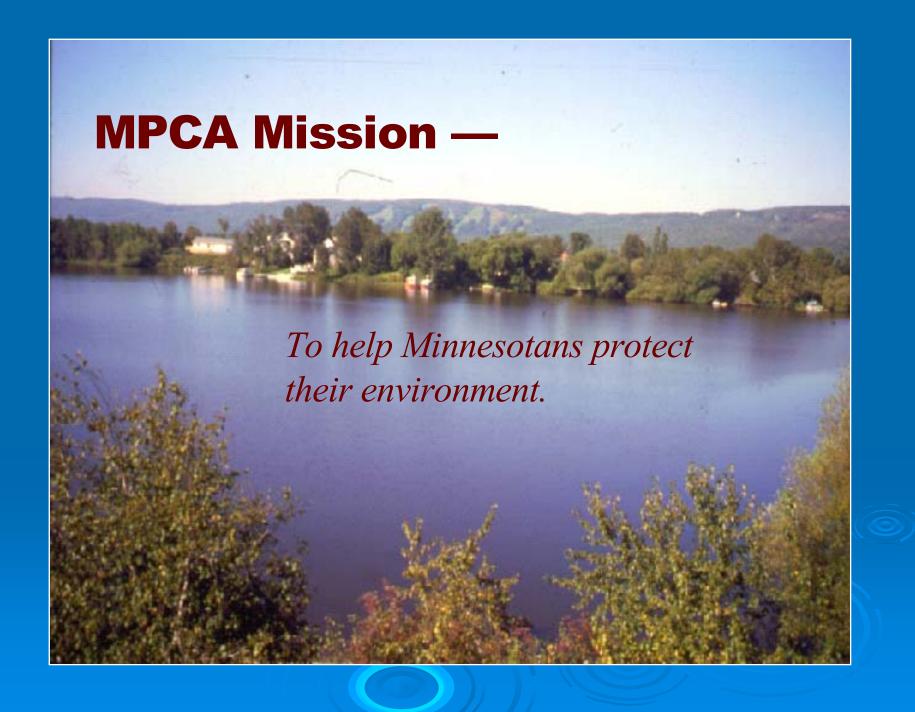
Natural Resource Damage Assessment

Emphasis on Groundwater May 4, 2004



Objectives

- Introduction to NRDA
- > Introduction to NRDA Process
- Introduction to groundwater and NRDA
- Introduction to Minnesota's NRDA program



Typical Scenario Today

- Typical scenario Today-
 - Discharge
 - Emergency clean up*
 - Remedial Investigation
 - Risk assessment
 - Eco-risk *
 - Human health risk*
 - Remedial Options
 - Active Cleanup
 - Passive Cleanup
 - Remediation Complete
 - Natural Resources may not be what they were before the discharge

NRDA Process

- > Preassessment
 - Determines further assessment work
- Injury
 - Determining injury
 - Quantification of injury
- > Restoration
 - Identify potential projects
 - Scale projects to injury

Baseline and Interim Damage

- Baseline Level of natural resources before the release.
- Return to Baseline RP liable to return natural resources to baseline.
- Primary Restoration –Restoration to achieve baseline.
- Interim natural resource damage Lost natural resources from discharge to time of "Return to Baseline."
- Compensatory Restoration –Restoration to compensate the public for interim lost resources

Typical Scenario and NRDA

- > Typical Scenario and NRDA
 - Discharge
 - Emergency clean up* and baseline and injury investigations.
 - Remedial Investigation and baseline conditions and injury
 - Risk assessment
 - Eco-risk and Injury to Natural Resources.
 - Human health risk and Injury to Human use of Natural Resources.
 - Remediation Options
 - Active Cleanup Integrate with natural resource restoration.
 - Passive Cleanup Integrate with natural resource restoration.
 - Remediation complete Natural Resources may not be what they were before the discharge

Primary and Compensatory Restoration

- Primary Restoration Natural resource restoration that brings the natural resource back to baseline.
- Compensatory Restoration Natural resource restoration that compensates the public for lost resources from the time of discharge to when baseline is achieved.

Emergency NRDA Work

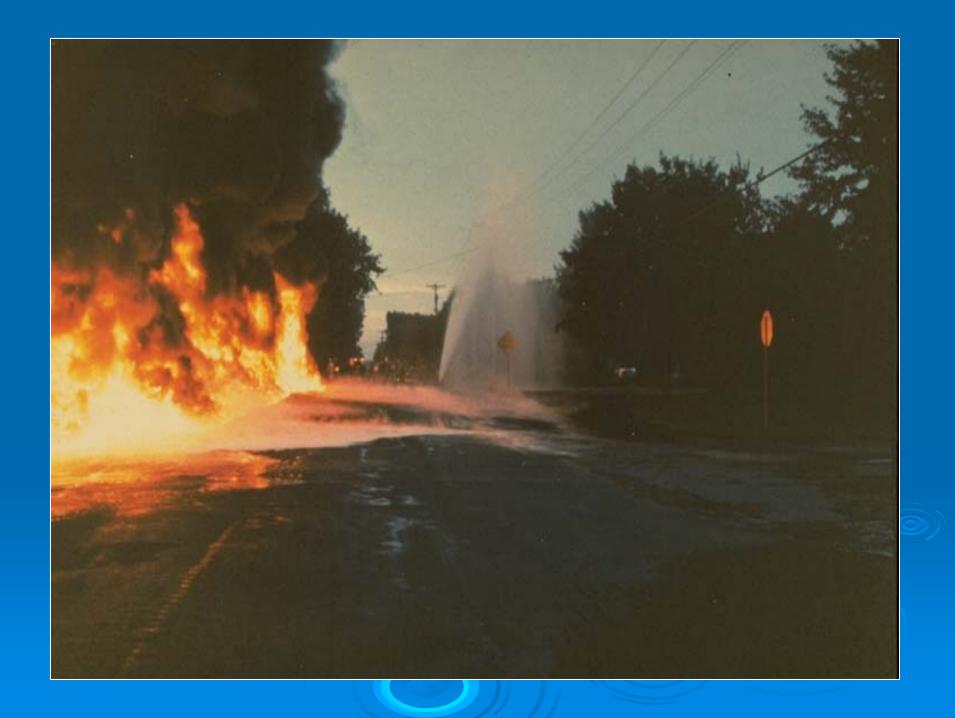
- > Ephemeral Data
 - Habitats
 - Forest type
 - Wetland type
 - Habitats
 - Water Sampling All
 - Biological Sampling
 - Air
 - Baseline
 - All of the above
 - NRDA Emergency Remedial Integration

Preassessment Screen

- Discharge
- Pathway to Natural Resources
- > Injury
- > Reasonable Cost for Assessment
- Response Actions will not Remedy the Injury





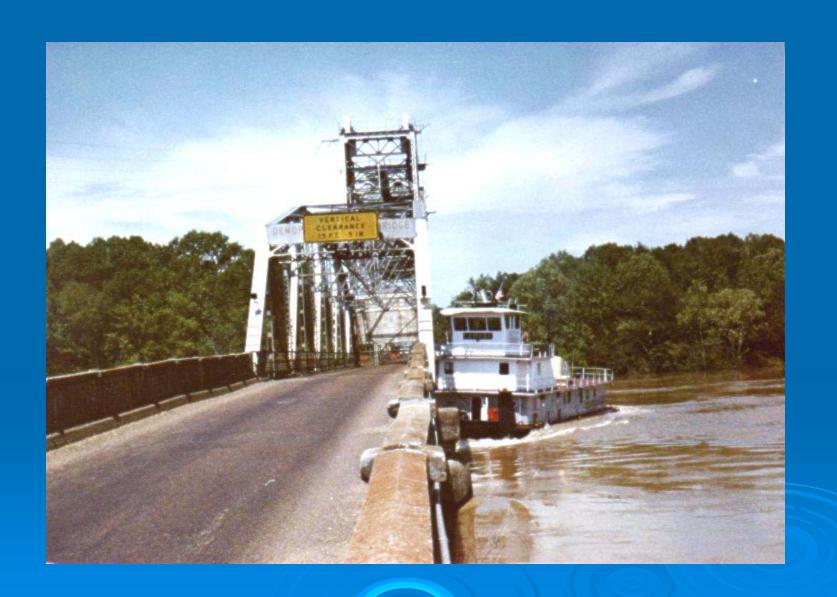


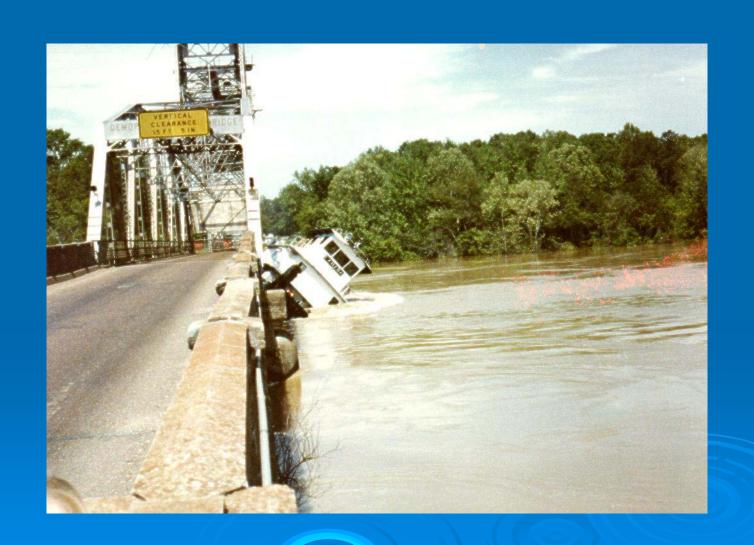
Investigate Natural Resource Injury

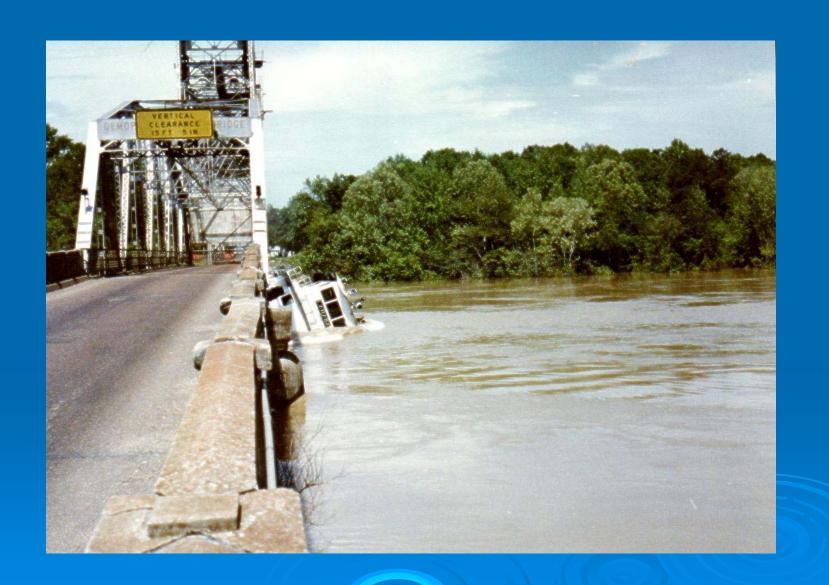
- Observable or adverse change
 - From baseline
 - Contaminates exceeding standards
- Impairment of service
 - Natural Resource Service
 - Human Service

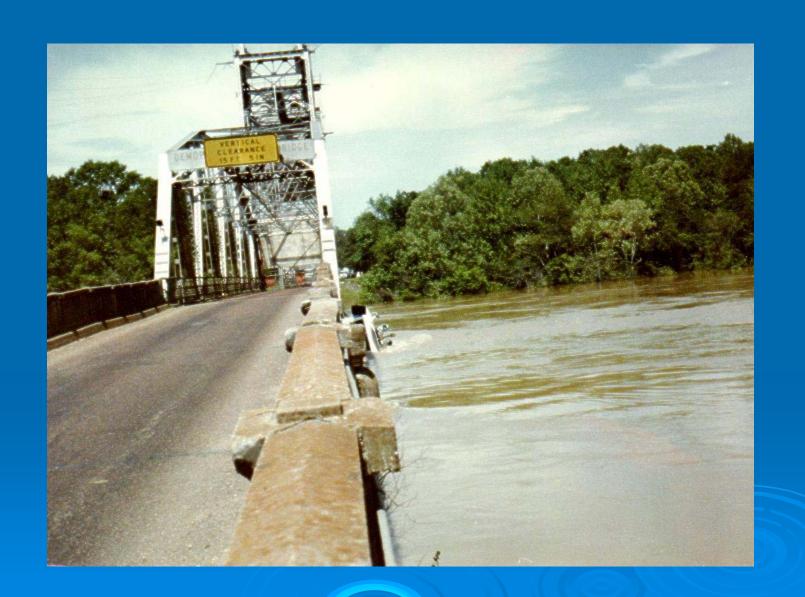
Injury Examples

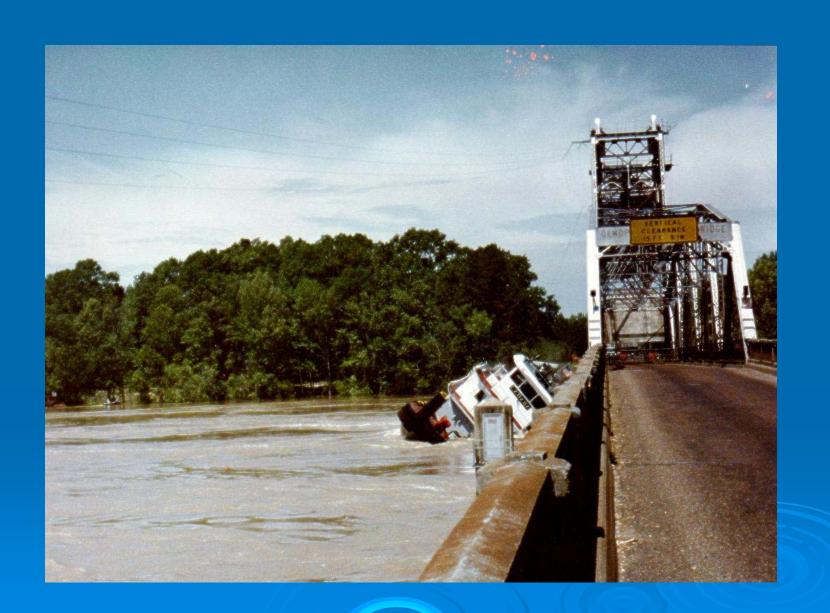
- Observable and/or Adverse Change
 - Exceedence of drinking water standards, surface water standards
 - Exceedence of action levels of edible organisms (for example, fish advisories)
- Impairment of Services
 - Loss of ecosystem functions (for example, impairment of food chain) (Natural Resource Service)
 - Loss of Human Use (Unable to drink the water)









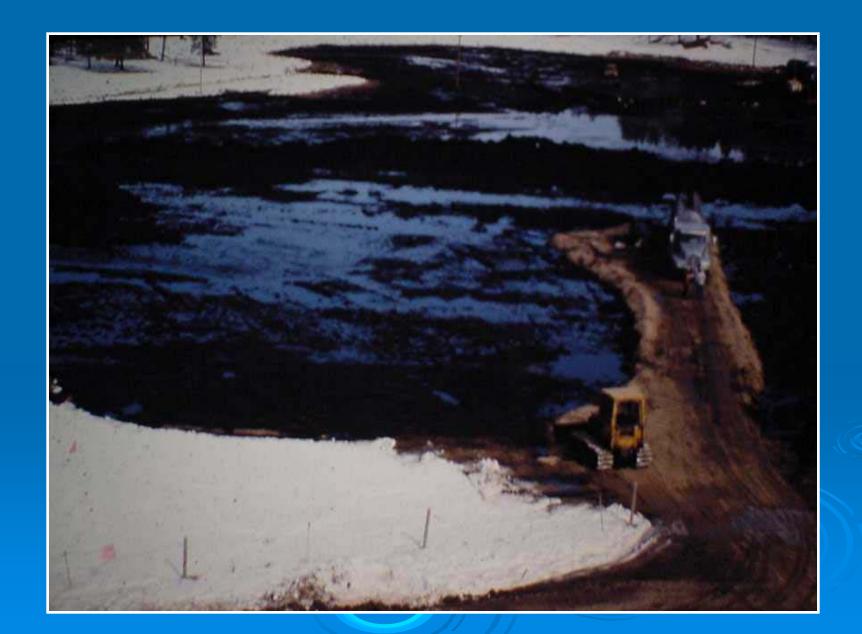




Injury Quantification

- Quantify injury relative to baseline
 - Degree, spatial and temporal extent of injury
 - Reduction or Loss of services
- Unit of Measurement for Scaling Restoration
 - Acre Years of Habitat Loss
 - Acre Feet of Contaminated Groundwater
 - Valuing Lost Resources or Services





Restoration

- Restoration options/projects
- Scale the restoration to the injury
- Determine type and scale of restoration appropriate for the injury

Groundwater and NRDA

- Assess injury
 - Change from baseline
 - Standard
 - Service Loss
- Groundwater Services
 - Ecological Services water for vegetation, water for wildlife via surface water, maintenance of hydrologic flows.
 - Human Services agriculture, drinking water, industrial, recreational, future use, assimilative capacity (buffers and cleans)
- Quantify injury
 - Physical and Chemical Attributes of the Aquifer
 - Volume
 - Flux
 - TIMEFRAME Return to Baseline
 - Unit of measurement appropriate scale
 - Valuing Groundwater

Groundwater and NRDA Continued

- Valuation of Groundwater
 - Market Price Methodology Where there is market prices for groundwater
 - Appraisal Methodology Similar to Market Price Methodology
 - Factor Income Methodology If groundwater is used in a process
 - Travel Cost Methodology Travel costs to obtain clean water
 - Hedonic Pricing Methodology Relates price of a market-traded commodity to its attributes. Example: land prices may be related to contaminated groundwater

Groundwater and NRDA Continued

- > Valuation of Groundwater Continued
 - Unit Value Methodology Preassigned dollar values
 - Contingent Valuation Methodology Human valuation of groundwater with and without contamination
 - Simplified Methods
 - New Jersey, Washington, Florida have formulas

Groundwater and NRDA cont.

- > Groundwater Valuation cont.
 - Cost Cost of treating contamination –
 Minnesota Closed Landfill Program
 - Service to Service Providing Equivalent Services as those Lost

Groundwater Restoration

- Groundwater Protection Strategies
- Providing Drinking Water to Affected Residents
- Providing Treatment for Municipalities
 Water To Treat Contamination
- Conservation Easements To Protect Aquifers in Danger of Contamination Due to Future Development

Alternative NRDA Process

- > Traditional Process
- Cooperative Process
- Negotiate
- > Settlement
- > Justification

Cooperative Assessments

- > Alternative to Traditional Process
- Promotes Participation from RP's and Trustee's
- Optimize Integration of Response and Restoration
- Integrate expertise
- Cost Effective