Source water is untreated water from rivers, streams, lakes, reservoirs or aquifers that supplies public drinking-water systems and private wells. Source water protection is a general term for the protection of all kinds of water uses, including water for drinking, recreation and the maintenance of aquatic ecosystems. In this paper, it specifically refers to protecting drinking-water sources with a view to protecting human health.

**Why is this issue important?**

Source water protection is a major component of an integrated management approach towards ensuring the safety of drinking-water, as recommended in the WHO Guidelines for Drinking-water Quality and as reflected in the Water Safety Plan concept. Regulatory frameworks and supporting policies and programmes are essential for effective source water protection.

Source water protection safeguards public health by ensuring the quality and quantity of source water used for drinking-water. Protecting water sources can reduce health risks associated with hazardous agents, particularly for those agents that cannot be effectively removed by conventional water treatment. Preventing source water contamination is often easier and less costly than treating contaminated water. For example, ensuring that wells are properly sealed from surface water runoff is less costly than removing persistent pesticides from source water.

In a multi-barrier system, as proposed in the concept of water safety planning, the first step in ensuring safe drinking-water is to select and protect reliable, high quality source water.

Practical approaches to source water protection commonly fall under two categories: controlling point source pollution and attaining standards for the management of diffuse pollution. All efforts should be made to identify possible pollution sources in the watershed to ensure that the appropriate strategies and plans for source water protection are implemented.

**Point source pollution** includes a continuous discharge of effluent to a water body such as industrial process effluents and municipal sewage discharges.

**Diffuse pollution** arises from land-use activities (urban and rural) that are dispersed across a catchment or sub-catchment, such as the run-off of fertilizers, pesticides and pesticide residues from agriculture lands.

**A watershed** is a discrete area of land which has a common drainage system. A watershed includes both the water bodies that convey the water and the land surface from which water drains into these bodies.
What regulatory frameworks should be in place?

1. Direct regulation of activities affecting source water and surrounding land use
   Types of direct regulation to be considered include:
   - Effluent control (e.g. setting targets, end of pipe control, control of point sources of pollution);
   - Control of activities in watersheds (e.g. the use of chemicals such as pesticides and fertilizers);
   - Watershed management approach (e.g. zoning, land use planning); and,
   - Codes of practice (e.g. those that control land use and management activities, such as agricultural activities).

2. Financial incentives and disincentives
   Economic approaches for source water protection such as financial incentives (and disincentives) provide effective support for regulatory mechanisms. Charging for effluent is widely used in Europe and in most industrialized countries based on the "polluter-pay principle." Charging for water abstraction is also an option. Financial sanctions such as fines for non-compliance with established permissible levels are less common. Subsidies or tax incentives for buying fertilizers and pesticides which pose a lower risk of source water contamination may be effective.

3. Evidence-based
   Regulatory frameworks should be based on accurate data and current scientific knowledge. The WHO Guidelines for Drinking-water Quality provides an objective and internationally-accepted source of data for developing and implementing health-based targets, qualitative microbial risk assessment and quality measures for source water protection and drinking-water. Assessing and monitoring the quality and quantity of water at intake points are fundamental activities in source water protection and should be included as a requirement in the regulatory framework. Timely identification of potential problems with the raw water will allow the adoption of plans that adequately ensure the safety of drinking-water.

To avoid conflict, regulations should aim to transparently disseminate relevant information. In many watersheds where transboundary water disputes have occurred, data disputes have been a major component of the overall conflict. Impartiality is needed to ensure decisions are strictly based on evidence, not on local power structures. Given competing demands, conflicts often arise over priorities for, and uses of, source water. Some stakeholders have stronger voices than others (e.g. organized and well-funded industries or sectors), sometimes preventing more marginalized or vulnerable communities from being heard. As such, regulations should facilitate engagement of a wide variety and comprehensive representation of all watershed stakeholders. Best practices for community involvement and public hearings should be followed. Special measures to engage specific groups or marginalized community members may be required.

4. Institutional support
   Developing and implementing source water protection plans requires effective institutions responsible for source water protection planning, implementation and management. For example, drinking-water supply agencies or water suppliers are often not responsible for managing source water catchment areas and may not necessarily have the appropriate expertise to develop and implement source water protection plans. Institutional arrangements should be put in place to assist with and/or assume these responsibilities. There are many examples of mechanisms for the establishment of such arrangements, such as Memoranda of Understanding, legally-binding contractual agreements and performance contracts. As public health and environmental interests often overlap significantly, cooperation between public health and environmental authorities in the field of source water protection is of strategic importance and should be pursued with priority.
5. Effective regulations

As for other regulations, source water protection regulations should be formulated in a way that ensures their effective implementation and enforcement. Roles and responsibilities of all stakeholders, both governmental and non-governmental, and compliance measures, including the authority to ensure regulations are adequately implemented and enforced, should be clearly defined. When developing and implementing regulations, attention should be paid to the capacity of all stakeholders to comply with them. Unrealistic provisions or timelines may place excessive burdens on specific stakeholder groups and lead to non-compliance.

6. Supporting policies and programmes

Iterative improvement

Policies and programmes should support the periodic review and update of source water protection plans to reflect, for example, changes in the watershed or advances in scientific knowledge.

Local context

Source water protection plans must be appropriate for the characteristics of and risks to specific water sources and catchment areas. They should take into account other aspects of local context, including knowledge, attitudes, practices, and beliefs of local people. Policies and programmes perfectly reasonable in some countries may not be acceptable in others.

Stakeholder engagement

Stakeholders should be engaged in formulating and implementing source water protection plans. The views and needs of different stakeholders should be identified, reviewed and incorporated as they are formulated. Public and stakeholder involvement throughout the process can help to incorporate and reflect these views and needs. Stakeholders should have an opportunity to comment on strategies to ensure they reflect agreement among key stakeholder groups. Given the multiple, often conflicting, demands on source water, ensuring an appropriate level of stakeholder engagement, cooperation and buy-in can be extremely challenging.

Stable and appropriate investment levels

Ensuring the appropriate level of investment, both financially and from a perspective of human resource capacity, is critical to ensure that source water protection regulations and associated policies and programmes are implemented. Interdisciplinary training may be required to ensure government staff is competent and has the necessary skills to resolve source water issues and to work with stakeholders in other disciplines and sectors. Education and awareness also helps improve stakeholders’ understanding of the importance of source water protection and can mitigate the impact stakeholders have on source waters.

Financial viability of the source water protection plan and process is critical, especially over the long-term. Funding may be needed for specific pollution control activities, including civil works, stakeholder awareness, engagement and conflict resolution, and for the inspection of activities and checking of compliance.

7. Boundary waters

Given the nature of water, neither surface nor groundwater resources stay within administrative or political boundaries. As such, nationally and internationally, boundary waters need to be considered when protecting source water and appropriate legal instruments agreed and applied.

New York City’s drinking-water supply serves nearly nine million people in the city and four counties (USAID Water Team 2009 and USEPA 2010). Its water source is a network of 19 surface water reservoirs in two different regional watersheds with source water protection areas located in seven counties. In 1997, New York City adopted a watershed agreement to protect its drinking-water. The agreement unites the watershed communities, New York City, New York State, the US EPA, and environmentalists in support of an enhanced watershed protection program. The agreement is regarded as a model for stakeholder consensus negotiations and sustainable development. The watershed protection program is composed of the following elements:

- Land acquisition and stewardship programme
- Partnership programmes
- Wastewater treatment plant upgrade programme
- Stormwater management measures
- Changes in policy and regulation
- Environmental education and outreach programmes

The 1909 Boundary Waters Treaty between Canada and the United States of America provides principles for both governments to follow in using the waters they share (International Joint Commission 2009). For example, both countries must agree to any project that would change the natural levels or flows of boundary waters. The treaty was incorporated into U.S. law and confirmed in the International Boundary Water Treaty Act by Canada. The treaty established the International Joint Commission (IJC), with three members from each country. The ongoing work of the IJC helps to fulfill the treaty’s purpose of preventing disputes as well as resolving them.
Further Reading


Key References


U.S. Environmental Protection Agency (2010). New York City Watershed, Washington, USA (www.epa.gov/region2/water/nyctshed/)

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