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GENII: Surface Water Transport

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RAMP GENII Training, Taipei, Taiwan

Surface Water Modeling

SW Scenarios

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- Drinking surface water
- Irrigation with surface water
- Domestic/industrial use of surface water
- Aquatic foods and recreation

Surface Water Transport

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- Initial Mixing
- Rivers
- Impoundments/small lakes
- Open coasts/large lakes
- Estuaries
- Sediment effects

Initial Mixing

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- Jets or diffusers
  - Buoyancy
  - Momentum
- Generally small area
  - Radionuclides unmodeled by regulatory models
- Screening models use unmixed effluent

Rivers - Chronic Releases

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- Usually use 2-D representation
- Usually use steady-state, continuous release
- Result is analogous to Gaussian atmospheric transport, concentration equals release/flow rate times a series of dispersion corrections
- At long distances, uniform mixing assumed
- Frequently used by regulatory/screening codes

Rivers - Acute Releases

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- Also 2-D representation
- Analytical solution restricted to straight-line rectangular channels, steady flow, instantaneous source
- Use of time-integrated concentration is helpful in regulatory analyses
- Not available in screening models

Impoundments -

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- Completely Mixed Ponds
- Plug Flow Pond
- Partially Mixed Pond
- Stratified Reservoir
- Computer Applications
  - **NRC - LADTAP II uses models for:**
    - **Completely mixed**
    - **Plug flow**
    - **Partially mixed**
  - **NCRP screening approach uses completely mixed pond model only**

Open Coasts

- Long-shore currents tend to be wind driven, so quasi-steady-state models usually used
- Analytic solutions available for steady, point sources as functions of long-shore distance, off-shore distance, and depth
- LADTAP II model uses uniformly vertically mixed model
- NCRP screen uses related model with single lumped dispersion parameter

Estuaries

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- Flow direction changes with tide
- Estuary volume often large compared to freshwater flow rate
- Wind driven currents
- Fresh/salt water density differences
- High sedimentation rates
- Changes in sorption caused by salinity

Estuarine Mixing Regions

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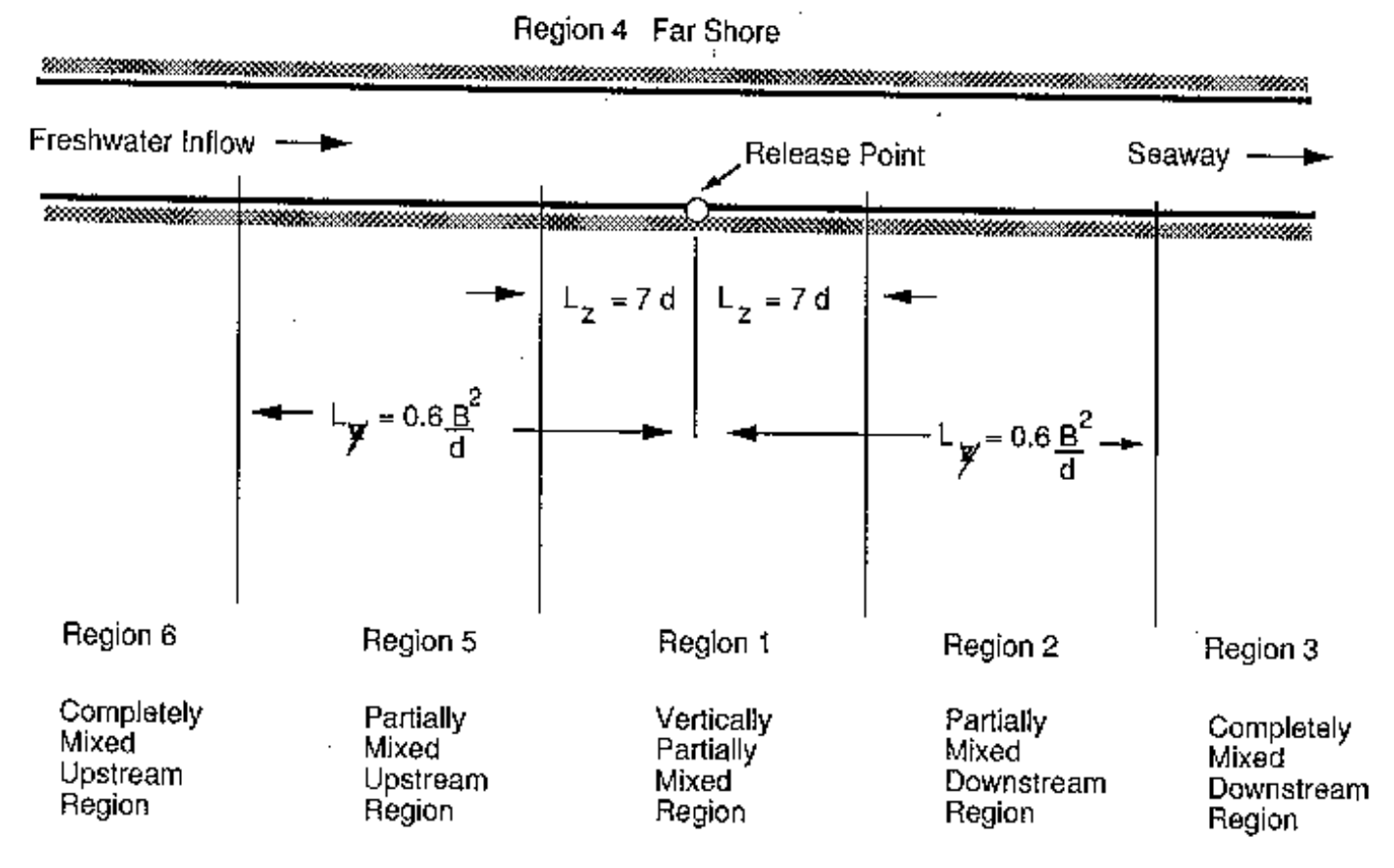

Sediment Effects

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- Radionuclides generally sorb to sediments
  - Generally settle, scavenging contaminants
  - Can resuspend, act as source in high flow
- Most screening and regulatory models neglect sedimentation

Sedimentation

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- Sorption frequently approximated with Kd, which lumps
  - Chemical form
  - Concentration
  - Sediment type/amount
  - Water quality/salinity
  - Contact time

Surface Water Models in GENII