



Salt Contamination Assessment and Remediation Guidelines

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Sources of Salt Contamination

- ◆ Road salt storage yards
 - ◆ NaCl, CaCl, KCl
 - ◆ **Produced water spills**
 - ◆ NaCl
 - ◆ Animal slaughter operations
 - ◆ NaCl
 - ◆ Pulp mills
 - ◆ NaSO₄
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Environmental Effects

◆ Plant growth

- ◆ inhibits water uptake
- ◆ chloride toxicity
- ◆ sodium toxicity

◆ Soil quality

- ◆ crusting
- ◆ inhibits water movement through soil
- ◆ trafficability, tilth

◆ Groundwater quality



Guideline Structure

- ◆ **Regulatory**
 - ◆ legislative background
 - ◆ Guidelines
 - ◆ **Site Assessment**
 - ◆ **Remediation**
 - ◆ **Technical background**
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Regulatory Practice *Remediation Objectives*

**Increasing Regulatory
Involvement**



- ◆ **Generic guidelines**
 - ◆ Soil
 - ◆ Groundwater
 - ◆ **Site-specific risk assessment**
 - ◆ **Risk Management**
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Generic Soil Guidelines

- ◆ **Separate values for surface (A horizon) and subsurface (B,C horizons)**
 - ◆ **Classify control soils into suitability rating category**
 - ◆ **Choose remediation objective from within same suitability category**
 - ◆ **Sites zoned for industrial use may default to industrial guidelines**
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Generic Soil Guidelines

Parameter		Rating Categories				Industrial
		Good	Fair	Poor	Unsuitable	
Topsoil	EC dS/m (salinity)	<2	2 to 4	4 to 8	>8	4
	SAR (sodicity)	<4	4 to 8	8 to 12	>12	12
Subsoil	EC dS/m (salinity)	<3	3 to 5	5 to 10	>10	4
	SAR (sodicity)	<4	4 to 8	8 to 12	>12	12



Generic Water Guidelines

Water Use	Parameter
Drinking Water	Chloride – 250 mg/l Total dissolved solids – 500 mg/l Nitrate (as N) – 10 mg/l Nitrite (as N) – 1 mg/l (where nitrates and nitrites are both present, the total acceptable concentration is 10 mg/l)
Livestock Watering	Total dissolved solids – 3000 mg/l 100 mg/l for nitrate plus nitrite, and 10 mg/l for nitrite alone



Risk Assessment

- ◆ **Estimate the potential for adverse effects from site-specific information:**
 - ◆ extent and severity of contamination
 - ◆ potential for contamination to spread
 - ◆ receptors that may be affected
 - ◆ **Use risk characterization to plan:**
 - ◆ remediation program
 - ◆ remediation objectives
 - ◆ risk management solutions
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Risk Assessment

- ◆ **Risk assessment is appropriate when:**
 - ◆ generic guidelines do not account for site-specific exposure conditions
 - ◆ significant or sensitive receptors
 - ◆ **Risk assessment endpoints may support:**
 - ◆ equivalent land capability, or
 - ◆ risk management and land use restrictions
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Site Assessment

◆ Goal:

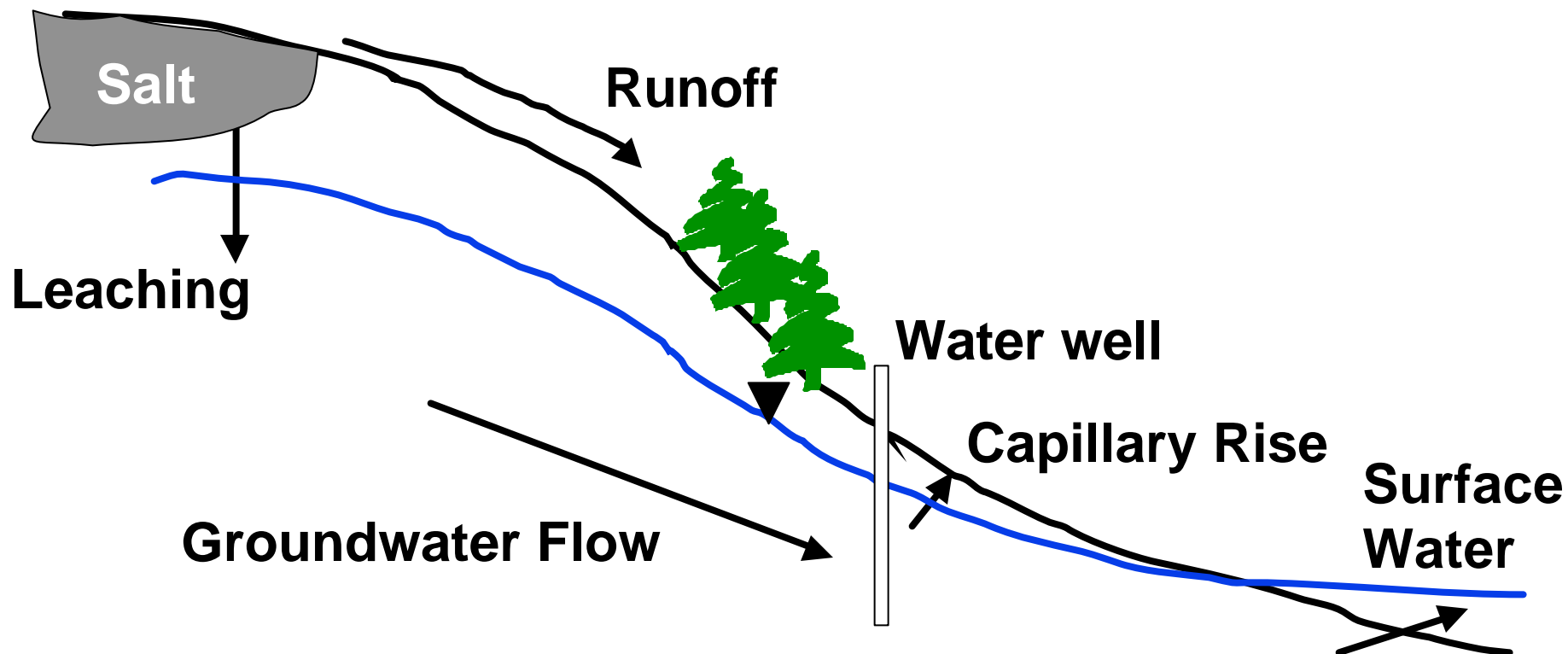
- ◆ Provide sufficient information to develop remediation objectives and a work plan

◆ Information required:

- ◆ Extent and degree of contamination
 - ◆ Land use and land capability (control sites)
 - ◆ Receptors
 - ◆ Potential for salts to move beyond spill site
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Pathways of Salt Movement





Site Assessment Tools

- ◆ **Soil sampling and lab analysis**
 - ◆ **Field screening techniques**
 - ◆ **Geophysical investigation**
 - ◆ EM surveys
 - ◆ **Visual indicators**
 - ◆ Vegetation damage
 - ◆ Salt tolerant vegetation
 - ◆ Crusting
 - ◆ **Groundwater wells**
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Remediation Options

- ◆ **Reduce salt concentrations**
 - ◆ **Provide calcium to replace sodium**
 - ◆ **Methods include:**
 - ◆ Excavation and disposal
 - ◆ In-situ flushing
 - ◆ Groundwater interception and disposal
 - ◆ Excavation and washing
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Technical Background

- ◆ **Provides the science behind the guidelines**
 - ◆ Sources of salt
 - ◆ Natural occurrence of salts in soil and groundwater
 - ◆ Transport mechanisms in soil and groundwater
 - ◆ Effects of salt on soil, vegetation
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Conclusions

- ◆ **Guidelines provide:**
 - ◆ options for developing remediation objectives
 - generic guidelines
 - site-specific risk based objectives
 - risk management programs
 - ◆ site assessment guidance
 - ◆ potential remediation techniques
 - ◆ scientific background
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