

## **Water as an Essential Element in Food Safety\*\***

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### **Summary**

Most public health officials understand that contaminated food and water can be important contributors to both infectious and chronic diseases. What is less understood and appreciated, however, is the degree to which water can impact the safety of foods. Adequately addressing this issue has been, and continues to be, hampered by a variety of factors, including a failure to recognize the importance of water as a food component; a disjointed and poorly coordinated regulatory system; a lack of fundamental scientific understanding of exactly how water can adversely affect food safety; and lack of political will.

Most efforts to address the issue of the water-food nexus focus on the impact of production agriculture and food processing on the availability of water. However, relatively little attention is paid to the fact that, regardless of whether water is used as a direct ingredient in food or used during production and processing, it nevertheless becomes part of the food and as such can be a major risk to the safety of that food.

This realization is only a first step in addressing water's role in food safety. One must then develop and apply appropriate science to minimize the risk, and make necessary water use policy changes to assure that regulatory agencies and the agrifood industry adopt best practices involving water use. However, within the larger issues of water conservation and availability, policy makers need to consider food safety when discussing water use. Water sources often cross state and national borders, and foods are a major component in global trade. Hence, solutions will require international attention and coordination.

### **Current realities**

There is general agreement that water, as a resource, has become a critical global issue. This situation has arisen from an increasing demand at the same time as the world is experiencing a decrease in available water. The most obvious reason for the increased demand is the need for clean, potable water for an expanding global population, expected to reach 9 billion by 2050.

An increasing standard of living in many developing countries is also increasing the demand for manufactured products, resulting in a less obvious, but even larger demand for commercial uses of water. The decreases in available and affordable fresh water arise from climactic changes, resulting in drought and salt-water intrusion into aquifers in regions that previously contained fresh water.

Although a variety of users compete for access to water, it is the agriculture and food sector that is the largest user of water, accounting for an estimated 80% of use. Much of this use is attributed to irrigation during production agriculture. However, water is also used during the processing of agricultural commodities into consumer products. Additionally, water is used as a transit medium to move product through the various steps in processing, during the heating and cooling of products, to wash products, and as a direct ingredient in the final consumer product. Consequently, water can be a source of contaminants in foods.

Food safety has become increasingly recognized as an important public health issue. The most recent estimates published by the United States Centers for Disease Control and Prevention

indicate that as many as 48 million cases, 128,000 hospitalizations, and 3,000 deaths are caused by foodborne illness each year in the U.S. The World Health Organization (WHO) estimates that more than 2 million people die each year from diarrheal diseases and that many of these cases are caused by consumption of contaminated food.

Concern over food safety has received increased attention by policy makers and regulators, and has prompted major regulatory changes in several countries, including China, Canada, and the U.S. In at least one case (the proposed Produce Safety Rule being promulgated in the U.S. under the Food Safety Modernization Act), agricultural water was specifically identified as a primary risk factor to the safety of fresh produce. This and other proposed regulations may adversely impact international trade in foods and perhaps even prompt World Trade Organization challenges.

Despite the recognition of the importance of water in the transmission of human illness, the regulatory system for water is largely disjointed and uncoordinated. In the U.S., bottled water is regulated by the Food and Drug Administration (FDA), whereas municipal water is regulated by local, state, or federal agencies, depending on the location of the source of water. The U.S. Environmental Protection Agency (EPA) sets standards for most uses of water, including potable and recreational uses. In most cases, however, water is regulated as a single component with little regard for what, if any, impact it may have on food safety.

### **Scientific opportunities and challenges**

Acquiring knowledge of how and to what degree water contributes to foodborne illness would be a major move forward in improving the safety of foods. Although the scientific issues surrounding the importance of water to food safety would appear simple, the issue is much more complicated. For example, little data exist on exactly how and to what degree pathogenic microorganisms gain access to foods via water. Without knowing this information, it is difficult to estimate the risk to human health attributed to any particular food, or to develop preventive controls to negate or reduce this risk.

Examples of the fundamental information that is needed include (i) the transfer rate of contaminants from water to food contact surfaces or plant or animal tissue, (ii) the extent to which water-borne microorganisms or chemicals become internalized in plant or animal tissue, and, (iii) credible baseline estimates of concentrations and distribution of potentially hazardous microorganisms or chemicals.

Another important question regarding the quality of water is: how safe is safe enough? An answer to this critical question is needed for policy decisions regarding food and water. Determining the public health impact would require a thorough quantitative risk assessment to ascertain the actual risk presented by typical scenarios.

The primary challenge to initiating research would be logistics due to the diverse sources and location of water, the number and types of contaminants that would have to be analyzed, the compilation of data, and the competing agendas for how the data could and should be used. The latter aspect, having entered the policy and political realm, would need to address leadership and funding as a priority.

### **Policy issues**

Changing the way that the public health and scientific community deal with water as food will require significant policy maker input and would have significant policy implications. Addressing

the public health implications of viewing water as food would require at the very least, a high level of coordination between water authorities and those responsible for food safety. In some cases, it would require changes in regulatory authority of one or both of these regulatory entities. Moreover, because food and agricultural commodities are so important to international trade, the issue would need to be addressed globally. Success in improving the safety of foods by addressing water issues would have both public health and societal benefits. Not only could it reduce the potential for foodborne illness, but it would also reduce regulatory burden by allowing regulatory agencies to focus more on prevention efforts, rather than detection and investigation of outbreaks. Improved prevention of foodborne illness would result in increased confidence in governments and trading partners.

- Concern over water has largely focused on conservation and availability of clean water. Although this concern is clearly warranted, it does not fully convey the role that water plays in food safety. It is critical that public health officials, regulators, and food companies understand, acknowledge, and appreciate that in order to produce safe foods, the quality of water used in the process is critical. There needs to be agreement that water must be treated as a national and international food safety issue.
- The disparate manner with which water has been viewed and considered globally has led to a situation in which fundamental issues involving water, and resulting interactions between the various uses of water, has never been fully considered. As one initial step forward, the National Academies of Sciences and the Institute of Medicine should be charged with conducting a comprehensive study of the public health impact of water as food, with the goal of identifying critical missing and researchable data.
- The public health community has largely underappreciated the role of water in food safety. Consequently, the contribution of water to food safety issues has likewise not been a priority for research funding. To that end, major funding agencies including the National Institutes of Health, U.S. Department of Agriculture (USDA)/National Institute of Food and Agriculture, and the National Science Foundation should be encouraged to include the topic as a major priority and fund resulting projects accordingly.
- Governments should consider placing regulatory authority for water intended to be used in agriculture for food within one agency. Although individual federal agencies responsible for food safety, primarily FDA and USDA/Food Safety and Inspection Service, would be good candidates to house such authority, a cabinet level department that would coordinate the efforts of all regulatory players might also be considered.
- Because water use and quality crosses national borders, the issue of water's role in food safety should also be addressed by international science and public health bodies. In particular, the WHO and Food and Agriculture Organization should convene a study group to determine how water resources can be used and shared without compromising agricultural products and foods in which it is used. The result could be a White Paper that serves as guidance for national and state efforts.

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