SAND2008-4299P

Cooperative Approaches to Environmental Security

Environmental Considerations Seminar with Military Operations

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Dr. Amir H. Mohagheghi
Physicist/Program Manager, Middle East Programs
Sandia National Laboratories
Phone: +1-505-844-6910 Fax: +1-505-284-5055
Email: ahmohag@sandia.gov

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Presentation Overview

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- Introduction and Background
- Monitoring Systems and Sensors
- Examples of Cooperative Environmental Monitoring
- Conclusions

Environmental Issues Relate to National Security

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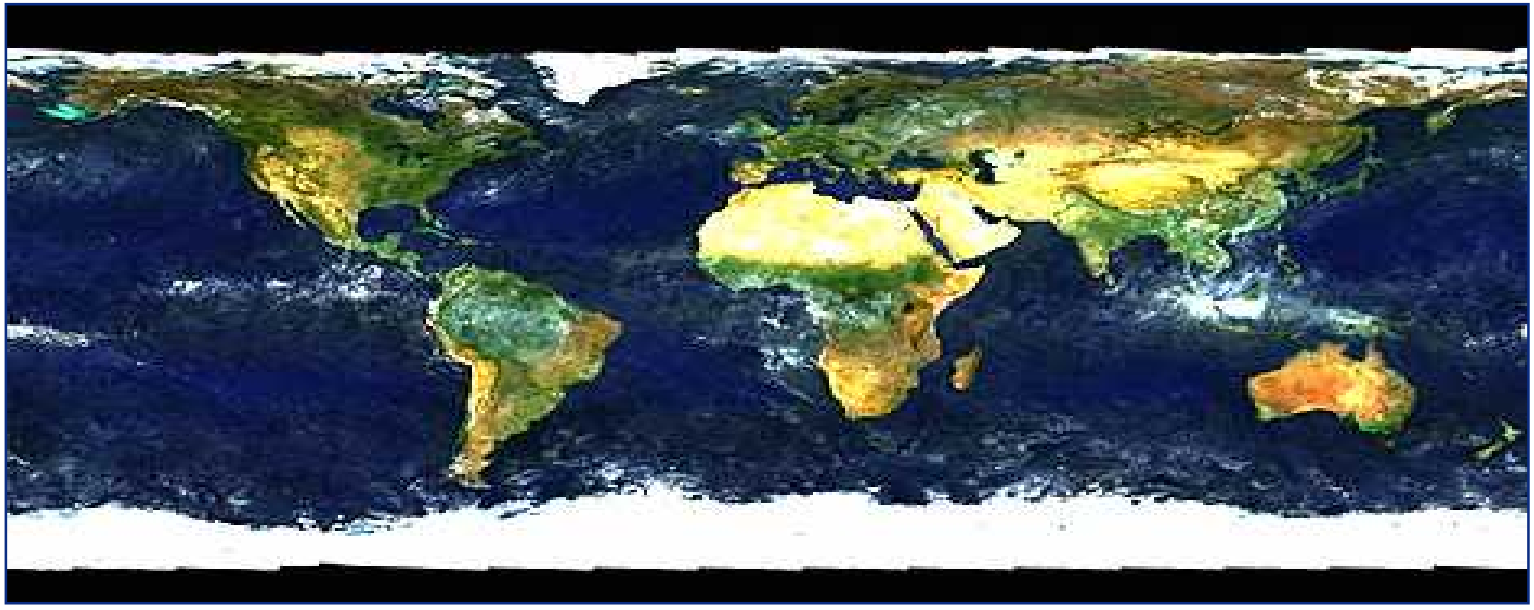
- Environmental problems can exacerbate tense relations among countries
  - water in the Middle East
  - famine and mass migrations in Africa
  - coastal and fisheries degradation in South Asia
- Cooperative environmental projects can increase mutual trust and confidence among hostile nations



Technical Collaborations Can Help Achieve Cooperative Security Objectives

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- Experiments with monitoring technology can help prepare for cooperative monitoring
  - test sensor systems in appropriate environment
  - understand impact of monitoring technology on routine activities
- Technical experimentation helps establish
  - infrastructure for implementing agreements
  - knowledgeable experts to assist negotiators
  - constituency for cooperative security in technical community
- Joint projects among two or more countries
  - pave way for implementation of future agreements
  - build trust among technical communities

Components of a Monitoring System

- What are you worried about?
- Determine Parameters
- Sensors
- Data Collection
- Communications
- Data Management
- Data Analysis
- Evaluation and Decision Making

Systems are used to help solve real-world problems and manage resources

Sensor Examples for Environmental Applications

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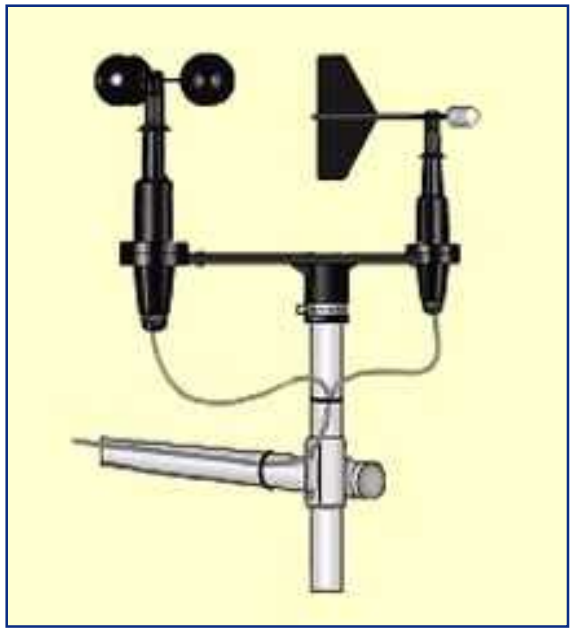
Land

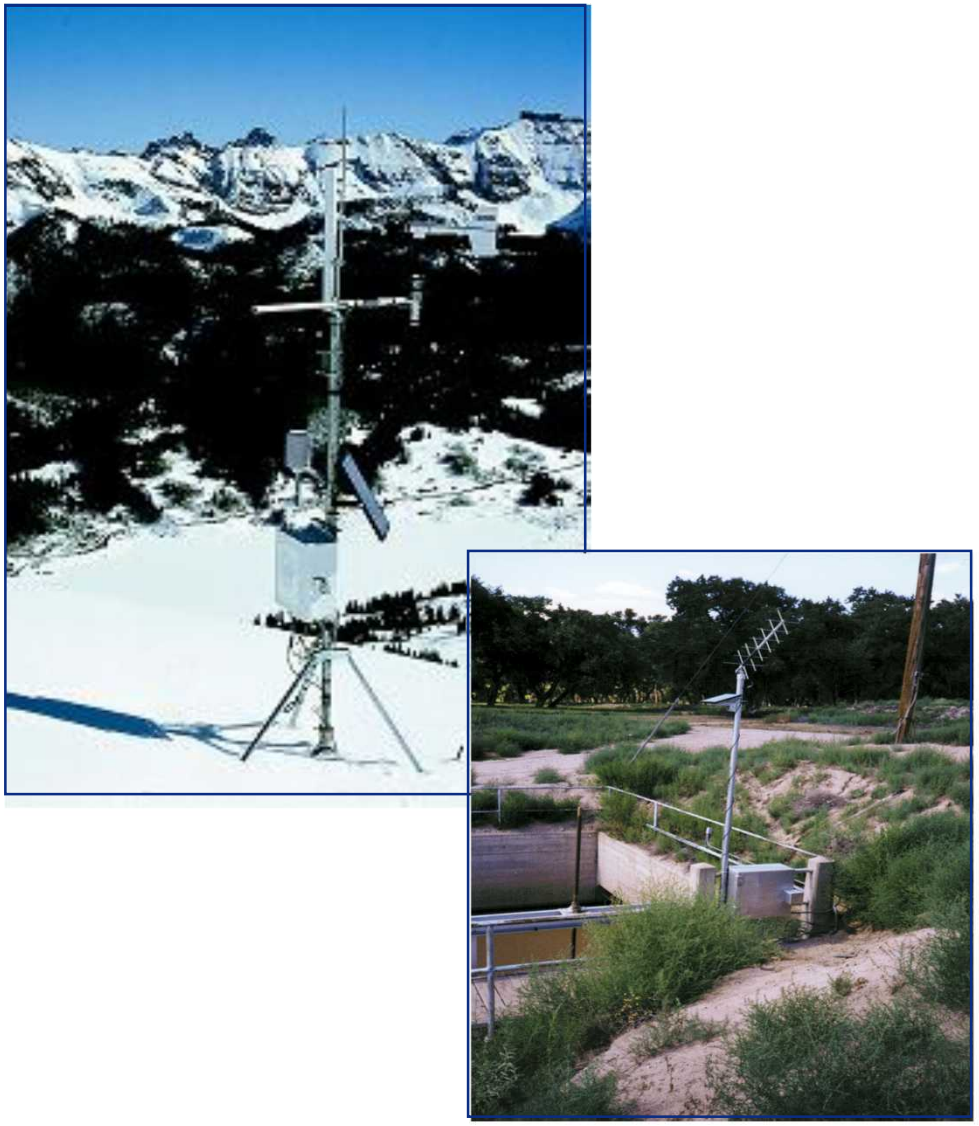


Air

Water

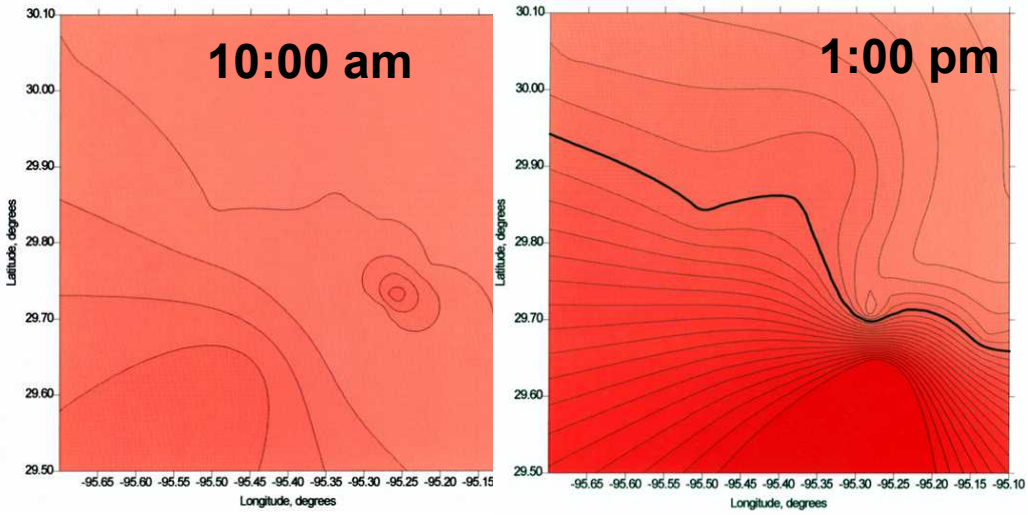
Data Collection and Telemetry Examples

- **Data Collection**
  - manually/on-site
  - remote access
- **Communication options**
  - direct connection
  - telephone
  - radio frequency (RF)
  - satellite
  - internet
  - combinations of above

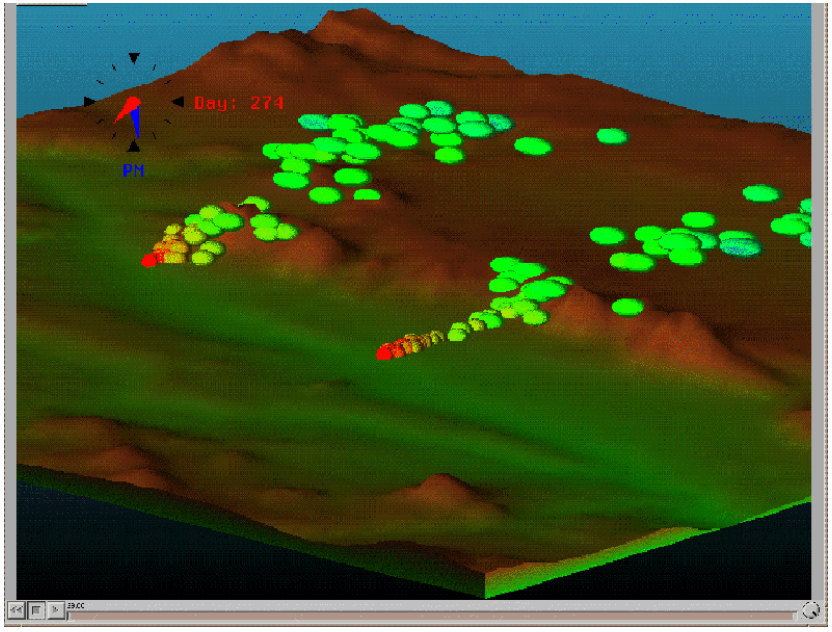


Data Analysis

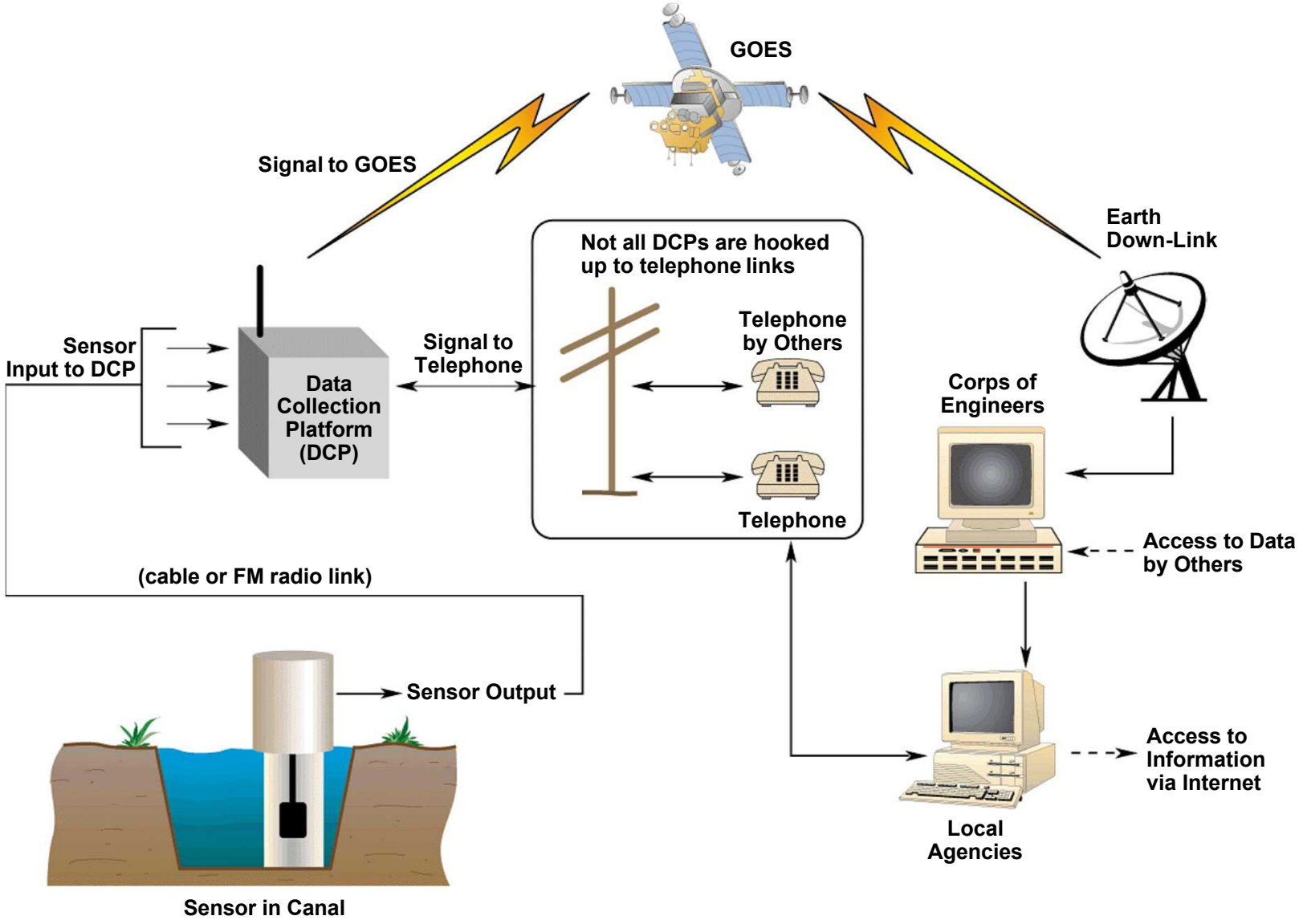
- **Understanding local measurements - Air quality example:**
  - data collected from several local sensors
  - draws lines of equal concentration
  - time sequence of diagrams shows flow pattern



- **Predicting propagation - Modeling**
  - realistic topography
  - input seasonal wind, temperatures, pressures
  - operator postulates pollution sources
  - program shows dispersion or stagnation



Example System for Environmental Monitoring Data Collection, Sharing, and Analysis



South Asia Transboundary Water Quality Monitoring Project

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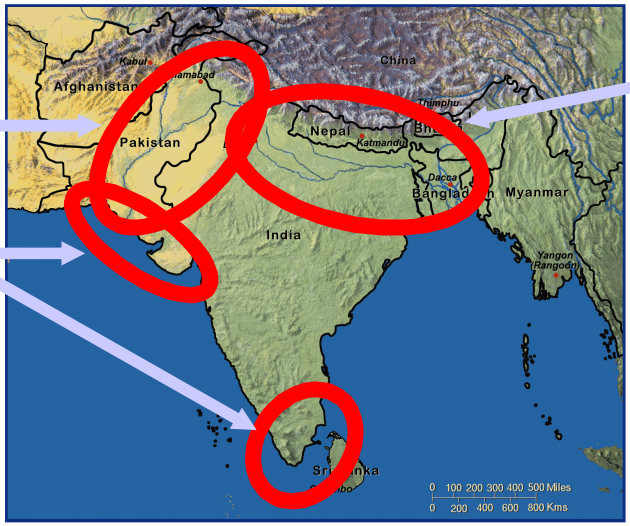
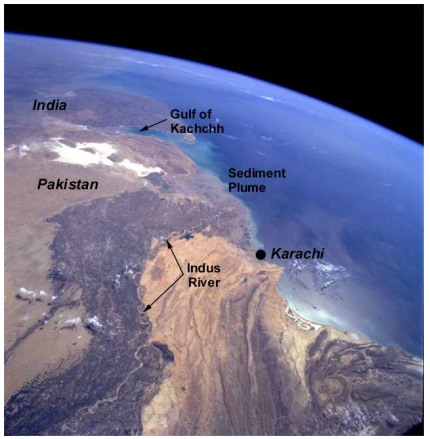
Indus River Basin

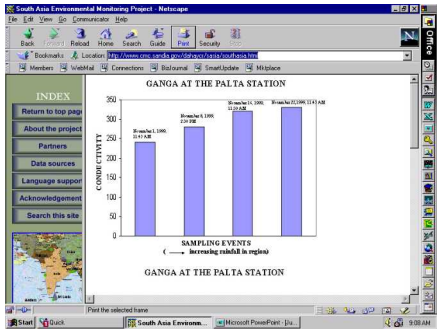
Coastal Zones



Ganga River Basin



- **Monitor South Asian Cross-Border Rivers**
  - address water quality problems: more parameters & analysis
  - technical collaboration promotes regional and local security - Confidence Building Measures
  - Water quality - deteriorating rapidly in many areas
  - Water scarcity - acute in some areas, growing worse



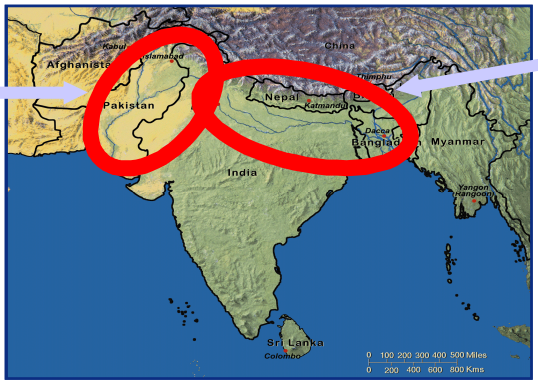
www.cmc.sandia.gov/sasia/southasia.html

SATWQM -- Monitoring Sites

World Wide Fund for Nature, Lahore, will sample at Ravi River and Hudiara Drain in Pakistan

PAKISTAN-INDIA

Indus River Basin



Ganges River Basin

Guru Nanak Dev University, Amritsar, will sample at Sutlej, Beas, and Ravi Rivers in India

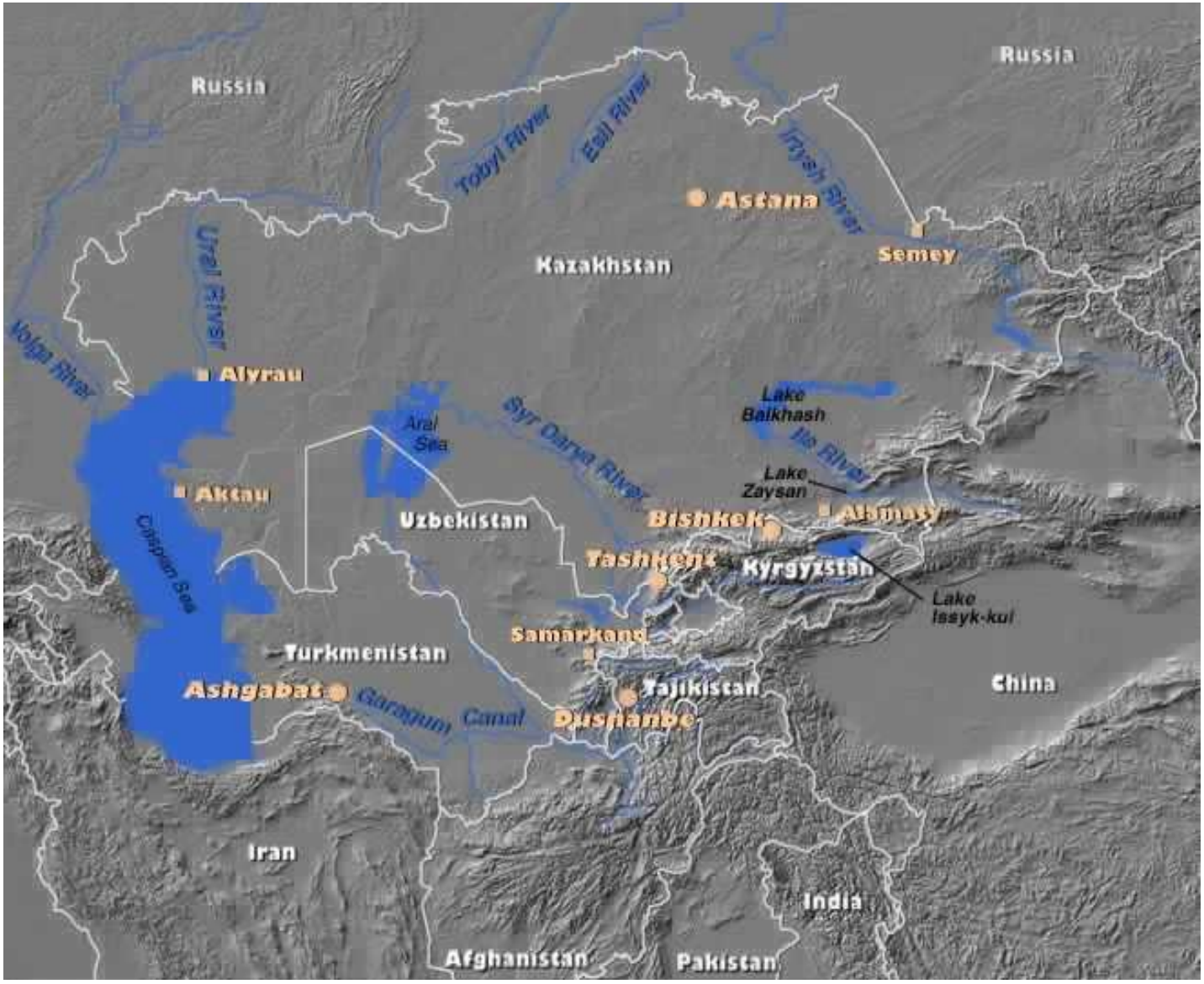
NEPAL-INDIA

Environmental and Public Health Organization, Kathmandu, and Patna University, Patna, will sample at Bagmati/Burhigandak, Narayani/ Gandak Rivers.

BANGLADESH-INDIA

Bangladesh Unnayan Parishad, Dhaka, and Center for Environment and Development, Kolkata will sample the Ganges/ Padma Rivers.

The NAVRUZ Experiment: Cooperative Monitoring for Radionuclides and Metals in Central Asia Transboundary Rivers



NAVRUZ Experiment

- **NAVRUZ "new beginning" Experiment**
  - **Legacy contamination of rivers by Soviet Union mining & industry**
  - **Project suggested and agreed by Institutes in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan**
  - **Survey the major Aral Sea Basin rivers and increase the understanding of radionuclides and metals contamination levels and locations**
  - **Data are shared among participants and released to the public**

Address by U.S. Ambassador, Joseph A. Presel, opening project workshop at Institute of Nuclear Physics, Uzbekistan, 3/00

Participants workshop at the Institute of Nuclear Physics near Tashkent, Uzbekistan 8/00

Map of NAVRUZ Sample Collection Sites

Project Methodology

- Partners conduct majority of work
  - Participating nuclear institutes in Central Asian Republics collect samples and conduct laboratory analyses
  - SNL conducts QA and publishes data on Internet site
- Jointly developed a standard scientific methodology for collection and laboratory analysis of experiment
- Each Institute selected & monitors 15 sites of concern (total 60 CA sites)
- Laboratories in Kazakhstan and Uzbekistan each analyze all samples
- Collectively compare results and write reports

Negotiations during project workshop in Tashkent, 3/00

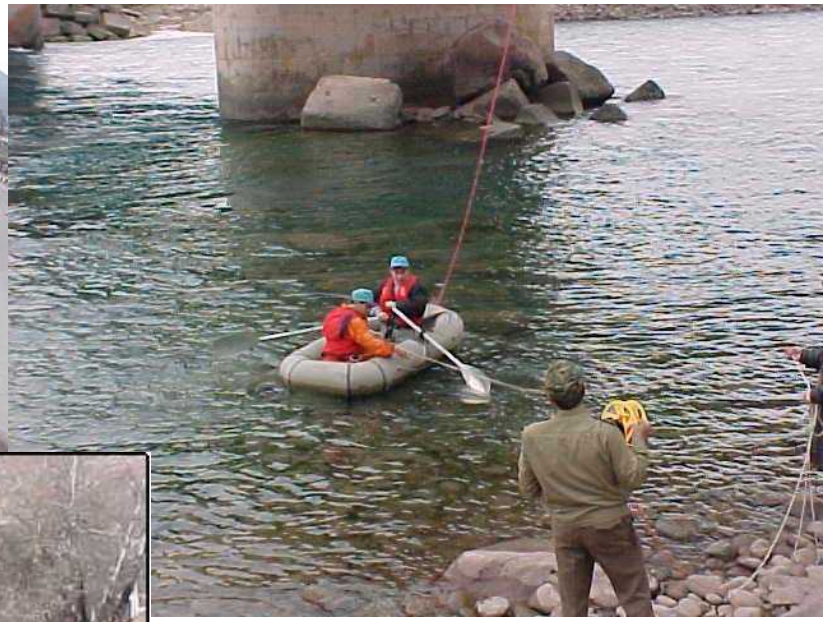
Training on use of sampling instruments, Tashkent 8/00

Sample Collection

- Collection from 60 sites rivers of the Aral Sea basin (15 each country)
- Syr Darya River, Amu Darya and major tributaries
- At each site collected:
  - Water (filtered & unfiltered)
  - Bottom sediment
  - Aquatic vegetation
  - Riverbank soils

Training on sample collection, Chirchik River, Uzbekistan, 8/00

Collection of samples Vahsh River, Tajikistan, 5/01



Naryn River near the town of Tash-Kumyr, Kyrgyzstan

Collected basic water quality data

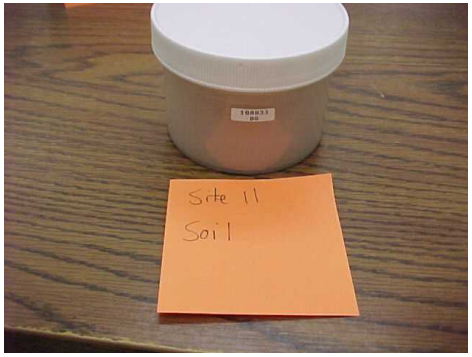
- **Basic water parameters**
  - Water temperature
  - Specific conductivity
  - Oxidation-reduction potential
  - pH
  - Dissolved oxygen (DO)
  - Salinity
  - Total dissolved solids (TDS)

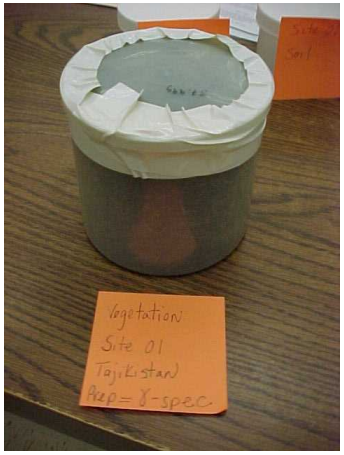
Collecting Hydrolab data on the Syr Darya near Kyzylorda, Kazakhstan

Using Hydrolab in Arys River, Kazakhstan

Samples Received at SNL

Sample Preparation





Sample Analysis

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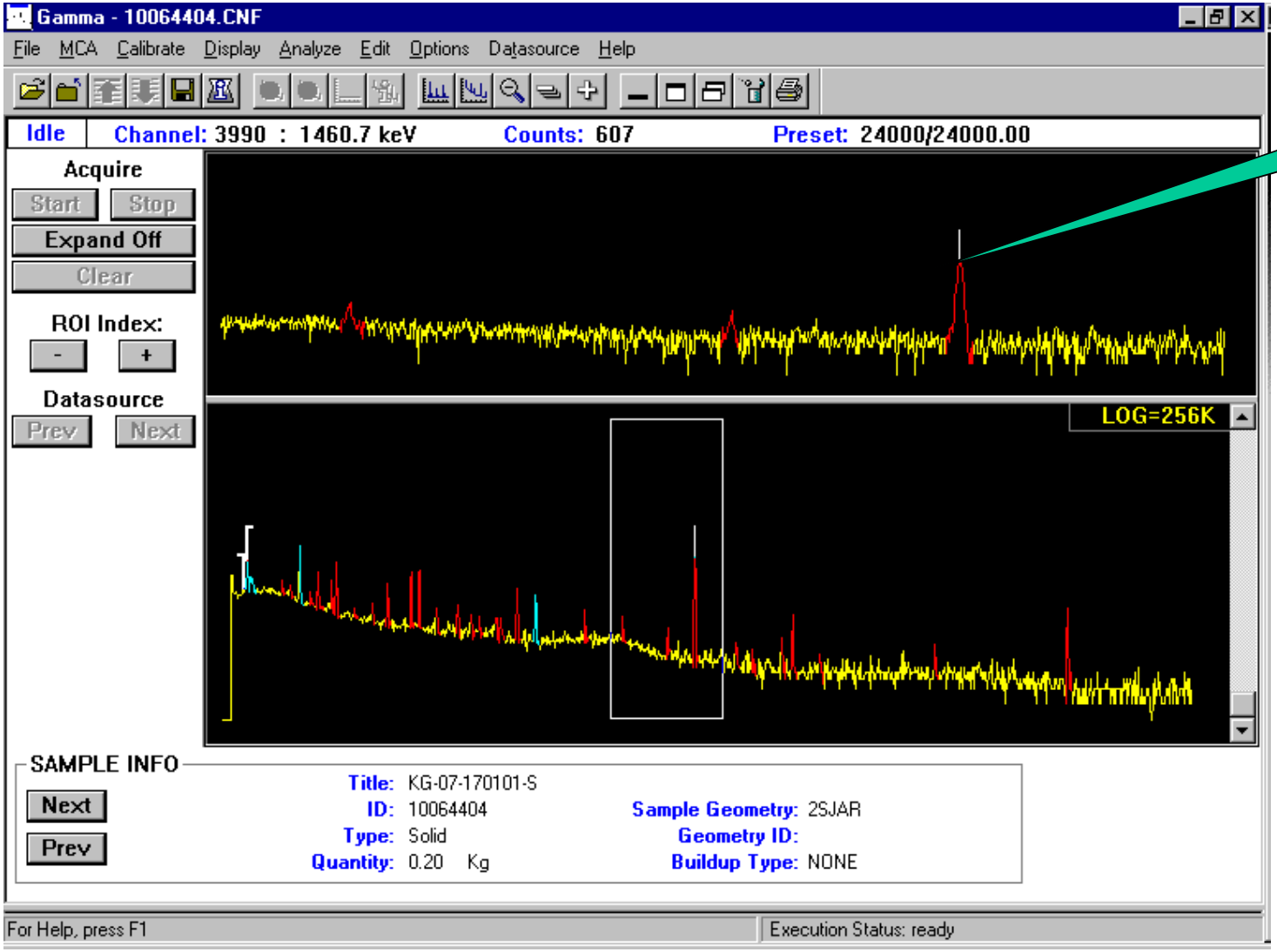
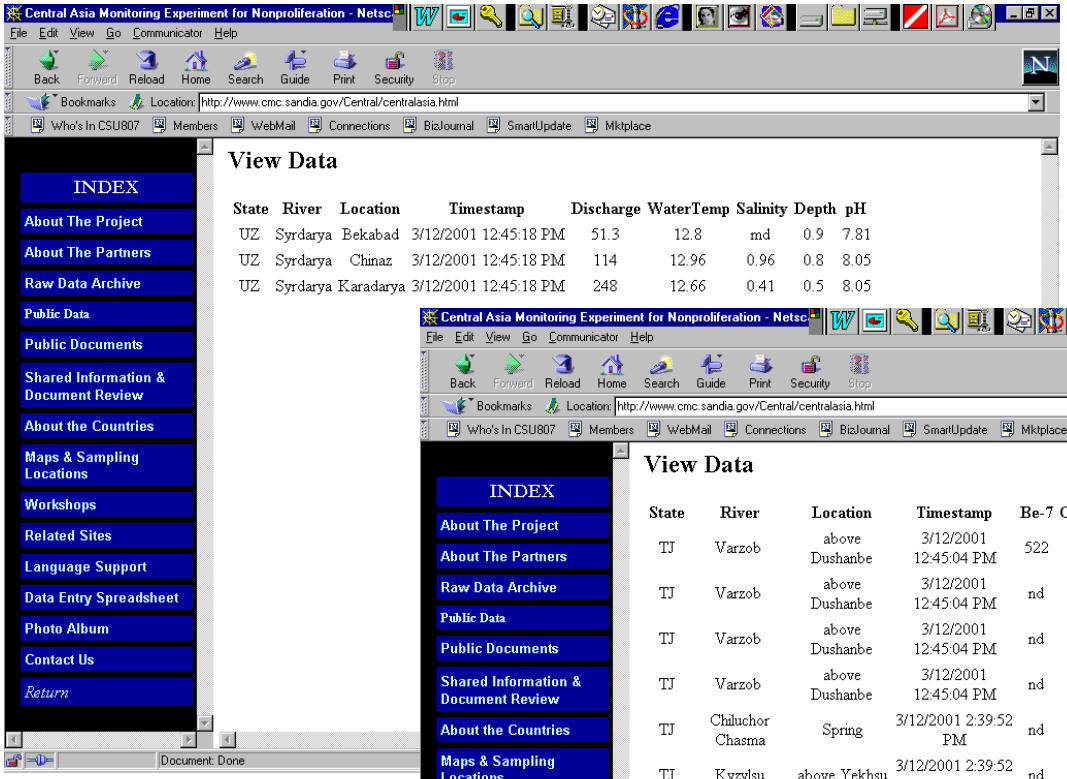
Example Spectrum

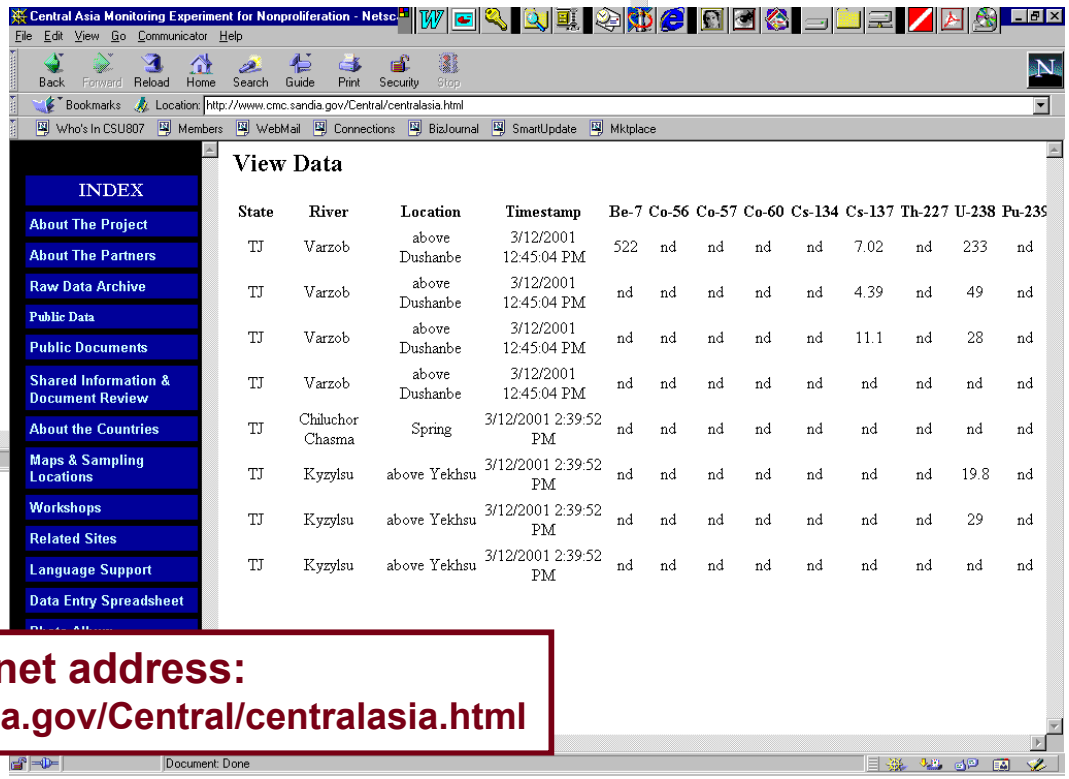


Data on CMC Central Asia web site

Central Asia CMC Cooperative Monitoring Center

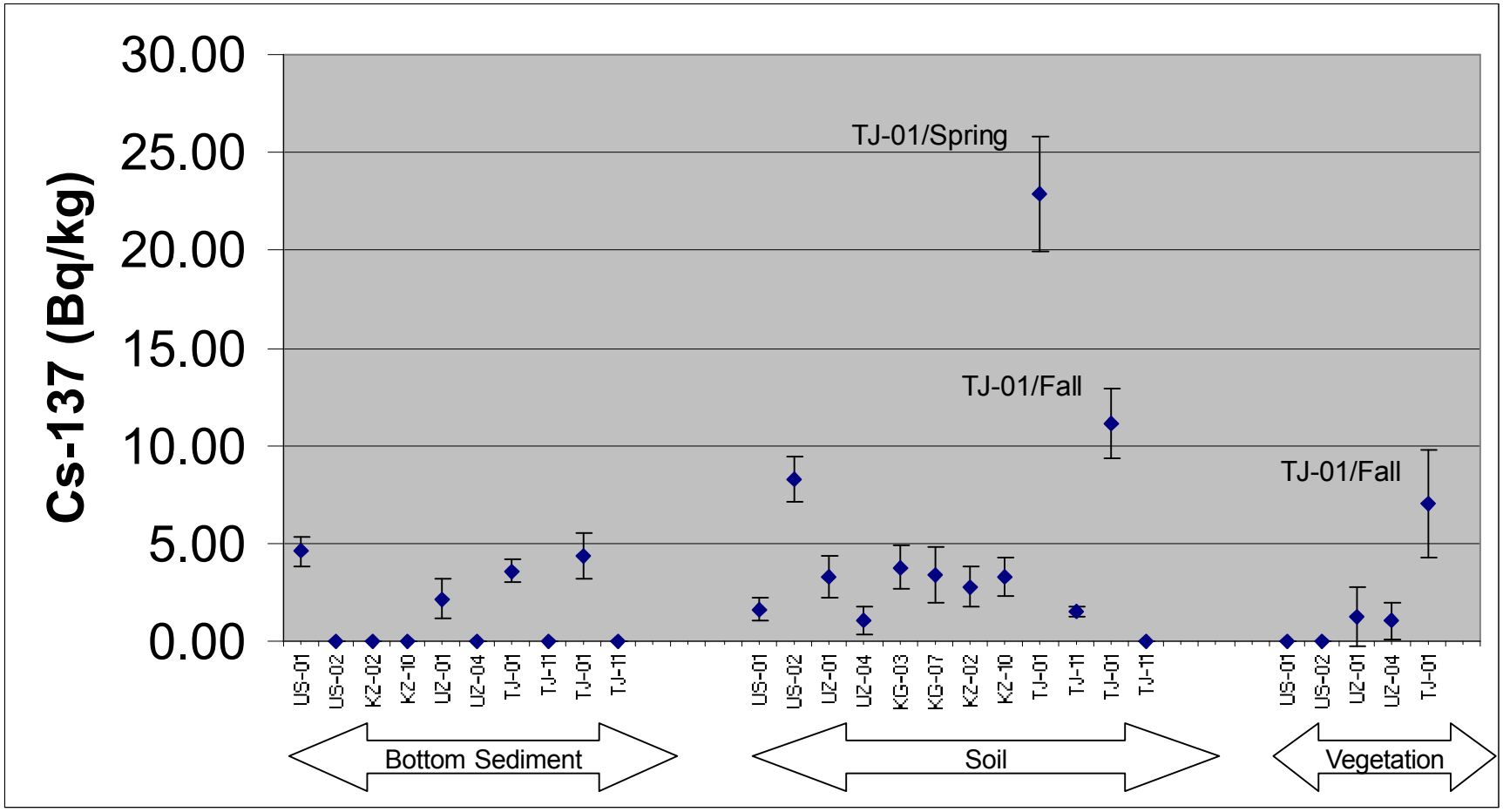
- Data from project posted on this site
- Available to all partners and worldwide



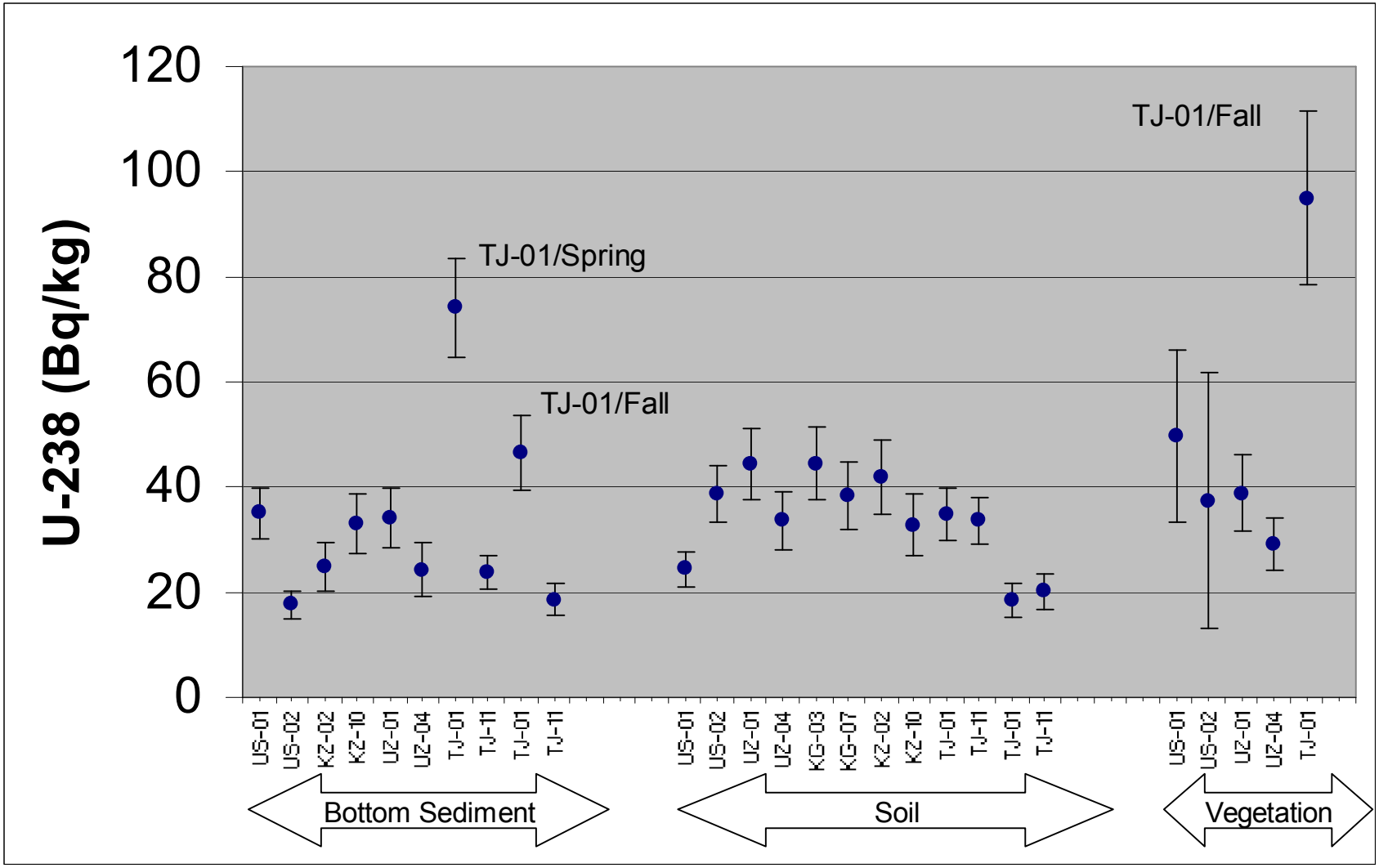


Internet address:
http://www.cmc.sandia.gov/Central/centralasia.html

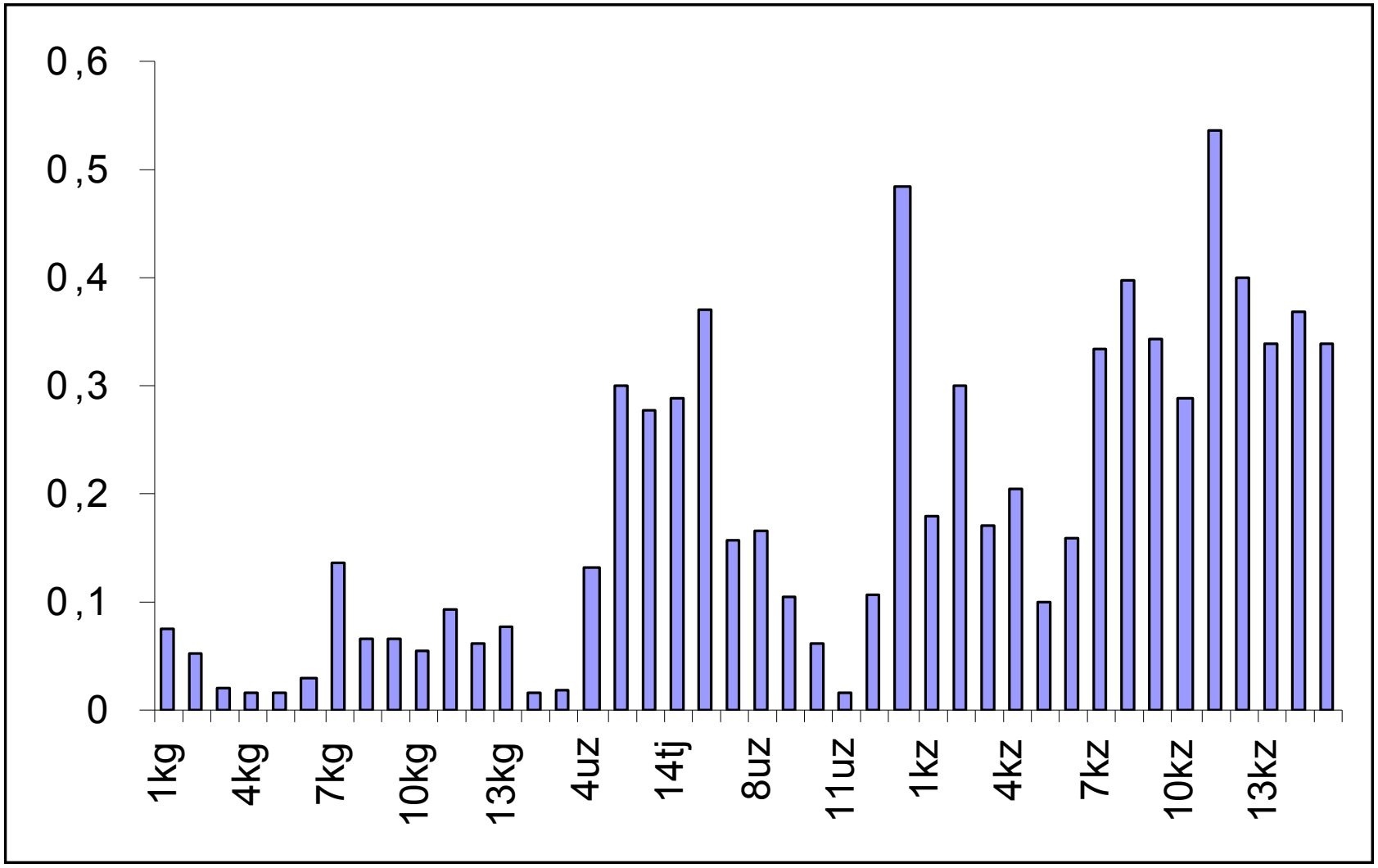
Cs-137


Cs-137 (Bq/kg)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
TJ-01/Spring
TJ-01/Fall
TJ-01/Fall
US-01
US-02
KZ-02
KZ-10
UZ-01
UZ-04
TJ-01
TJ-11
TJ-01
TJ-11
US-01
US-02
UZ-01
UZ-04
KG-03
KG-07
KZ-02
KZ-10
TJ-01
TJ-11
TJ-01
TJ-11
US-01
US-02
UZ-01
UZ-04
TJ-01
Bottom Sediment
Soil
Vegetation

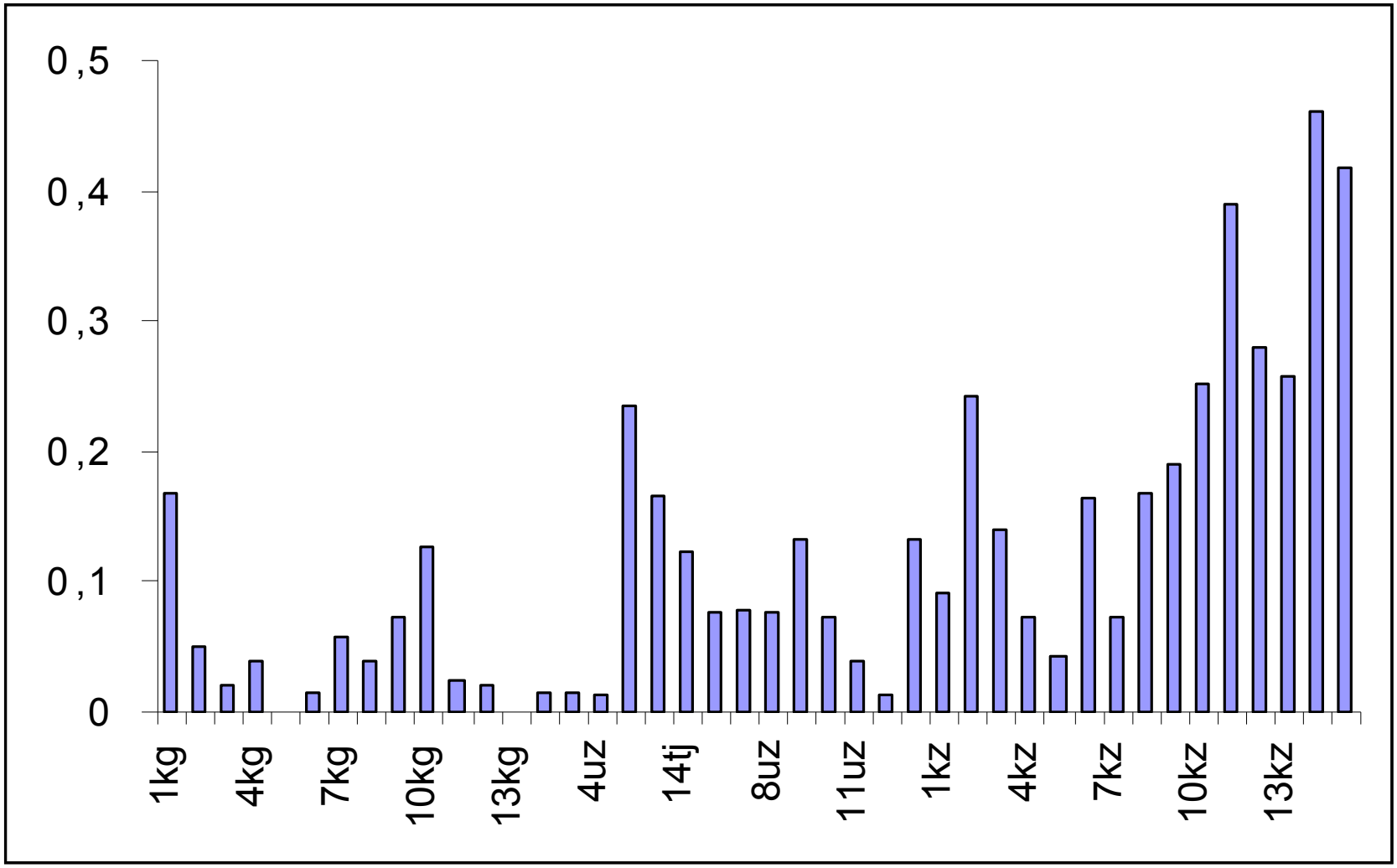
U-238 by Gamma Spec (based on Th-234)



Gross Beta Activity (Bq/L) along the Syr Darya River



Gross Alpha Activity (Bq/L) along the Syr Darya river (Uzbek Report)



Benefits of NAVRUZ Project & Next Steps

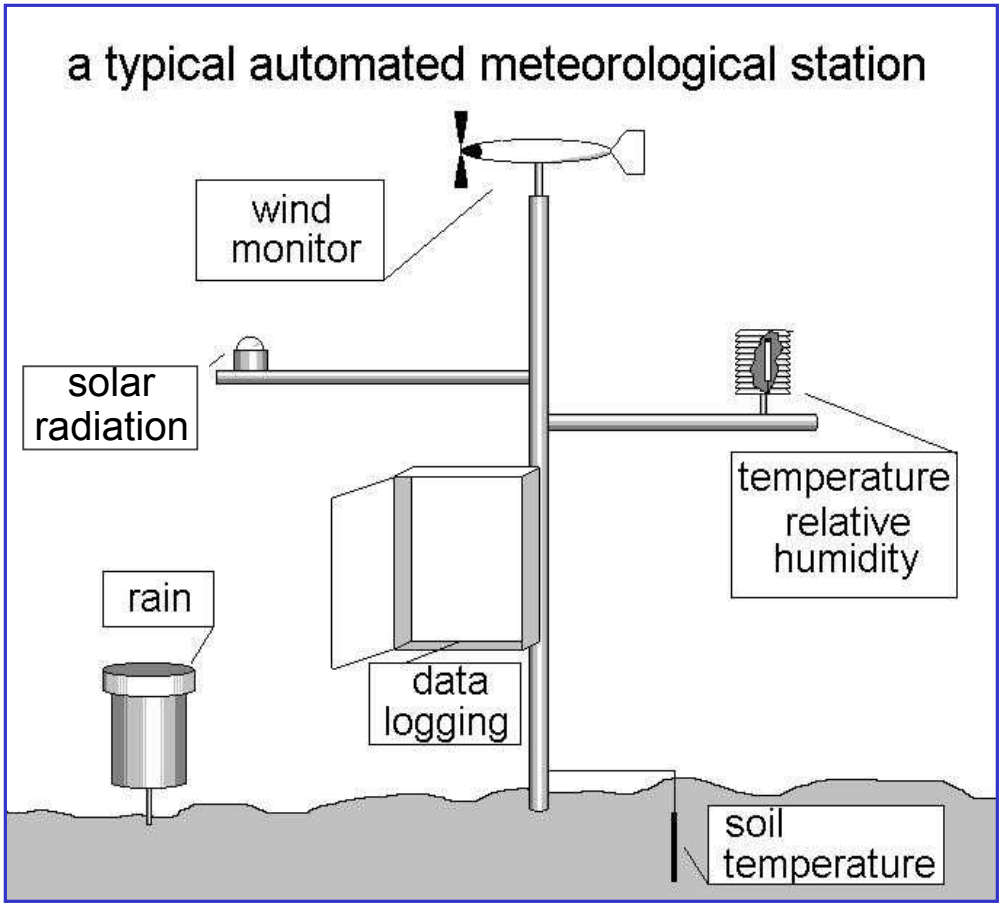
- Demonstrates a sub-government method for resolving regional issues and fostering cooperation & stability
- Shows a method to develop a common understanding and assist resolution of regional water management problems
- Public ministries & institutes can use data to better manage a public health concern created by legacy contamination
- Next Step:
  - Navruz 2
  - Characterize “Hot Spots” in Ferghana
  - Trace to contamination source using radioisotope analysis
  - Risk analysis from contamination sites

Sustainable Land Use (SLU) Project

- A collaborative project between Israel and Palestinian Authority scientific organizations
- Four automated monitoring stations in Israel and the West Bank to measure weather and soil conditions
- Project website is forum to exchange data and ideas

Cooperative monitoring strategy: Integrate four meteorological stations in the PA and Israel

- **MET station features:**
  - 3 - meter tower
  - data logger for multiple sensor inputs
  - cellular phone modem
  - battery w/ solar panels
  - meteorological sensors
    - wind speed and direction
    - solar radiation
    - barometric pressure
    - temperature
    - relative humidity
    - precipitation
  - soil sensors
    - moisture content
    - temperature



Accomplishments in Science & Confidence Building

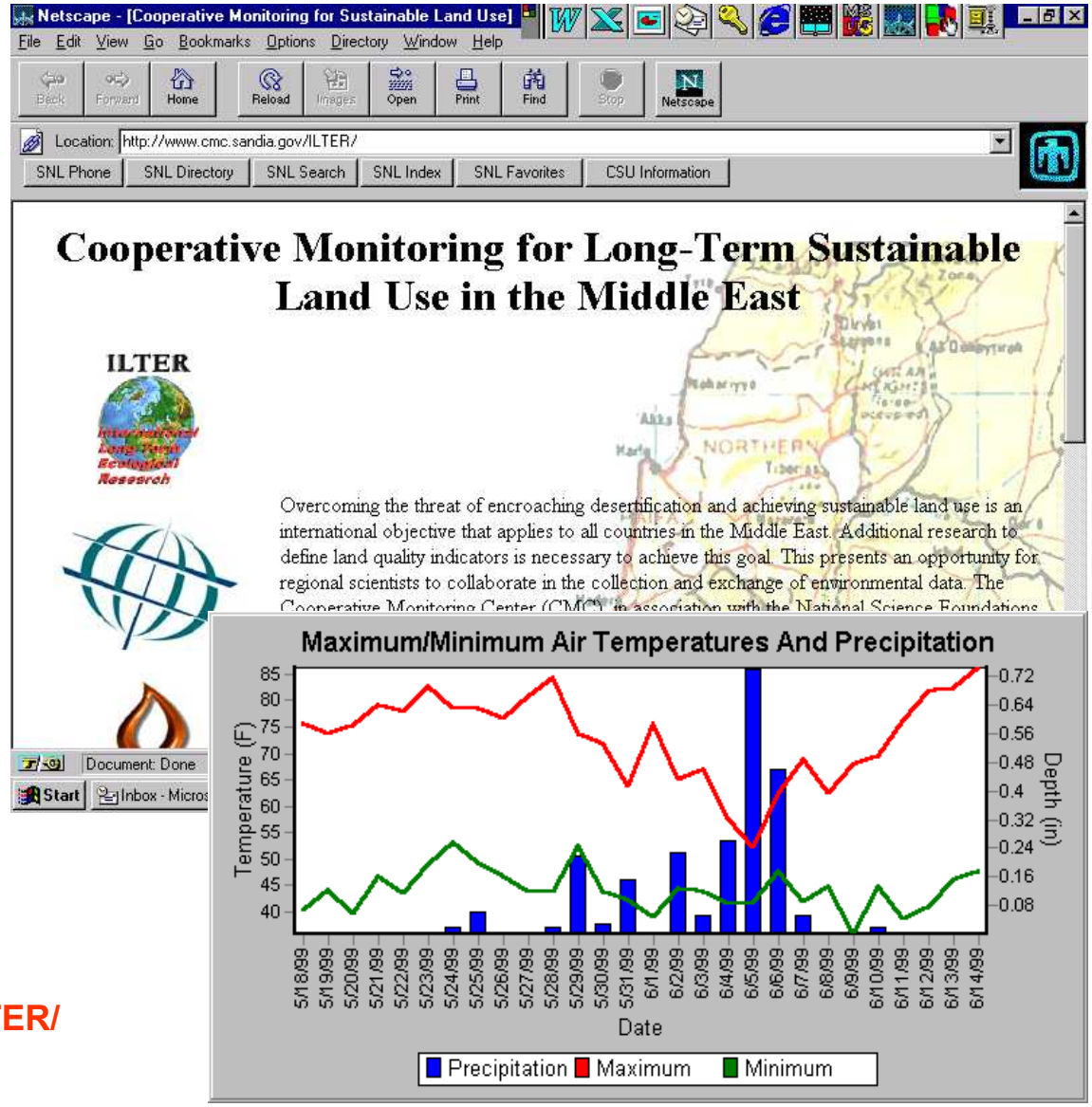
- The project planning phase conducted a precedent-setting joint visit to each participant's research sites
  - Scientists had *never* visited each other's sites
  - Previously knew very little of each other's research and capabilities
  - Developed positive personal rapport and scientific respect

Joint Visit to Lehavim site in Israel

Joint Visit to Samu'a site in Palestinian Authority

Data from the monitoring network are displayed on an Internet website

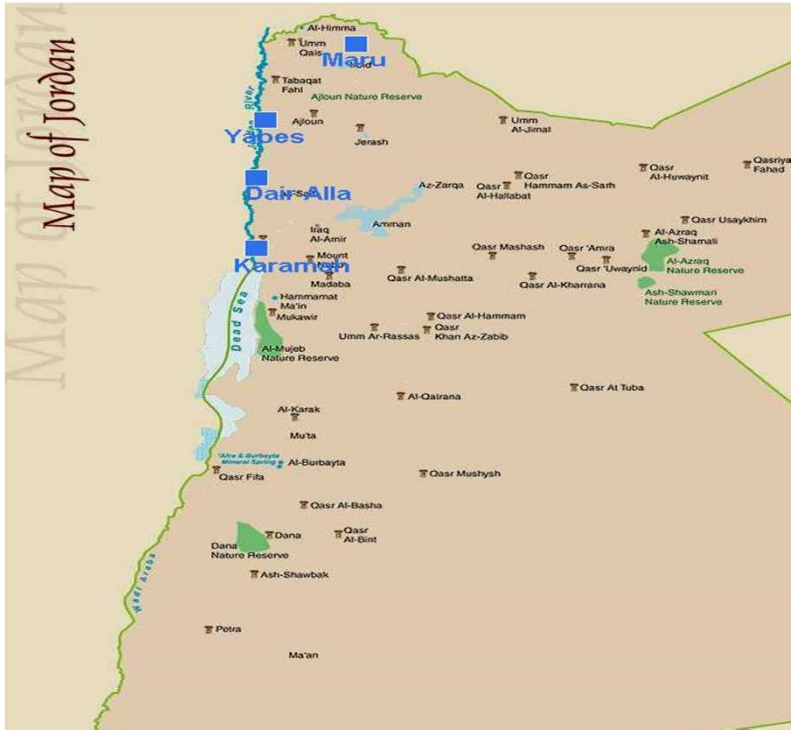
- Describes project background
- Displays data and images from sites
  - text
  - graphical
- Provides direct links to relevant partners
- Provides data and links to international research community



www.cmc.sandia.gov/ILTER/

Next Steps in the SLU Project: Middle East Meteorological Data Sharing System (MEMDSS)

- **Develop New Partners**
  - Jordanian National Center for Agricultural Research and Technology Transfer (NCARTT)
  - 4 Automated MET stations in Northern Jordan and Jordan River Valley
    - Data used by farmers and researchers
    - Similar equipment, network, and database to SLU Project
    - Geographically complements SLU Network
- **New applications:**
  - Consequence management
  - Agricultural
  - Climate



Environmental Cooperative Monitoring -- Summary and Conclusions

- Monitoring can be a key component of implementing international environmental agreements
- Technology is readily available for monitoring a wide range of environmental conditions
- Domestic, bilateral, multilateral, and global nuclear cooperation and environmental agreements are in place, many of which have monitoring requirements