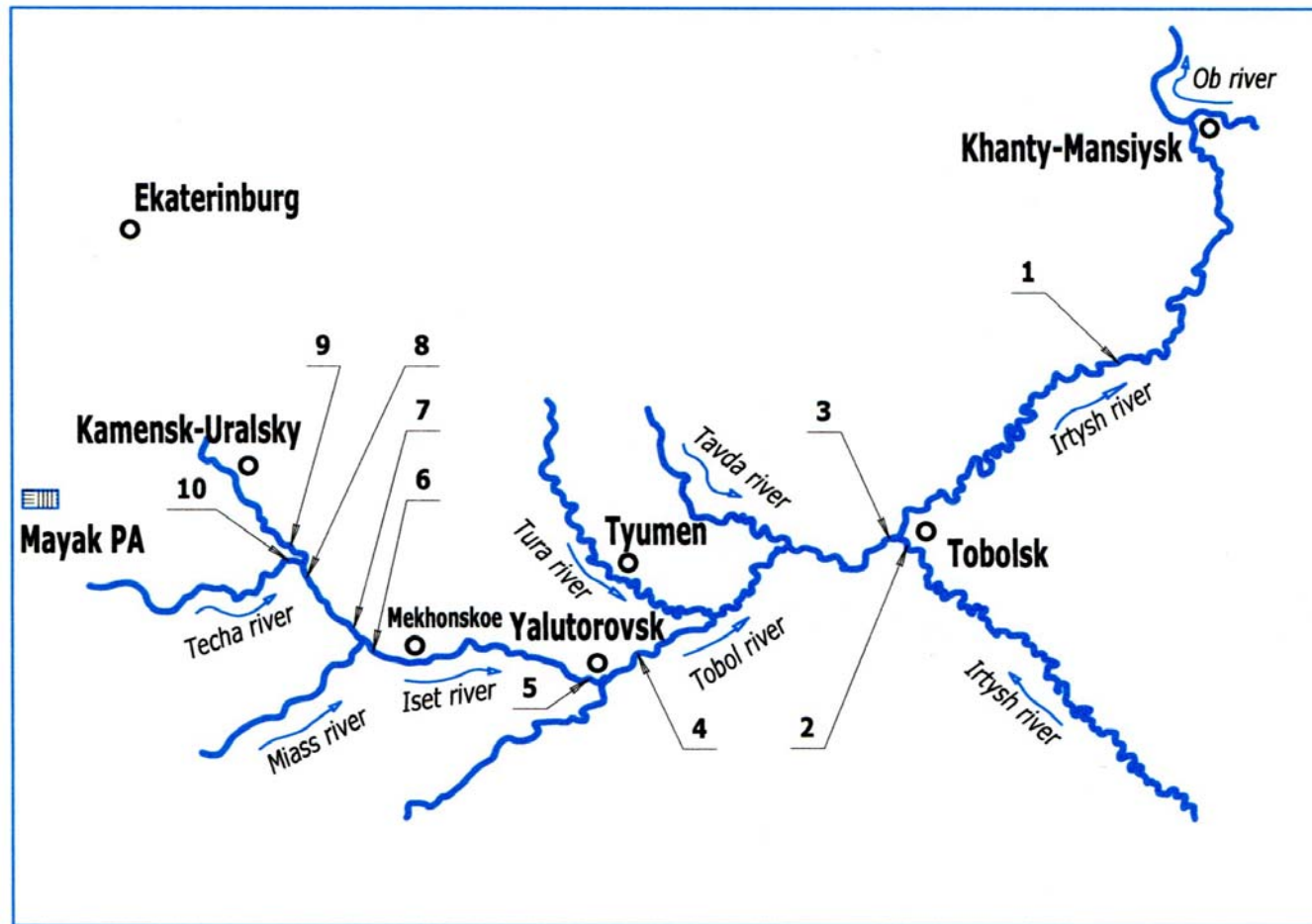
Confluence of the “contaminated” river Tobol and “clean” river Irtysh

Sampling on a monthly basis in 2004-2006 in three points.



ISTC project 2558 field studies

Radioecological surveys were conducted in 2004 and 2005 for the section between the lower reaches of the Techa river and the point of the Irtysh inflow to the Ob (totally about 1400 km).



**Survey
in August, 2005.
Location of cross-
sections for water
environment
sampling.**



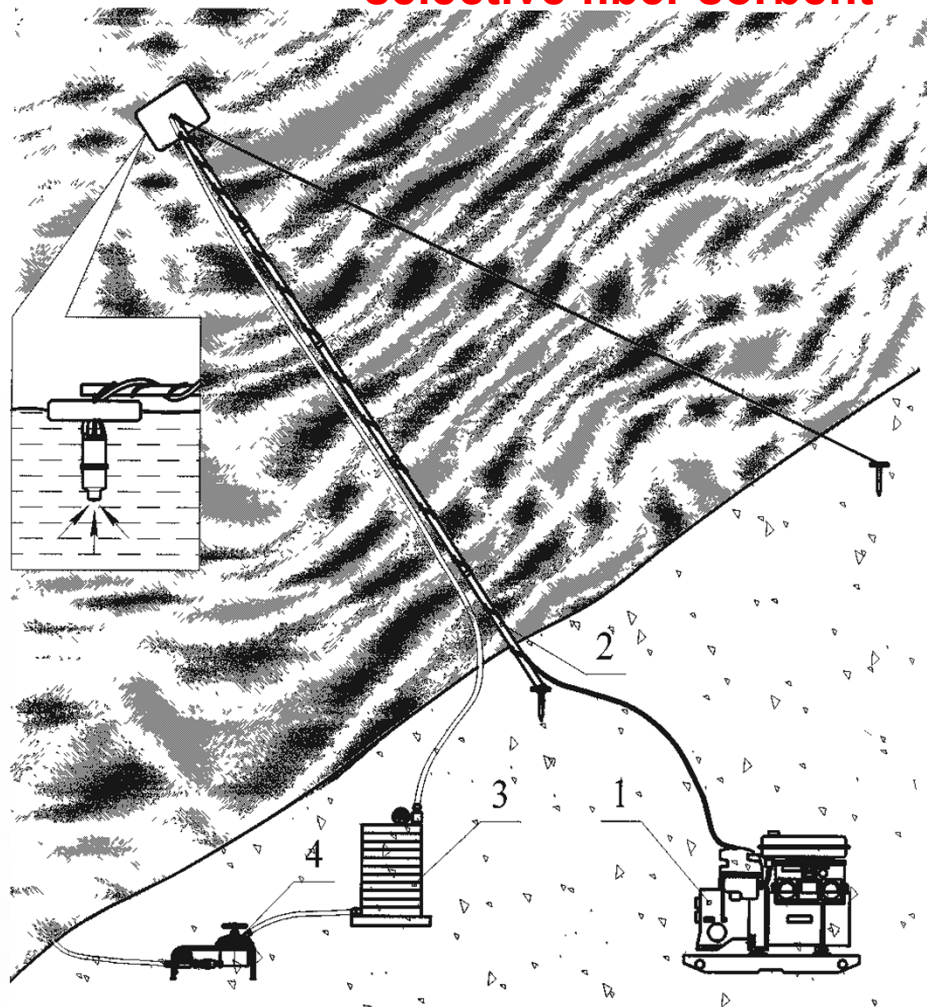
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Working moments of the field works
on the Ob-Irtysh river system radioecological
monitoring



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Basic methods used for the water environment sampling:
Equipment for water sampling, with simultaneous separation
of suspended matter and radiocesium concentrated on
selective fiber sorbent



1- power supply source

2- remote device for the intake of water samples

3- water filtration system "Midiya":
filters pore size 1 μm or less,
filtration speed up to 1000 l/h

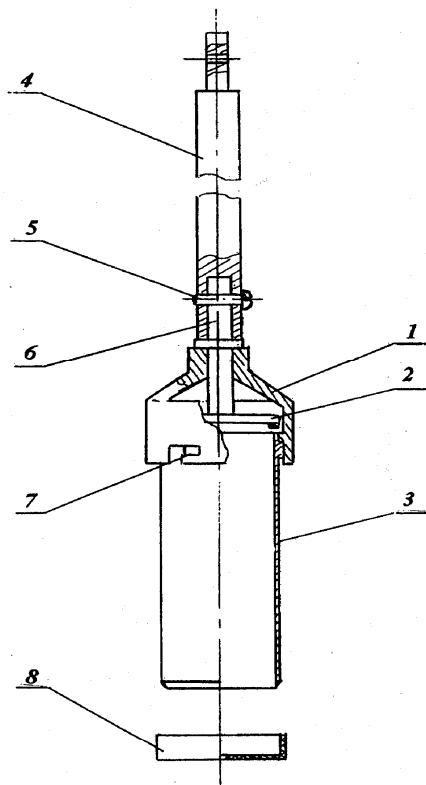
4- absorber: **fiber sorbent,**
selective to Cs, pumping speed up
to 500 l/h



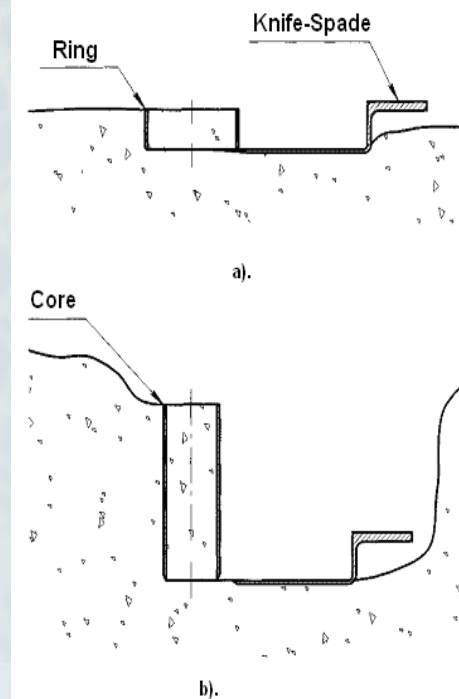
Basic methods used for water environment sampling:

Equipment for bottom sediment and flood-plain soil sampling

Rod sampler – the main instrument used for bottom sediment sampling, allows to take an undisturbed core of bottom sediments. The device for slicing up bottom sediment cores was used for their vertical layer-by-layer cut.



- 1 – housing
- 2 – shutter
- 3 – sleeve
- 4 - rod
- 5 – screw
- 6 – stem
- 7 – retainer
- 8 - cover



**Schematic diagram
of flood-plain soil sampling**

Description of data base

on parameters of radioactive contamination of rivers performed under the ISTC Project No.2558



Data base contains the experimental data on content of artificial radionuclides in river water, bottom sediments and floodplain soils and based on two arrays of experimental information:

- The results of regular (monthly) observations of artificial radionuclide content in the waters of the Tobol and Irtysh rivers in the region of their confluence.
- The results of determination of the artificial radionuclide content in components of the water environment of the river system Techa-Iset-Tobol-Irtysh received in expedition surveys of the river system.



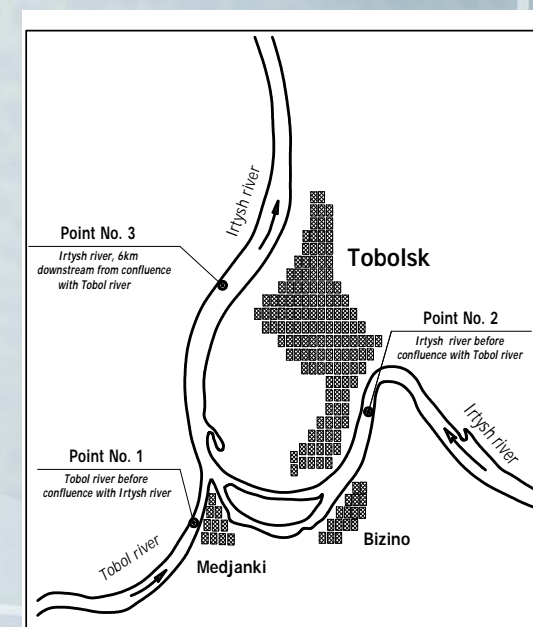
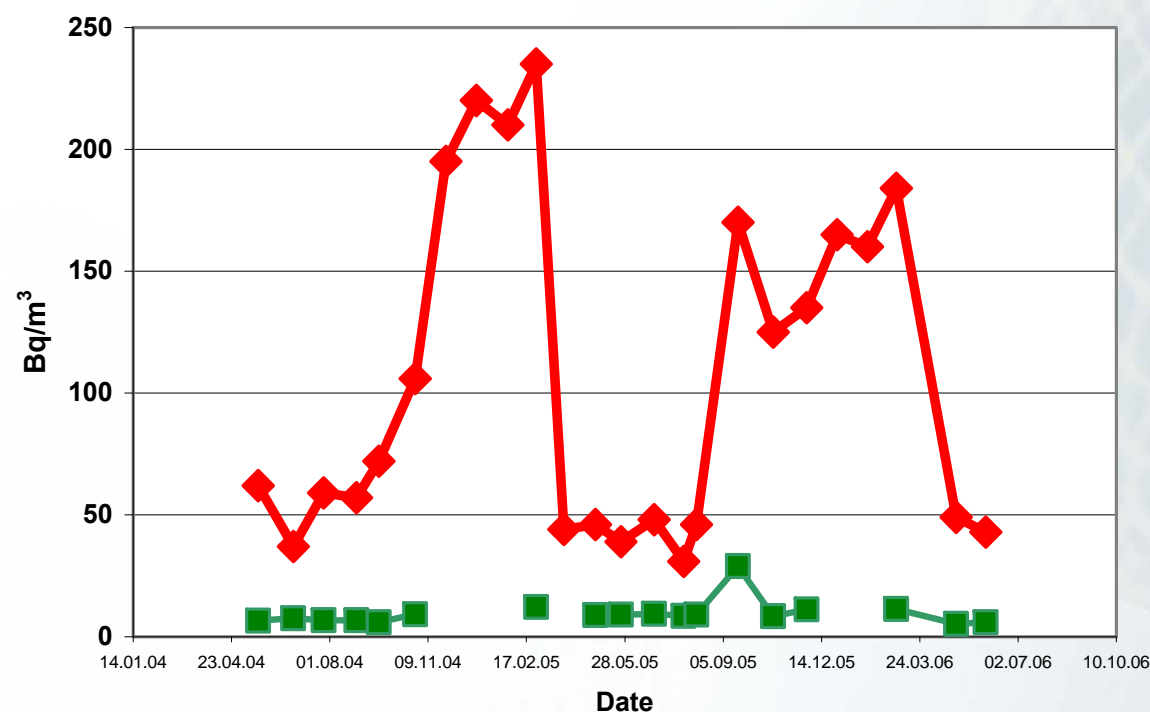
ISTC project 2558 and 3547

Selected results of monitoring of concentrations of man-made radionuclides in the river water

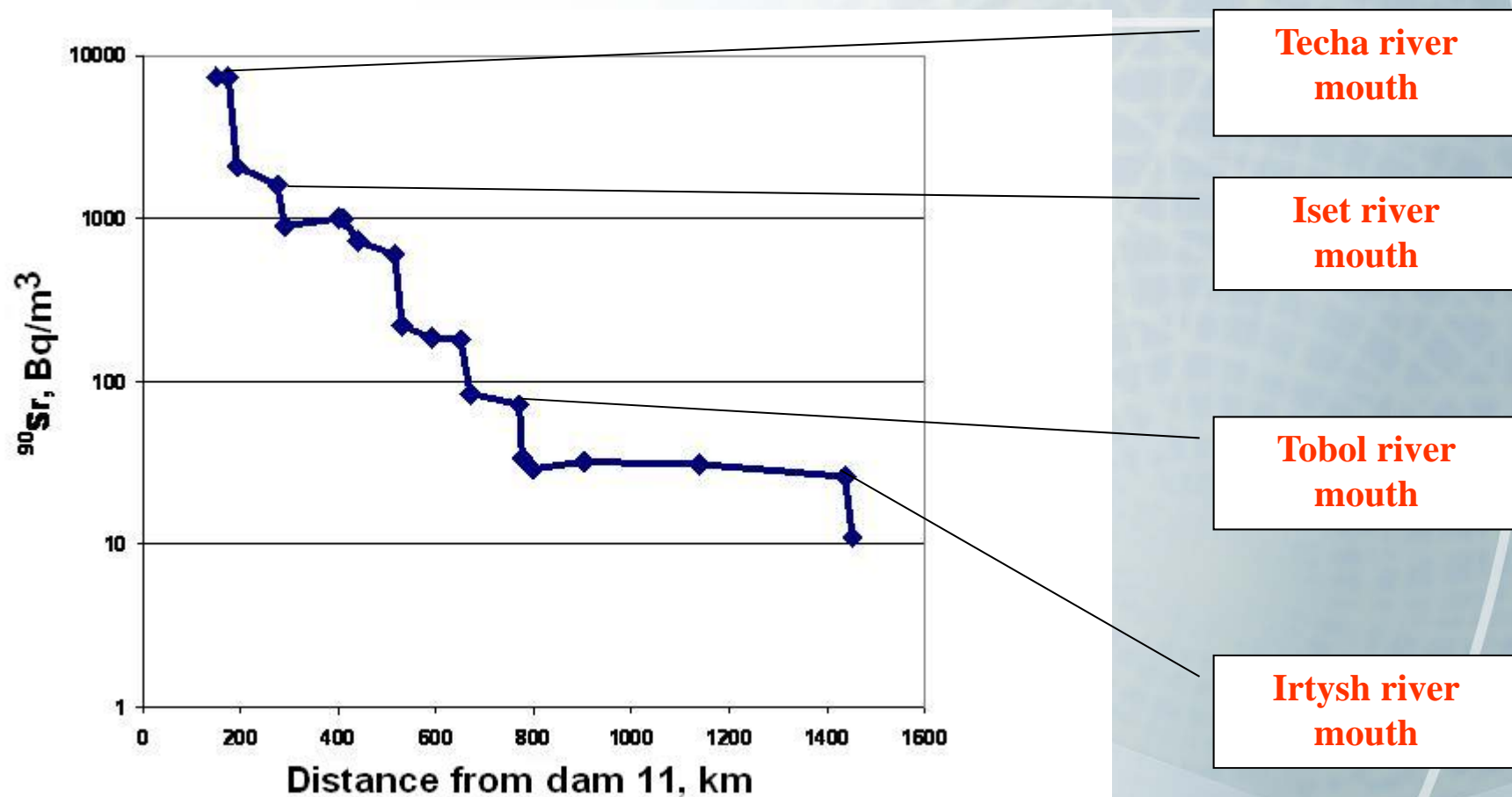


Results of monitoring of ^{90}Sr content in Tobol and Irtysh rivers water in region of their confluence (2004-2006):

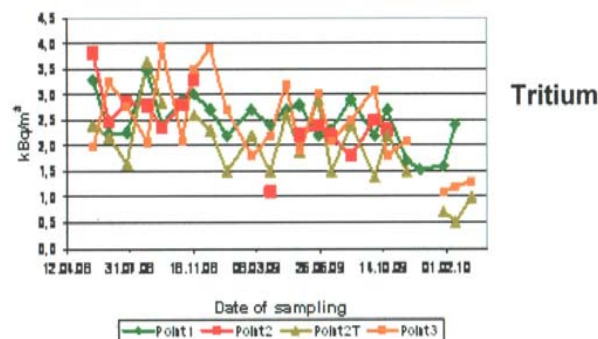
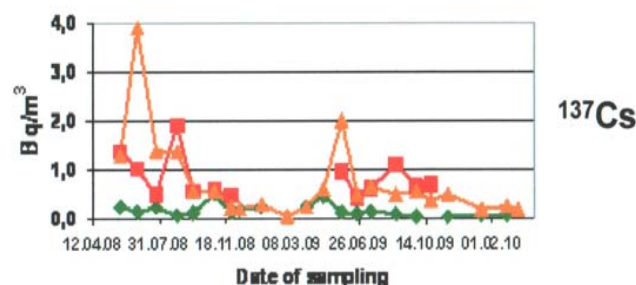
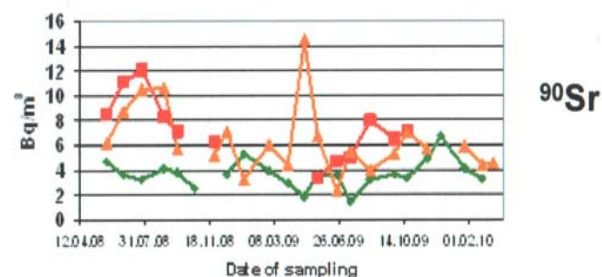
Changes of ^{90}Sr vs time



The impact of PA “Mayak” waste transport is distinctly traced by ^{90}Sr as far as the area of the Irtysh and Ob confluence.



Results of concentration monitoring in the water environment.

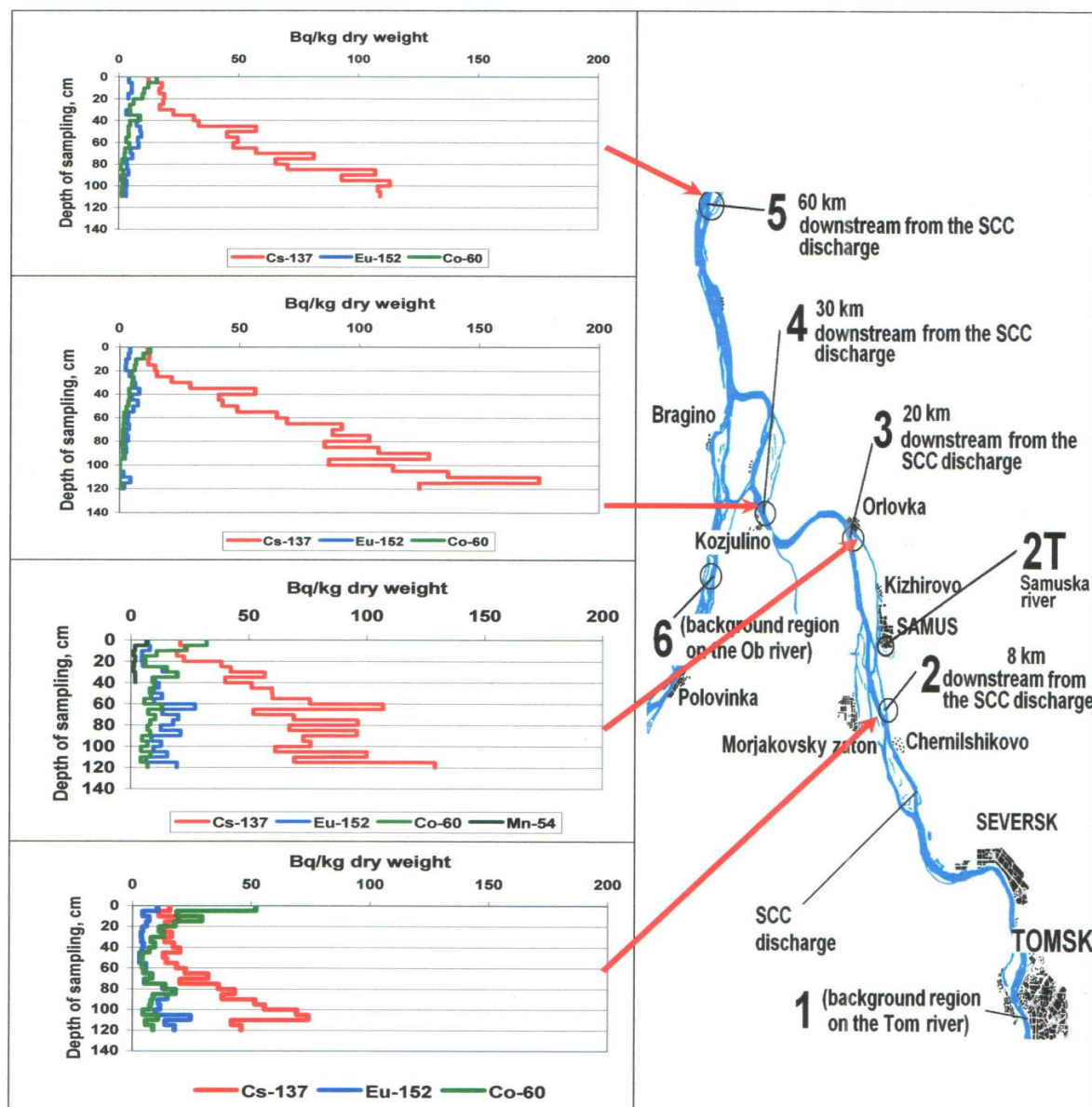


^{137}Cs , ^{90}Sr and ^3H content in Tom River water upstream and downstream of the SCC (2008-2010)

After shutdown of last SCC reactor in June 2008, volume activity of long-lived radionuclides in Tom River water downstream of the SCC process water discharge point began to decrease.



Radioecological survey of the Tom and Ob rivers (from Tomsk to their confluence, August 2008).



Significant decrease of ^{137}Cs specific activity with depth of sampling in flood-plain soils from the right bank of the Tom and Ob Rivers reflects improvement of situation with radioactive contamination of water after closing the SCC reactors (the first single pass reactor was shutdown in 1990).



CONCLUSIONS of Project No. 3547



The results received after shutdown of the last SCC single pass reactor indicate no significant consequences of SCC activities for water media:

- Concentrations of ^{137}Cs , ^{90}Sr , $^{239,240}\text{Pu}$ and ^3H in river water are many times lower than the intervention levels.
- Absence of increased ^3H concentrations in river water indicates that there are no inflow from underground radwaste depository
- No formation of radioactive waste soils and sediments.

However:

- Density of flood plain soil contamination by ^{137}Cs in the area influenced by SCC liquid discharges is higher than regional technogenic background.
- Local flood plain areas are contaminated not only by ^{137}Cs , but also by other gamma-emitters, such as ^{152}Eu and ^{60}Co .



Application of the ISTC Projects experience for monitoring and assessment of radioecological consequences of the Fukushima accident:



- **Field radioecological investigations and regular monitoring of marine and river ecosystems radioactive contamination in Japan.**
- **Field radioecological investigations of migration of Fukushima accidental releases and discharges products with marine currents in the Northern Pacific.**
- **Assessment and prediction of dose from irradiation and ecological risk according to data of radioecological monitoring and by radioecological models.**



Proposals for future works:



1) Radiological monitoring and risk assessment for population and environmental objects from radioactive contamination of marine and freshwater ecosystems in Japan.

Output:

- **Experimental data of radioecological field studies and monitoring of the river and marine ecosystems, contaminated after the Fukushima accident**
- **Integrated assessment of radioecological situation**



Project 1

Proposals for a work program:



- **To produce map of space distribution of radionuclids from Fukushima accidental releases and discharges in bottom sediments of nearby coastal region of the Pacific Ocean (by sampling of bottom sediment cores on a regular grid)**
- To determine position of sampling station for future long term monitoring of marine bottom sediments radioactive contamination.
- To perform assessment of doses to reference biota species from bottom sediment radioactive contamination.
- To produce working program and to perform radioecological monitoring of contaminated rivers, including river water, bottom sediments, flood-plain soil and reference river biota.
- Assessment of radioecological situation from Fukushima radioactive environmental contamination by our model ECOMOD.

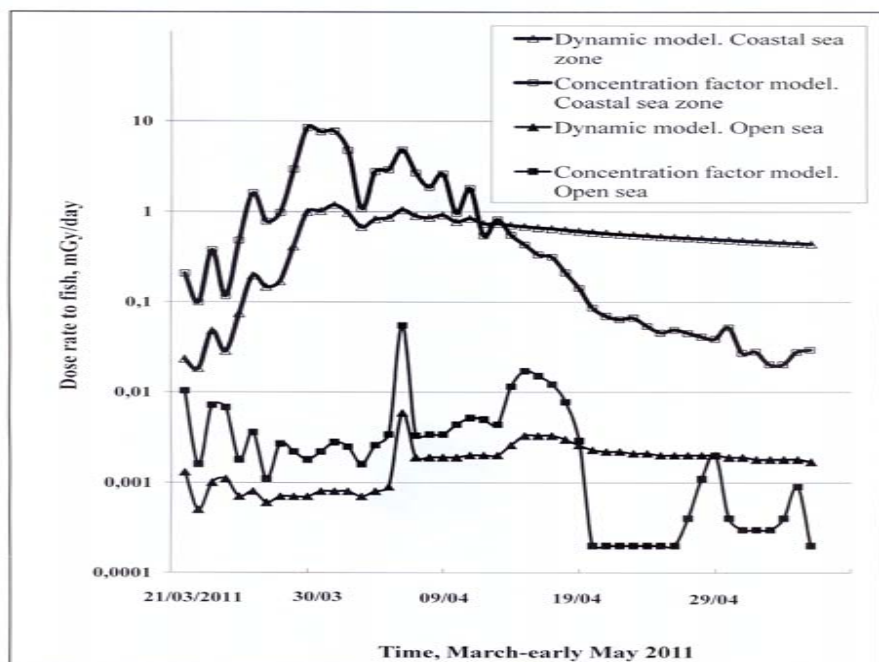


PROJECT 1 TOPICALITY

Calculations made using ECOMOD model shows comparability of consequences of the Fukushima NPP accident with consequences of other radiation accidents

(Chernobyl NPP 1986 and PA Mayak 1957 accidents)

Dynamics of dose rate due to internal irradiation of fish in the coastal area of the sea nearby the “Fukushima-1” NPP and 30 km from the NPP in the open sea

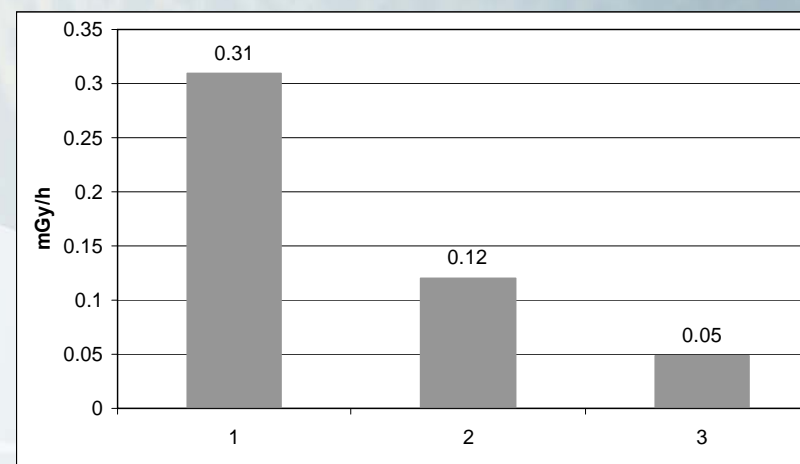


Dose rates of internal irradiation of fish in the exclusion zones for radiation accidents :

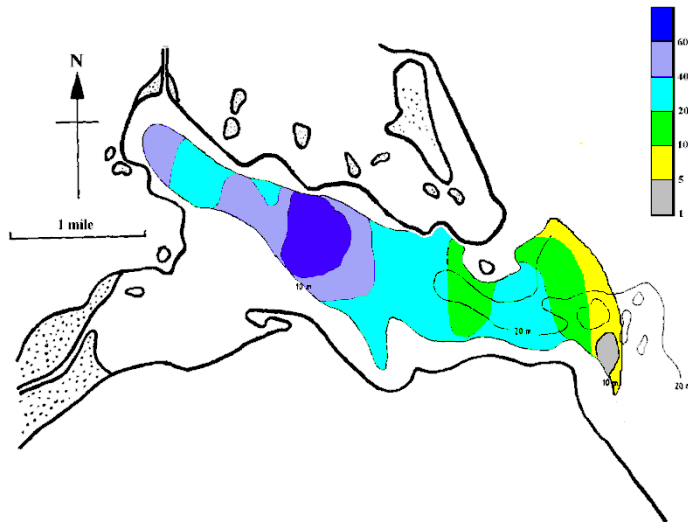
1 – Eastern Urals Radioactive Trail (lake Uruskul, September-October 1957);

2 –Chernobyl NPP cooling pond (April-May 1986);

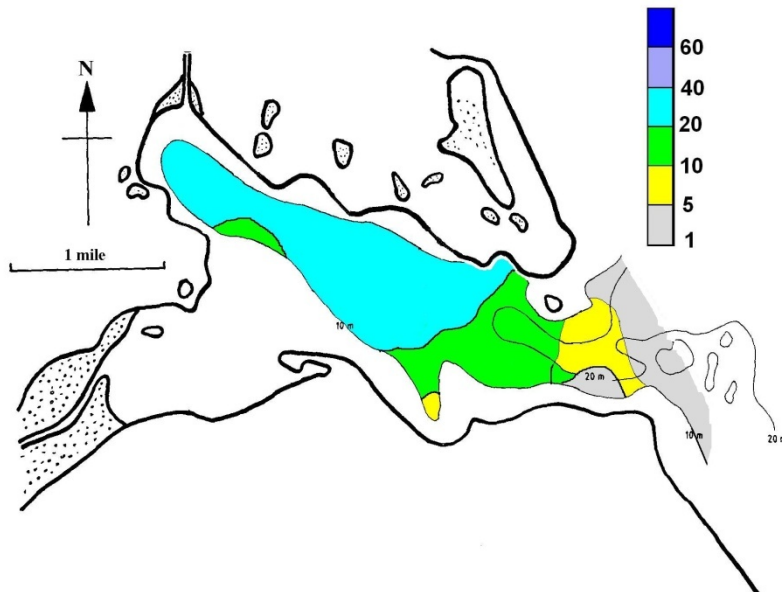
3 – the coastal area of the sea near Fukushima-1 NPP (March-May 2011).



1994



2002



PROJECT 1 TOPICALITY

20

Example of mapping of the sea bottom sediments radioactive contamination in the sea areas used for RW and SNF dumping (Kara sea, Abrosimov bay)

Spatial distributions of ^{137}Cs (Bq/kg d. w.) in the surface layer of the Abrosimov bay bottom sediments:

1994- Joint Russian-Norwegian expedition

2002- ISTC Project No.2254 "Search, assessment of condition and methods to protect the packing dumped in the Kara sea and containing nuclear fuel of the icebreaker Lenin emergency reactor".



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Proposals for future work:

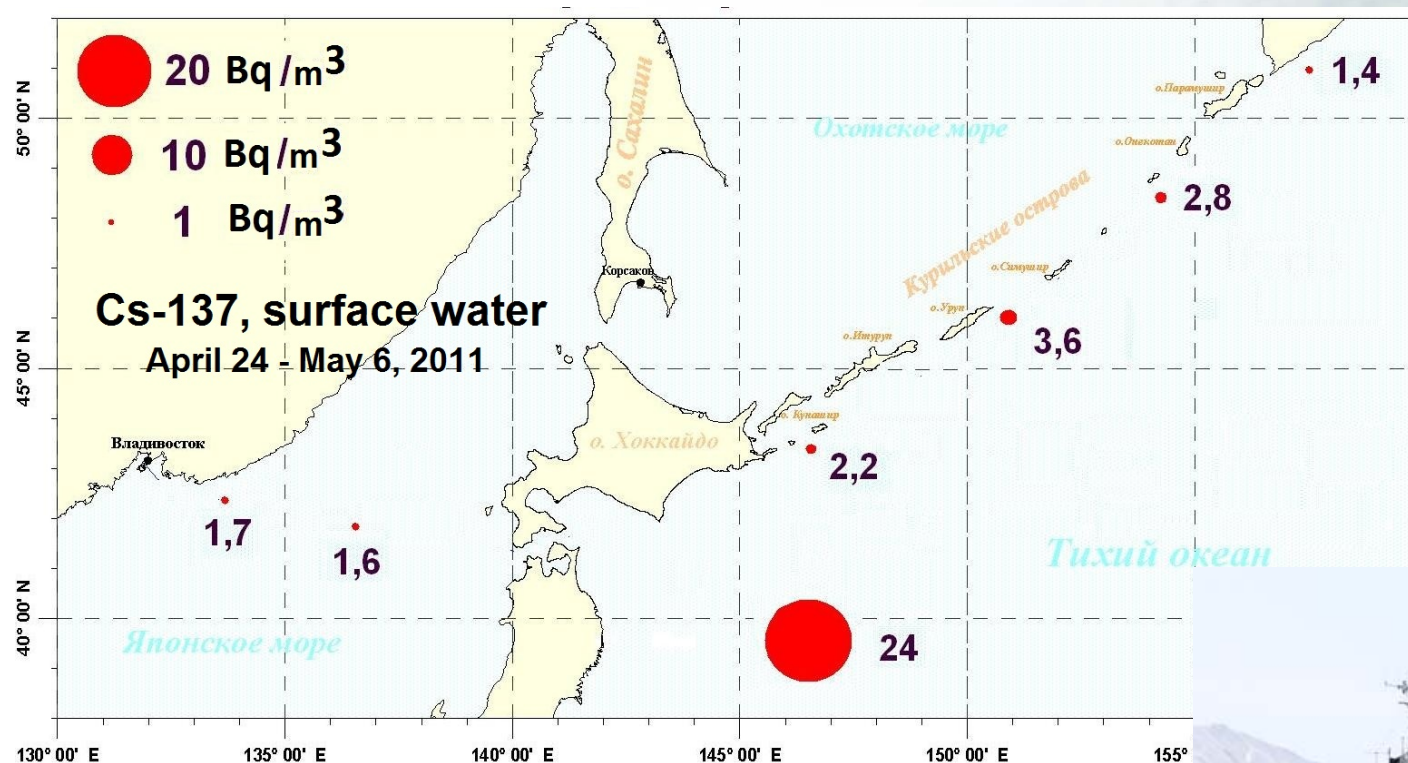


2) Field radioecological investigations and risk assessment from transport (migration) of radionuclides from Fukushima accidental releases and discharges with marine currents in the Northern Pacific.

Output: Map of space distribution of radionuclides from accidental releases and discharges (^{134}Cs , ^{137}Cs mainly) on dominated marine current routes from the Northern Pacific Japan coast to the coast of USA and Canada.



Roshydromet expedition on R/V “Pavel Gordienko” in April-May, 2011, revealed large-scale contamination by ^{137}Cs and ^{134}Cs of water area of the North-Western Pacific in region of the Kuroshio current.

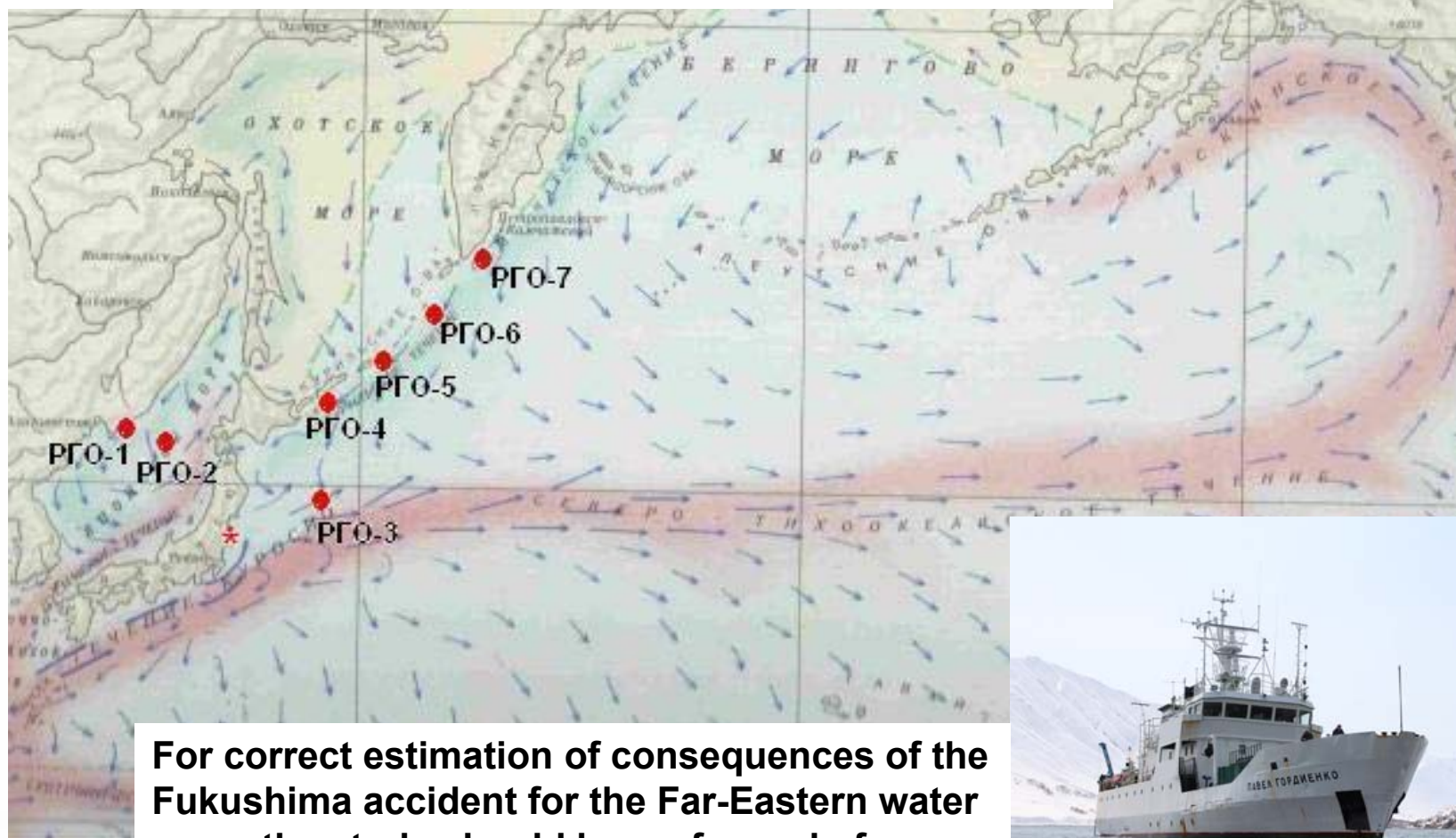


^{137}Cs concentration in sea water at a distance about 400 km from accidental NPP reached 30 Bq/m³, which approximately 20 times exceed preaccidental level, and water mass till at least 100 m below the surface was contaminated.



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Directions of the marine currents in the Northern Pacific and location of the R/V “Pavel Gordienko” April-May 2011 expedition sampling stations



For correct estimation of consequences of the Fukushima accident for the Far-Eastern water areas the study should be performed of transport with marine currents of products of accidental releases and discharges.



Proposals for a work program



- Transport of Fukushima NPP accidental radioactive products is dynamical process, and one survey is not enough for it's characterization. Under this project we propose to undertake two expedition surveys each other separated by a long time interval.
- Sea water sampling should be conducted from surface and deep-water horizons for determination of volumetric activity of artificial gamma emitters (**first of all, Cs-134 and Cs-137**), Sr-90 and plutonium isotopes (Pu-238, Pu-239,240).





THANK YOU FOR YOUR ATTENTION!

