

Assessing the Degree of Appropriate Treatment of Urban Stormwater Stormwater Runoff

G. Fred Lee, PhD, PE, DEE and Anne Jones-Lee, PhD

G. Fred Lee and Associates, El Macero, CA

Adapted from

Presentation at Marine Technology Society, Oceans 99 Conference
Seattle, WA September 1999

Review Water Quality Management Issues for Urban Area and Highway Stormwater Runoff

Discuss Current Regulatory Problems That Lead to Over-Regulation

Suggest Alternative Approaches for Assessing the Real, Significant Water Quality Impacts and Their Management.

Introduce Evaluation Monitoring Approach

Definitions

Lack of Understanding of Basic Regulatory Issues/Definitions Leads to Over- Regulation and Under-Regulation of Wastewater Discharges and Stormwater Runoffd Constituents

Pollution - Clean Water Act - Impairment of Beneficial Uses

Water Quality - Assessed by Impairment of Beneficial Uses

Not a List of Chemical Concentrations

Water Quality Assessment - Evaluation of Beneficial Use Impairment

Cannot Use Exceedance of Water Quality Standard

Aquatic Chemistry - Chemical Reactions That Control Chemical Species Impacts

Not a List of Chemical Concentrations-Chemical Characteristics

Administrative Exceedance - Exceedance of a Water Quality Standard without Beneficial Use Impairment

Related to the Overly Protective Nature of US EPA Water Quality Criteria and State Standards

Cause of Aquatic Life Adverse Impacts - Toxic/Available Forms of a Chemical That Are Present for Sufficient Time to Exceed Critical Exposure

Aquatic Life Toxicity - Must Be Assessed Based on Toxicity Measurements

Cannot Be Evaluated Based on Chemical Concentrations in Water or Sediments

Managing Urban Area Stormwater Runoff Water Quality Impacts

Urban Area and Highway Stormwater Runoff Contain Elevated Concentrations of Potential Pollutants

Heavy Metals, Nutrients, Organics and Pathogen Indicator Organisms

Need to Reliably Evaluate Whether Concentrations in Runoff above Water Quality Standards Cause Impairment of the Beneficial Uses of the Receiving Waters for the Runoff

Requires Site-Specific Evaluation to Avoid Over- and/or Under-Regulation
Over-Regulation Associated with Use of Existing Water Quality Standards
and Sediment Quality Guidelines

Under-Regulation Occurs for Unregulated Chemicals, i.e., Those for which
There Are No Water Quality Standards

Must Consider both Watercolumn and Sediment Impacts

Suggested Approach

Use **Evaluation Monitoring** Approach

Focus on Assessing Receiving Water Impacts Rather Than on Chemical
Concentrations in Runoff

Determine if Exceedance of a Water Quality Standard(s) in Runoff Waters Impairs
Beneficial Uses

Is the Runoff **Toxic** to Aquatic Life?

Use US EPA Standard Three-Species Toxicity Test

If **Toxic**, is the Toxicity Adverse to Beneficial Uses of Receiving Waters?

Are the Numbers and Types of Desirable Aquatic Life Altered by Toxicity?

Does the Runoff Contain Hazardous **Bioaccumulatable** Chemicals?

Do Edible Organisms in Receiving Waters Contain Excessive Hazardous
Chemicals That Are Present in the Runoff?

Do Not Assume That All Chemicals of a Certain Type from All Sources Are in
Toxic/Bioaccumulatable Available Forms

Use Site Specific Toxicity Identification Evaluations (TIEs) and/or Organism
Uptake Studies

Does the Runoff Contain Particulate Forms of Chemicals That Are Potentially
Hazardous in Receiving Water Sediments?

Do the Sediments near the Point of Runoff Contain Elevated Concentrations of
Potentially Toxic/Bioaccumulatable Chemicals That Are Present in the Runoff?

Use Watershed-Based Stakeholder-Developed Consensus Approach

Work with Regulatory Agencies and Others as Appropriate in Developing,
Conducting, and Evaluating Current Water Quality - Beneficial Use Impacts of Existing
Runoff

If Real, Significant Water Quality Problems Are Found That Are Appropriately Related
to the Runoff:

- Evaluate the Cost of Controlling the Constituents in the Runoff Causing the Use-
Impairment
- Evaluate the Improvement in the Beneficial Uses of the Receiving Waters
Through Control of the Constituent(s) Responsible for Use Impairment

If Exceedance of Water Quality Standards in Runoff Occurs That Is Not Associated with a Significant Adverse Impact on Beneficial Uses, Work with Regulatory Agencies and Others to Address the **Administrative** Exceedance of the Water Quality Standard

Adjust the Water Quality Standard for Site-Specific Conditions in Accord with US EPA Water Quality Standards Handbook

If This Approach Does Not Eliminate Administrative Exceedance, Work with Regulatory Agencies, Federal and State Legislatures to Change Regulatory Approach to modify US EPA **Independent Application Policy**

Search for Undetected/New Water Quality Problems Due to Runoff Associated Constituents

Adopt Proactive Approach to Work with Regulatory Agencies and Others in Detecting Subtle and/or New Water Quality Problems

Proactive Approach Needed to Gain Acceptance of Regulatory Approach for Discharge/Runoff That Is Based on Best Professional Judgment Rather Than Worst Case Based Water Quality Criteria

Best Professional Judgment - Regulatory Approach

Current US EPA Regulatory Approach Does Not Properly Incorporate Current Science/Engineering into Management of Water Quality

Focuses on Managing Chemical Concentrations Rather Than on Chemical Impacts - Cannot Translate Chemical Concentrations to Water Quality - Use Impairment Impacts

Need to Adopt an Expert Panel-Developed, Non-Numeric Best Professional Judgment Weight-of-Evidence Approach for Managing Subtle Water Quality Impacts Based on an Integrated Use of:

- Aquatic Life Toxicity/Bioaccumulation
- Altered Aquatic Organism Assemblage Information
- Chemical Information on the Chemicals Responsible for Toxicity/Bioaccumulation and Altered Aquatic Organism Assemblages

Do Not Use Total Concentration of Chemicals

Must Use TIEs to Establish Cause of Use-Impairment

Use Public, Interactive Peer Review to Resolve Disputes among "Experts" on Technical Issues

Managing Contaminated Sediments

Contaminated Sediments - Elevated Concentrations of Potentially Toxic/Bioaccumulatable Chemicals-Next "Superfund" - "Aquafund"

Technically Invalid Approaches Used to Evaluate Water Quality Significance of Chemical Constituents in Aquatic Sediments

Long and Morgan, MacDonald, and US EPA So-Called "Sediment Quality Guidelines" Not Reliable for Evaluating Toxicity of Chemical Constituents

in Aquatic Sediments

Based on Total Concentration of Chemicals - Well-Known There Is No Relationship between the Total Concentration of a Chemical in Sediments and its Impact on Aquatic Life/Water Quality

To Assess Whether a Chemical in Sediments Is Toxic, Must Conduct Toxicity Tests with a Suite of Sensitive Organisms Using Several Appropriate Reference Sediments Properly Interpret Results in Terms of Waterbody Beneficial Use Impairment - Are the Organism Assemblages in "Toxic" Sediments Significantly Altered Due to a Suspected Toxicant?

Must Due Site-Specific TIEs to Identify Toxicant(s)

Stormwater Runoff BMP Selection and Evaluation

Current US EPA Stormwater Runoff Water Quality Management Program Requires That Ultimately Stormwater Runoff Associated Constituents Shall Not Cause or Contribute to Violations of Water Quality Standards in Runoff Waters

Timetable for Implementation Not Established

Will Likely Be Determined by Environmental Group Litigation

Currently Using a BMP Ratcheting-Down Process for Exceedances of a Water Quality Standard in Stormwater Runoff

Stormwater Manager Must Work with the Regulatory Agency in Developing BMPs to Eliminate the Exceedance

Will Cost the US Public Hundreds of Billions of Dollars

US EPA Water Quality Criteria/State Standards Tend to Over-Regulate Stormwater Runoff Associated Constituents

Many Stormwater Runoff Water Quality Standards Violations Represent **Administrative** Exceedance of Water Quality Standards

- Stormwater Runoff Constituents Often in Non-Toxic, Non-Available Forms
- Short-Term Exposure Compared to Critical Exposure Needed to Be Adverse to Aquatic Life

Conventional "BMP" Such as Detention Basins and Grassy Swales Will Not Treat Stormwater Runoff to Achieve Water Quality Standards

BMP Selection Should Be Based on Site Specific Evaluation for Controlling Chemical Constituents in the Stormwater Runoff That Are Significantly Impacting the Beneficial Uses of Receiving Waters

Use **Evaluation Monitoring** Procedures

BMP Efficacy Evaluation Should Be Based on Evaluating the Improvement in the Beneficial Uses of the Receiving Waters for the Stormwater Runoff

Measurement of Percent Reduction of a Chemical Constituent across a BMP Not a Reliable Evaluation of BMP Efficacy

Leads to Erroneous Conclusions on BMP Effectiveness

Conclusions

Current Regulatory Approach for Stormwater Runoff Water Quality Management Tends to Over-Regulate Discharge/Runoff

Can Cause Significant Unnecessary Expenditures for Chemical Constituent Control

Should Focus on Assessing and Managing Chemical Impacts in Discharge/Runoff Rather than Chemical Concentrations/Loads

Chemical Concentration-Based Regulatory Approach, While Bureaucratically Simple to Administer, Often Leads to Technically Invalid Approaches for Assessing and Managing Water Quality Impacts from Wastewater Discharges and Stormwater Runoff

Should Use an Evaluation Monitoring Approach to Determine Real, Significant Water Quality Use-Impairments Caused by Discharge/Runoff to Develop DRunoff Management Program That Will the Beneficial Uses of Receiving Waters without Significant Unnecessary Expenditures for Chemical Constituent Control