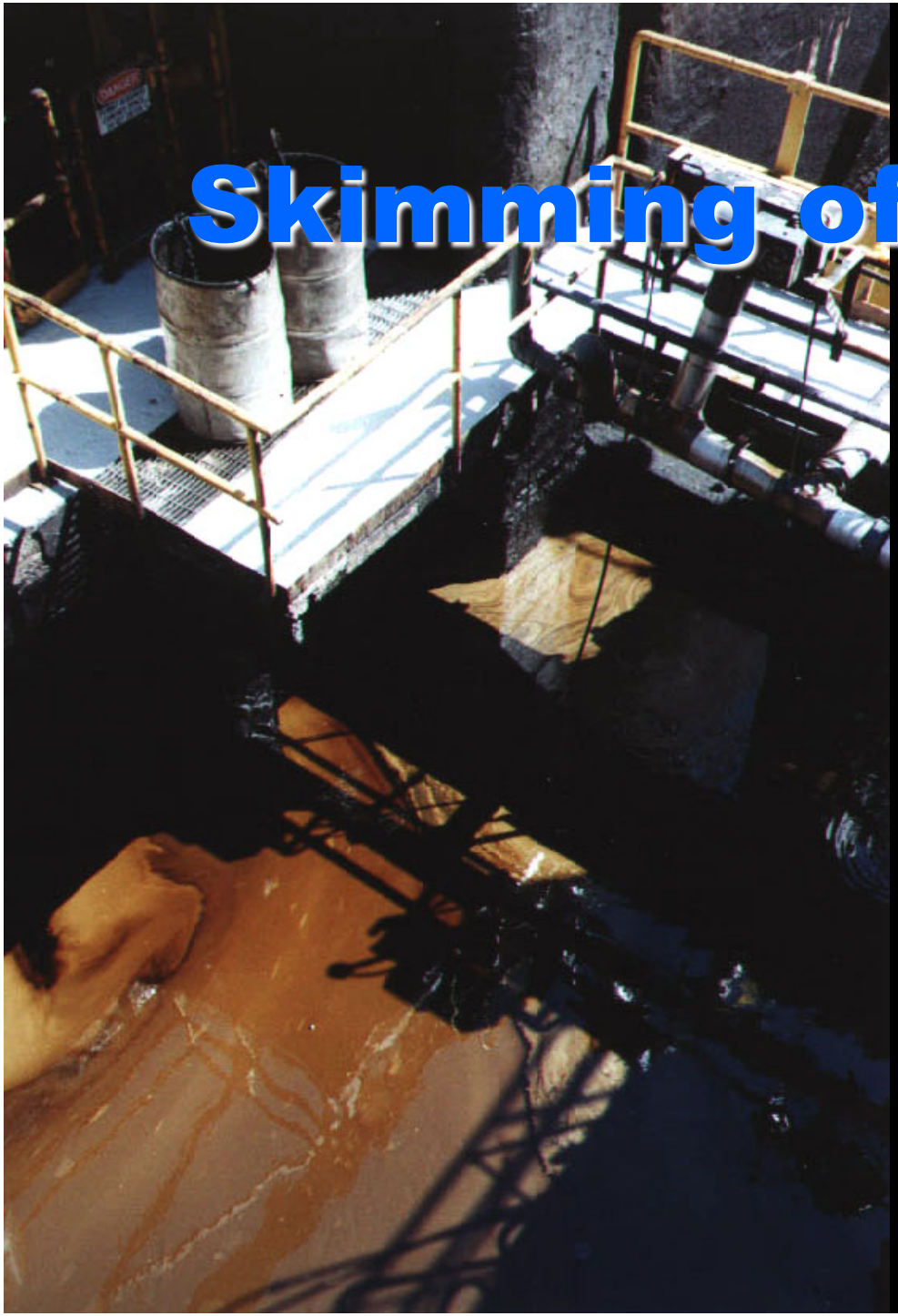
Industrial Waste Characterization, Pretreatment and Neutralization

Dr. John T. O'Connor, PE

Waste Pretreatment

- Bar Racks 1”- 3” Steel Bars
- Screens 0.01 - 0.5” SS Wire Mesh
- Comminutors 0.25 - 0.4” Slots

Skimming of Floatables



Greases

- **Fats**
- **Oils**
- **Wax**

Influent Equalization

- Blending of Sources
- Flow Equalization
  - Daily, Seasonal Variations
  - Infiltration, Rainfall
- Waste Concentrations
- Neutralization

Wet Weather Flow Storage

Stormwater retention: 9 million gallons

Waste Constituents

- Physical
- Chemical
- Biological
- Radiological

Influent Wastes

Solutia

Acids: Sulfuric, Hydrochloric, Phosphoric, Formic

Ammonia, Aniline, Benzene,
Xylene, Ethylene Glycol
Methylethyl ketone, Methylisobutyl ketone,
Monochlorobenzene, Orthodichlorobenzene,
Orthonitrophenol, Paranitrophenol

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Influent Wastes

Cerro	Ethyl
#2 Fuel Oil	Gear, Crankcase Oil
Gasoline	Transmission Fluid
Kerosene	Benzene
Trichloroethylene	Isobutylene

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Influent Wastes

Big River Zinc

Oxides: Arsenic, Cadmium, Calcium, Manganese, Sodium

Zinc & Copper Sulfate, Sulfuric Acid

#2 Diesel Fuel, Gasoline, PCB

Potassium Permanganate, Soda Ash,

Sodium Hydrosulfide, Strontium Carbonate

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Physical Properties

- **Temperature** — Density, Reaction Rates
- **Floatables** — Grease: Oils, Fats, Wax
- **Turbidity** — Light Scattering

- **Solids** — Inorganic (sand), Organic (fiber)
- **Odor** — Sulfides, Ammonia, Volatile Organics
- **Color** — True (dyes), Apparent (precipitates)

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Chemical Constituents

Inorganic Compounds

- **Metals** As, Ba, Cd, Cr, Pb, Hg, Se, Ag
  Cu, Zn, Fe, Mn, Ca, Mg
- **Non-Metals** Bicarbonate (Alkalinity),
  Chloride, Sulfate, Nitrate

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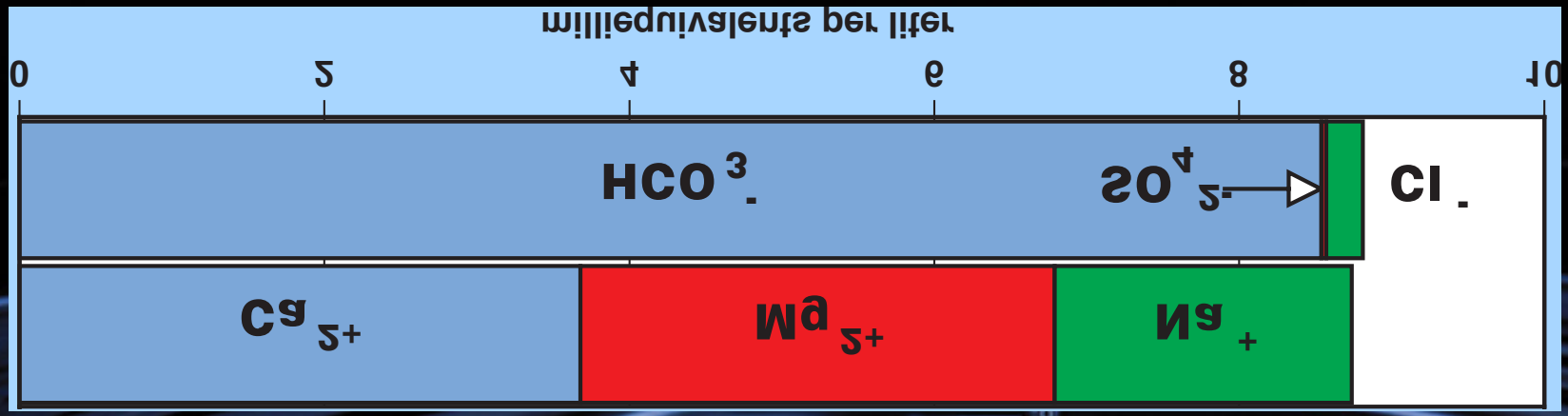
Electroneutrality Condition
Illinois Well Water



1 meq/ l = 50 mg $CaCO_3$ eq./ l

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Chemical Constituents

Organic Matter - Aggregate Measures

- **Biochemical Oxygen Demand: BOD** $_{5d,\ 20\ °C}$
  -- microbially-mediated oxygen demand
- **Chemical Oxygen Demand, COD**
  -- chemically enhanced oxidation of organic matter
- **Total Organic Carbon (TOC)**
  -- direct measurement of organic carbon, mg C/l

Chemical Constituents
Individual Organic Compounds

- Phenols, Benzene, Toluene
- Pesticides, Herbicides, Insecticides
- Poychlorinated Biphenyls
- Polynuclear Aromatic Hydrocarbons
- Methane

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Municipal Wastewater

Total Solids	
Dissolved	500 mg/l
Suspended	200 mg/l
BOD 5d, 20 °C	200 mg O/l
COD	500 mg O/l
TOC	160 mg C/l

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Toxic to Biological Waste Treatment

	Carbonaceous	Nitrification
Copper	1.0	0.005
Nickel	1.0	0.25
Zinc	0.8	0.08
Cyanide	0.1	0.34
Arsenic	0.1	-
Phenols	200	4

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Aerated Grit Chamber

Grit Settled for 60 minutes

Fine Sand > 0.2 mm,

Dense Organic Debris

S.G. 1.3 to 2.7

Organic Matter Suspended at velocity > 1 foot per second

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Grit Collection
• Inclined Continuous Screw
• 1-4 cubic feet per million gallons

Acid Neutralization Process

Lime Storage (CaO)

Lime Slaking $Ca(OH)_2$

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Mixing Basin

Lime Slurry Fed in Three Stages

Lime Dissolution yields alkali, OH^-

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Neutralization Basin
Lime feed adjusted to maintain
pH 8.3 in plant effluent

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