Sand Creek Watershed, Colorado

Watershed-Based Selenium Standard

Permitting Authority:
Colorado Department of Public Health and Environment

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Pollutants of Concern in the Watershed:
Selenium

Watershed Approach:
Stakeholder collaboration to develop a watershed-based selenium standard

Permit Type:
Individual permits to publicly-owned treatment works and industrial facilities

Permits Issued: Various dates

Overview

Suncor Energy (U.S.A.), Inc., formerly Conoco Denver Refinery, convened the Selenium Stakeholder Group to discuss the scientific merit and feasibility of implementing Colorado's proposed more stringent selenium standard for point sources discharging to the South Platte River and its tributaries, specifically Sand Creek. Members of the group predicted that applying the lower standard would result in Sand Creek being inappropriately placed on Colorado's Clean Water Act (CWA) section 303(d) list of impaired waters because ambient background selenium concentrations would exceed the more stringent standard.

The dischargers worked with state and federal agencies to develop a proposal in which the dischargers would collect the biological, chemical, and physical data necessary to justify a less stringent selenium standard for western plains stream ecosystems. The goal of the program is to develop a science-based water quality standard for selenium that is protective of, and appropriate for, western plains stream ecosystems. Pending the results of the study, the Colorado Department of Public Health and Environment (CDPHE) granted a temporary modification of the selenium standard for Sand Creek and Segment 15 of the South Platte River. The approach allows for adaptive implementation in which stakeholders work cooperatively and proactively to solve problems outside the regulatory arena.

This case study focuses on NPDES dischargers in the Sand Creek watershed working together using a watershed approach to develop a site-specific water quality criterion.

Watershed: Sand Creek, South Platte River, Colorado

Key Water Quality Concerns: Selenium concentrations

Stakeholder Involvement Techniques:

- Municipality, 2 refineries, & wastewater district voluntary collaboration on research.
- Shared stakeholder goal—avoid lower selenium standard.
- Economic and environmental concerns that movitate stakholders to work together.

Case Study Issues of Interest

Type of Point Sources	POTW Discharges	✔
	Industrial Process/Nonprocess Wastewater Discharges	✔
	Concentrated Animal Feeding Operations	
	Municipal Separate Storm Sewer System Discharges	
	Construction Site Stormwater Discharges	
	Industrial Facility Stormwater Discharges	
	Combined Sewer Overflows	
Highlighted Approach(es)	Statewide Watershed Approach	
	Implementation of Water Quality Standards	✔
	Implementation of Total Maximum Daily Loads or Other Watershed Pollutant Reduction Goals	✔
	Permit Coordination/Synchronization	
	Integrated Municipal Requirements	
	Point Source – Point Source Water Quality Trading	
	Point Source – Nonpoint Source Water Quality Trading	
	Discharger Association	
	Coordinated Watershed Monitoring	✔

Watershed Approach Background

In 2000 through its triennial review process, the CDPHE's Water Quality Control Commission (Commission) proposed lowering the selenium standard for protection of aquatic life (chronic effects) from 12 μg/L (micrograms per liter) total selenium to 4.6 μg/L dissolved selenium on the basis of the U.S. Environmental Protection Agency's (EPA) then-current dissolved selenium criterion. Dischargers in the Sand Creek watershed believed that the standard change was unwarranted on the basis of preliminary site-specific biological data and literature review. It appeared that the standard was based on lake ecosystems on the east and west coasts and was not appropriate for a western plains stream ecosystem. A change in the selenium standard could make compliance with National Pollutant Discharge Elimination System (NPDES) water quality-based effluent limits (WQBELs) extremely challenging considering current technological limitations for selenium removal from process wastewater discharges.

Colorado's Three-step Triennial Review Process for Water Quality Standards

1. **October Year 1: Issues Scoping Hearing.** Provides an opportunity for early identification of potential issues to be addressed in the next major rulemaking hearing and for identification of any issues that might need to be addressed in rulemaking before that time.
2. **November Year 2: Issues Formulation Hearing.** Results in identifying specific issues to be addressed in the next major rulemaking hearing.
3. **June Year 3: Rulemaking Hearing.** Revisions to the water quality classifications and standards are formally adopted.

The Selenium Stakeholder Group, consisting of two refineries, a municipality, and a wastewater district, formed around the dischargers' shared concerns over the economic impacts of compliance with the more stringent standards, which they believe are not appropriate for Sand Creek and the South Platte River. The Selenium Stakeholder Group worked with EPA, CDPHE, the U.S. Fish and Wildlife Service (USFWS), and the Colorado Division of Wildlife (CDOW) to design a monitoring program to collect data that would allow the stakeholders and agencies to evaluate the suitability of Colorado's selenium standards and, if necessary, develop a more appropriate standard. The study that the Selenium Stakeholder Group began was one of the first studies in Colorado to involve collecting and analyzing water column, sediment, and biological data to determine the ecological impacts of selenium. The work of the Selenium Stakeholder Group is still underway.

Watershed Approach Strategy

The goal of the Selenium Stakeholder Group is to facilitate a collaborative approach to developing and adopting a water quality standard that is protective of western plains stream ecosystems through data collection and analysis. To meet this goal, the group has focused on building relationships among stakeholders and designing and implementing a scientifically sound selenium study.

Stakeholder Collaboration

The members of the Selenium Stakeholder Group represent dischargers in the watershed that would be impacted by a lower selenium standard. The group comprises two industrial dischargers, an upstream publicly owned treatment works (POTW) on Sand Creek operated by the city of Aurora, and a downstream wastewater reclamation district on the South Platte River, which is the wastewater treatment authority for most of metro Denver. The municipal stormwater dischargers in the watershed were invited to participate but generally were not interested, largely because they did not feel that they would be affected by a revision to the selenium standard. Two local organizations concerned with water quality issues, the South Platte Coalition for Urban River Evaluation and the Sand Creek Regional Greenway Partnership, were engaged in the process but are not members of the stakeholder group.

Each member of the Selenium Stakeholder Group has different motivating factors for participating. For the upstream municipality on Sand Creek, concerns over elevated upstream selenium concentrations and potential impacts on NPDES permit limits motivated its participation in the group. The industrial dischargers, although competitors, were motivated to cooperate under the watershed approach through a shared concern about future WQBELs based on a total maximum daily load (TMDL) for a stream in which background selenium concentrations exceed the proposed lower selenium standard. Permit renewals for these facilities were imminent at the time of the 2000 temporary modification. The downstream wastewater reclamation district on the South Platte River initially joined the group because it tends to be an active participant in local water quality issues. The reclamation district is motivated to continue participation because it cannot control selenium concentrations entering the POTW and because of the economic and technical limitations of treating huge municipal flows to meet the wasteload allocations in the 1998 selenium TMDL for Segment 15 of the South Platte River, which are based on the more stringent standard.

The Selenium Stakeholder Group worked closely with CDPHE and the other agencies in a collaborative process to develop the proposal for a temporary modification of the selenium standard and to design the selenium study. Because of this collaboration, the proposal for the temporary modification was uncontested.

Study Design and Results

The Selenium Stakeholder Group presented preliminary data demonstrating that suspected nonpoint sources of selenium in the upper Sand Creek watershed would cause a violation of the lower selenium standard and require Colorado to place Sand Creek on its section 303(d) list. On the basis of these data and the proposal developed jointly by the Selenium Stakeholder Group and participating agencies, in November 2000 the Commission granted a temporary modification of the selenium standard for Sand Creek and Segment 15 of the South Platte River, which was already subject to a TMDL for selenium. During the temporary modification, the 12 μg/L chronic total selenium standard would be retained, and no acute standard would be adopted for Sand Creek. For Segment 15 of the South Platte River, the Commission adopted temporary modifications for chronic selenium of 5.2 μg/L and acute selenium of 18.4 μg/L. The temporary modifications would expire in June 2004, pending the results of a study to be conducted by the Selenium Stakeholder Group.

The dischargers agreed to develop and implement a study during the temporary modification period to collect more information to better understand the sources of selenium in the Sand Creek watershed and to determine appropriate site-specific selenium standards. The specific terms of the study plan were negotiated among the Selenium Stakeholder Group, EPA, CDPHE's Water Quality Control Division (Division), CDOW, and the USFWS and were included in the agreement. The dischargers hired third-party consultants to design the study with input from the dischargers and agencies. The third-party consultants also performed all data analyses under the study.

The stakeholder group implemented the first phase of the study in March 2001. During this phase, the group collected monthly water column and outfall data and quarterly sediment sampling data. They also conducted semiannual fish population and watershed habitat assessments. The study results indicated that the current selenium standard was not resulting in any significant negative impacts on fish populations.

The stakeholder group completed the first phase of the study as required and presented its findings at CDPHE's 2004 triennial review hearings. On the basis of the more complete data set provided by the Selenium Stakeholder Group and because of uncertainty regarding the sources of selenium in the watershed, the Commission agreed to retain the temporary modification for Sand Creek until 2010; however, Colorado placed Sand Creek on its 303(d) list in 2002 because of exceedance of the underlying 4.6 ug/L selenium standard. The Commission removed the temporary modification for Segment 15 of the South Platte River in 2004 because ambient conditions in the river met the underlying water quality standards.

During the extension of the temporary modification, the stakeholders, principally Suncor Energy and the city of Aurora, contracting with the U.S. Geological Survey for additional services, are continuing with the second phase of the study. In this phase, stakeholders are focusing on identifying the sources of selenium in the watershed, primarily using ground water analyses.

Highlights of the Selenium Stakeholder Group's Approach

Outreach

The process promoted a broad watershed approach to issues of mutual concern and provided an effective catalyst to bring dischargers and regulators around the same table.

Coordination

Coordination among dischargers and between dischargers and regulatory agencies is a key element of this watershed approach. The relationship established among neighboring dischargers and between dischargers and regulators through this approach expanded to other issues. In one case, a wasteload reallocation (water quality-based trade) between two refineries was uncontested during the permit renewal process. In another example, a municipality improved its communication, which enabled an exchange of technical expertise with state and federal agencies.

This approach provided a medium for adaptive implementation. Working cooperatively and proactively allowed a group of stakeholders to solve problems outside the regulatory realm, furthering efforts toward sustainability.

Data Collection

The study plan facilitated collection of a large amount of quality data that can be used to develop an appropriate selenium standard and for implementing better science-driven TMDLs if they are needed in the future. The study plan also facilitated sharing important ecological data about a western plains ecosystem with state and federal agencies.

Factors Considered During Development

In the early stages of the watershed approach, the Selenium Stakeholder Group was challenged with determining how to divide among its members the administrative costs to operate the group and the costs of the study itself. The total cost of the project to date has exceeded $0.5 million, incorporating costs for consultants, sampling, and legal assistance. The stakeholder group determined individual contribution levels on the basis of discharge rates. Because the refineries had more flexibility in allocating budgets to the project than did the POTWs, stakeholders agreed that the industrial dischargers would contribute a larger share of the dollars, whereas the POTWs would make primarily in-kind contributions. A primary consultant to the effort coordinated all billing, dividing the charges and invoices among the individual stakeholders according to the agreement.

The dischargers were motivated to fund the program for economic and environmental reasons. The industrial dischargers found that it would be more economical to fund the project than it would be to implement controls to meet a lower selenium standard, which likely would be exceeded anyway because of natural background selenium concentrations in Sand Creek. In addition, all the dischargers supported the decision, from an environmental standpoint, to conduct the study with the aim of developing a water quality standard appropriate to the ecosystem. Suncor Energy also saw the study as a good opportunity to build relationships with neighboring dischargers.

Watershed Approach Effectiveness

To date, indicators of success for this watershed approach include collecting new selenium data that were unavailable to regulators before implementing the study and achieving temporary modifications to the selenium standard in Sand Creek and Segment 15 of the South Platte River. Ultimately, stakeholders and others will consider the program a success when the stakeholders agree on and the Commission endorses a water quality standard that is protective of western plains streams. Another measure of future success will be whether the results of the watershed approach align with or influence EPA's process for developing a national selenium criterion.

The members of the Selenium Stakeholder Group identified the following benefits as a result of their participation in the watershed approach:

- State regulatory agencies now recognize the dischargers as proactive supporters of environmental progress because they were willing to generate and provide new data for use in objectively determining an appropriate selenium standard. The working relationship between the dischargers and the agencies has fostered trust among the groups and has provided all stakeholders with better insight on the opportunities and challenges presented by various regulatory options for controlling selenium.

- All the dischargers benefited from the cost-sharing approach. By providing in-kind contributions to match the financial contributions from the refineries, the POTWs were able to participate in a data collection effort that otherwise would not have been supported by their annual budgets. The cost-sharing approach allowed each discharger to be proactive in implementing a solution that none could have achieved on its own.

- The upstream municipality, the city of Aurora, benefited from its positive interaction with the regulatory agencies. Because of this watershed approach, the city has established a good working relationship with EPA and CDPHE, which has allowed it better access to technical expertise. The relationship has allowed the agencies and dischargers to proceed in a streamlined and collaborative effort in which they exchange ideas throughout the process and agree on the best ways to move forward. These relationships have extended to other areas in which the city interacts with the state and federal agencies.

A report developed by one of the refineries and the participating consultants during the first phase of the selenium study identifies a number of additional environmental, economic, and social benefits of the watershed approach. They include the following:

- Beneficial Monitoring Data—The collaborative, watershed-based data collection effort resulted in collecting valuable and previously unavailable data to inform the selenium standard development process. Regulators can also use these data to inform watershed modeling and TMDL implementation. This could help the state prioritize TMDLs to achieve the greatest environmental benefit.

- Avoiding Unnecessary TMDLs—By proactively addressing the selenium standard before TMDL development, the Selenium Stakeholder Group expects to achieve economic benefits for the dischargers and regulators through collecting data that will allow Colorado to remove stream segments, including Sand Creek, from its 303(d) list, thereby avoiding development of unnecessary TMDLs.

- Early Awareness of Economic Sustainability Challenges—The selenium stakeholders' early participation in the watershed approach made it clear to dischargers that selenium discharge reductions would be required. This allowed the dischargers to identify economically sustainable selenium reductions through project scoping and pilot study work well in advance of NPDES-imposed compliance schedules.

- Relationship Building for the Future—In addition to improved relationships with regulators and agency personnel, the dischargers have benefited from relationship building within the Selenium Stakeholders Group. Early collaboration with neighboring dischargers has laid the groundwork that would be necessary to establish wasteload allocations under any future TMDLs. Improved relationships facilitated a water quality trade during a Colorado Discharge Permit System permit renewal for the two refineries. Although competitors, the refineries were able to build on the relationship they developed through the stakeholder process, working with the wastewater reclamation district to achieve uncontested wasteload reallocations for iron, manganese, and zinc among the dischargers.

Lessons Learned & Next Steps

The Selenium Stakeholder Group has faced several challenges that were not foreseen in the early stages of the watershed approach. First, communication with the agencies was complicated by frequent agency staff turnover. The dischargers found that new agency personnel had different priorities and goals for the watershed approach; this created challenges to the group in maintaining momentum. Second, over the course of the study, it was sometimes difficult for some of the stakeholders to meet their in-kind obligations. Dischargers establishing similar agreements should carefully consider their respective abilities to perform in-kind functions relative to the feasibility of making financial contributions toward hiring outside consultants to conduct activities on their behalf. Finally, in collaborating with the agencies on the study design, the dischargers were challenged to cooperate with the agencies in meeting agency needs for scientific integrity, while ensuring that the activities requested by the agencies would truly add value to study results.

The source identification phase of the selenium study is still underway; therefore, it is too early to draw conclusions. Early indications are that much of the selenium load in the affected streams is naturally occurring. The dischargers hope that these results will lead to the development of a water quality standard that considers the natural background selenium concentrations. If this result is achieved, streams that Colorado placed on the 303(d) list on the basis of the current selenium standard can be delisted, avoiding unnecessary TMDL development. Stakeholders will present the results of the source analysis at CDPHE's 2009 triennial review hearings.

Resources

Colorado Department of Public Health and Environment. 2004. *Water Quality Control Commission Public Participation Handbook.* www.cdphe.state.co.us/op/wqcc/GeneralInfo/PublicParticipation/pubpart.html

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Congram A., S. Reeves, B. Linenfelsar, and S. Canton. No date. *The Selenium Stakeholders—Case Study for a TMDL Alternative.*

Foster, T.S. 2004. *Prehearing Statement of Selenium Stakeholder Group.* Presented to the Colorado Department of Public Health and Environment's Water Quality Control Commission on behalf of the Selenium Stakeholder Group.

Selenium Stakeholder Group. 2001. *Selenium Stakeholder Site Specific Selenium Study Plan—South Platte Segments 15 and 16a (Sand Creek).* Draft.

Note: All Web references current as of July 6, 2007.