



# Monitoring and Modeling of the Chernobyl Cooling Pond as a Case Study

## Projects supported by:

- DOE EM-32 Office of Soil and Groundwater Remediation  
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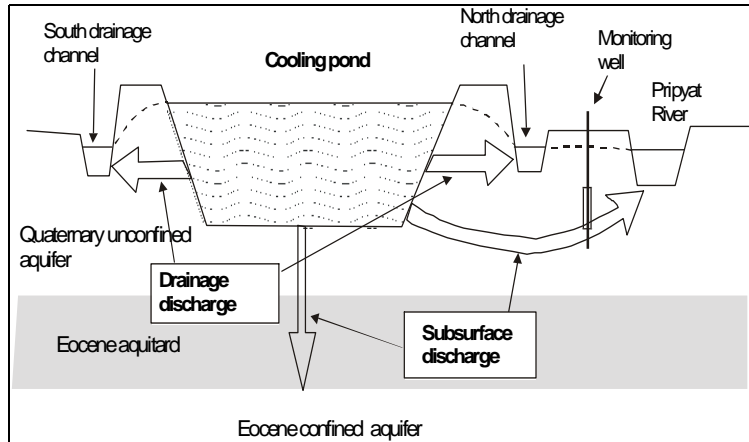


# Monitoring Systems

- **Monitoring atmospheric deposition**
  - Post-accident monitoring of aerosol distribution along with modeling studies
  - Resuspension of radionuclides
- **Monitoring contamination of surface water and bottom sediments**
  - Monitoring of contamination of surface water and bottom sediments since mid-1986.
  - Research sites
- **Monitoring saturated and unsaturated zone**
  - Post-accident network of groundwater wells, surface water sampling stations
  - Unsaturated (vadose) zone research sites.
- **Specific monitoring data and analyses used to test the conceptual models**
  - Surface water and groundwater monitoring,
  - tracer and pumping tests,
  - radiochemical, geochemical, meteorological measurements,
  - pilot cooling pond drawdown,
  - resuspension monitoring,
  - monthly sampling and radioactive analysis of water from the input and output canals,
  - radio-ecological studies.

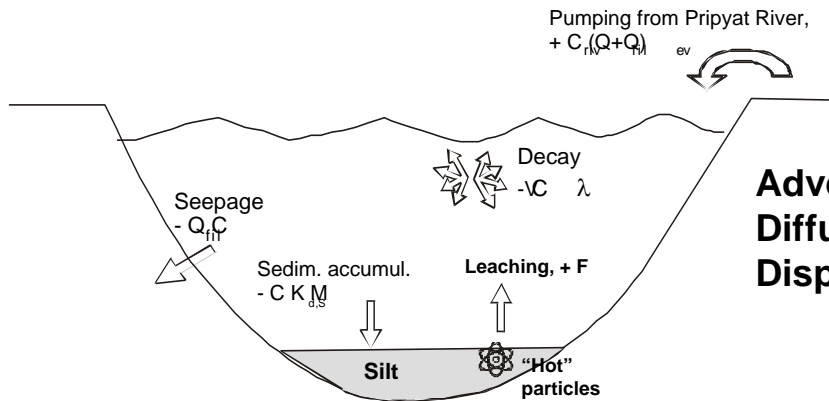
**New monitoring methods and tools to monitor pond decommissioning and remediation are needed.**

# Testing Conceptual Site Models

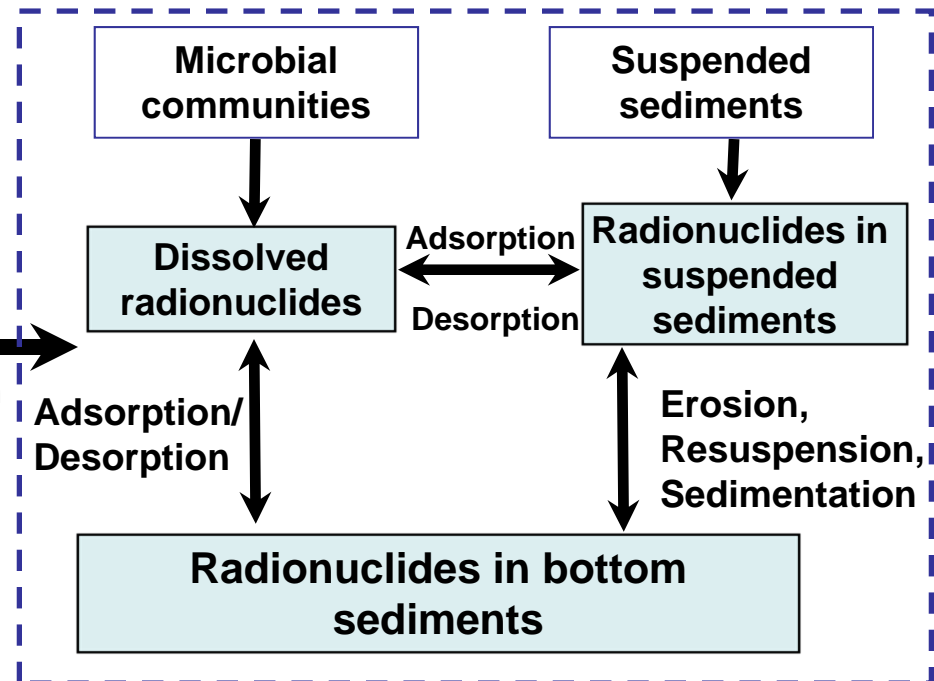


Bugai et al., 1997

- Processes affecting hydrological and radionuclide transport in the pond and bottom sediments
- Atmospheric deposition and resuspension processes:
  - estimation of a source term;
  - evaluation of the consequences of hypothetical emergency scenarios.

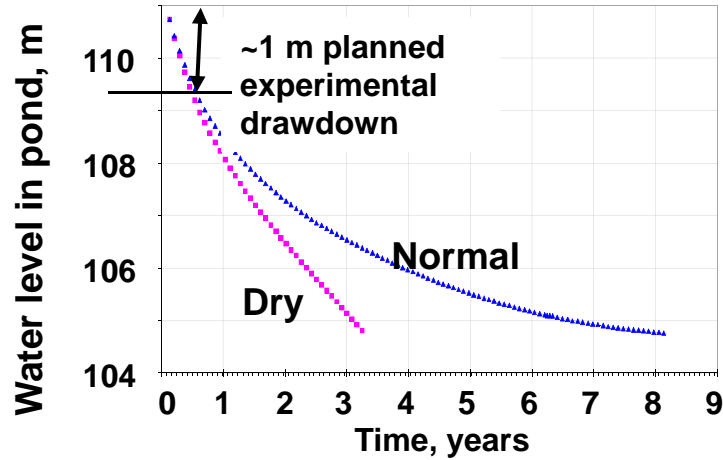


Advection,  
Diffusion/  
Dispersion

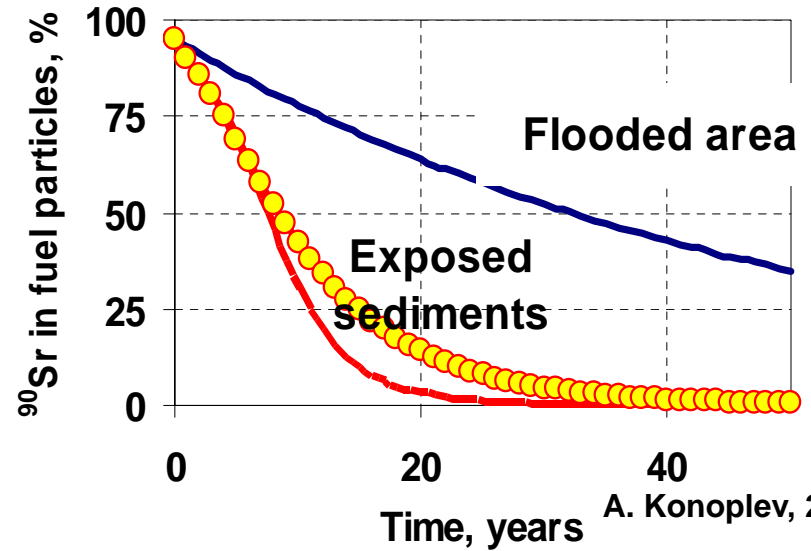


Modified after M.Zheleznyak

# Modeling of Water Level Drawdown, Radionuclide Behavior, and Vulnerabilities of Environmental Resources



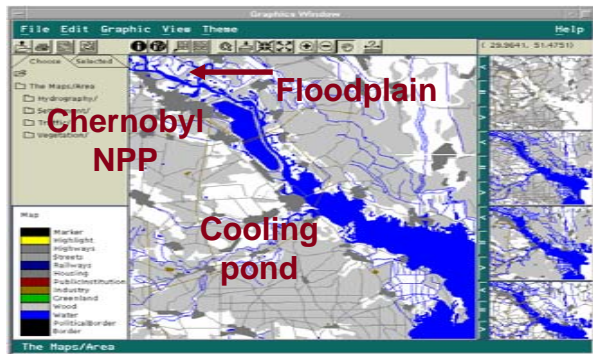
D. Bugai et al., 1999



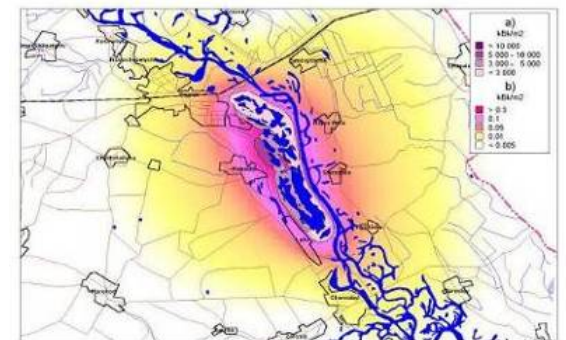
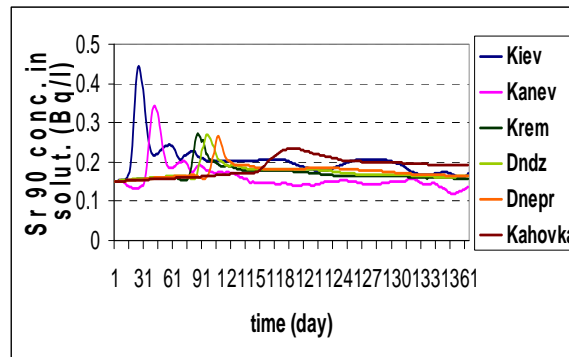
A. Konoplev, 2009

Modeling of the dam break (left) and  $^{90}\text{Sr}$  concentration (right) in the Dnieper River reservoirs

Modeling of additional  $^{137}\text{Cs}$  contamination of soil due to sediment resuspension after a hypothetical fire



M. Zheleznyak et al., 2006



V. Kashparov, et al. 2001

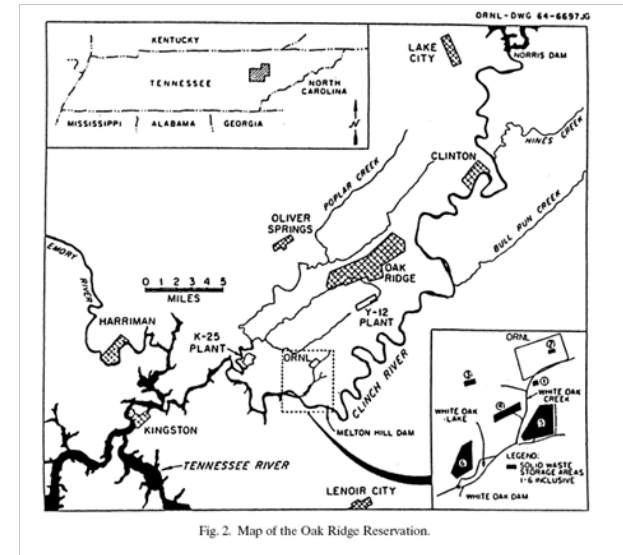
# Potential Use of Chernobyl Cooling Pond as a Case Study for Testing Monitoring, Modeling and Remediation Techniques

## Savannah River PAR Pond



- Constructed in 1958 as a Cooling Pond for the Savannah River Site's P and R Reactors
- Experimental water-level drawdown in 1991 and monitored radionuclide concentrations in water and bottom sediments.

## Oak Ridge Reservation White Oak Lake



## Testing of Remotely Operated Field Monitoring Techniques:

- Savannah River ADCON Telemetry-a real-time soil moisture monitoring system.
- FDTAS-tritium analysis system in surface and groundwater in near real time.
- Sol-Gel Indicators for Process and Environmental Measurements
- INL Soil and Surface Assay Systems for Gamma, Beta, and Alpha Radiation Sources