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Water for Peace

In academia, the hard sciences (chemistry, biology, physics, mathematics, etc.) and humanities (english, history, peace and conflict studies, etc.) are held apart from each other, presented as mutually irrelevant, each determined to achieve the highest potential within discipline. However, in their roles as agents in the world, the line between the humanities and the hard-sciences is blurred. Examples include efforts to prevent interstate and intrastate conflicts. According to various studies, access to clean water has become one of the most severe causes of conflict. Political science, sociology, peace and conflict studies, and similar disciplines are not the only ones engaged. Chemistry and chemical engineering also play a critical role because they pioneer water-purification technology. The application of chemical technology is critical for conflict prevention and resolution.

In the past, wars were fought over land and over cultural, ethnic, and religious disagreements. These conflicts were often rooted in differences of identity. However, in a world today, where access to natural resources is becoming a key factor for prosperity, conflicts tend to concern the most basic of human needs, water. Violent conflicts over water primarily occur at the local level. However, interstate conflicts over water have contributed to interstate issues that interfere with economic development. Solving disputes over water depends on particular situations, each unique and embedded in a different geopolitical environment (Carius). Former United Nations Secretary General Boutros Boutros Ghali asserted in 2003, “Water will be more

important than oil this century" ("Talking Point" 2003). With this statement, he acknowledges that water is a resource that can cause conflicts that endanger human security.

The UN has characterized water as both a threat and an opportunity. Lack of access to clean water is a security risk that obstructs economic development and human health. However, according to scholars of the Woodrow Wilson International Center, "Water has also proven to be a productive pathway to confidence building, cooperation, and arguably conflict prevention." Cooperation toward securing clean water access for multiple parties promotes a strong foundation for development and peace as different groups attempt to share a common challenge. Water can also be used as a negotiating factor in a conflict, regardless of whether or not water precipitated a conflict. Water can provide a "pathway to peace" (Carius). Since 1948, 295 international water agreements have been established, contributing greatly to regional ability to harness clean water and achieve economic development (Tulloch).

The role of chemistry and chemical engineering is critical because they provide various methods of water purification. These methods increase the range of sources for obtaining clean water. In developing countries where access to clean water is limited, water purification can be instrumental for preventing violent conflicts. One purification method is chlorination, which involves adding small amounts of chlorine to water; chlorination prevents the presence of pathogenic bacteria and other microorganisms that carry diseases. Another important method of water purification is desalination, a process for removing salt from ocean water to make it suitable for drinking. This method, although more expensive, has the potential to secure access to clean water for regions whose lack of water access is due to drought or to insufficient proximity to a freshwater source. In a world of conflict, violence, and uncertainty, chemical technology and social science converge toward using water as a 'pathway to peace.'

Chlorination provides a cost-effective way to reduce water-related diseases in many areas where conditions of hygiene and sanitation are poor. Chlorination involves adding chlorine gas to water. An active oxidant (an electron acceptor), chlorine reacts with organic matter to purify water ("Chlorination of Drinking Water" 2009). In a study of a community in Bolivia by the University of North Carolina's Department of Environmental Science and Engineering, escherichia coli levels were as low as 1/100 mL in households that had chlorinated water. Other bacteria levels were also lower than those of households without chlorination. The frequency of diarrhea and other illnesses was decreased. In communities in Bolivia, one of the poorest countries in South America, diarrheal illnesses were decreased by almost 50% , which, thanks to chlorination, can contribute to addressing conflicts derived from lack of access to clean water. Bolivia has seen local conflicts caused by water scarcity; subsequent tensions may decline due to chlorination for water purification (Sobsey).

Another method of water purification is desalination. Although more expensive, desalination holds much potential for water purification because its source is the ocean, an essentially infinite water source. Desalination uses reverse osmosis, where pressure is applied to force water across a selectively permeable membrane. While large molecules and salts remain on one side of the membrane, pure water is produced on the other. Another method for desalination is distillation, where steam is evaporated from seawater and condensed. However, distillation is relatively expensive.

Desalination is particularly useful in regions of the world where water is scarce due to a dry climate. Arid areas often have limited freshwater sources but, provided they are near the ocean, desalination provides an alternative method of obtaining clean water (Heimbuch). In dry areas, tension over access to the few freshwater sources available is common. Examples of such

countries are Sudan and the Ivory Coast (Tulloch). Desalination could provide sufficient clean water to avoid conflict.

Chlorination and desalination are two useful methods where chemistry and chemical engineering intersect with conflict prevention and resolution. The hard sciences and the humanities can overlap in an academic community. In 2009, a group of students at the University of Virginia and the Global Sustainability Club students of the University of Venda together with University of Venda faculty, and local community members in Venda, set out to tackle issues of water access in a village in Venda, a region of the Limpopo Province in South Africa. The collaboration produced a sand-filtration system that provides a sustainable source of clean water for the majority of households in the community. A sand-filtration system is inexpensive; it removes contaminants by filtering them through layers. The surface of the sand has an active layer called "schmutzdecke," a layer of biological matter that serves to break down microorganisms and other organic matter in the water. Subsequently, the water passes through a series of layers of sand; as it moves through, contaminants are trapped in the sand by adsorption, releasing clean water into an underground piping system (Harshfield). Here, chemical engineering students and faculty from different centers of academia came together with a common goal of achieving water security for a community.

Because the Limpopo Province has a lack of access to clean water, unrest and conflicts existed in the region. Access to water is critical for both drinking and soil fertility. The livelihoods of community members are directly impacted by the scarcity of clean water in the area, an issue the collaborative project successfully addressed (Clewell).

Another example of water as a pathway to peace is a negotiation that occurred among Turkey, Syria, and Iraq. In March 2008, the three nations negotiated the creation of a Water Institute to monitor and study water resources across boundaries (Tulloch). Instead of resorting

to armed conflict for access to water, combined efforts were used to create a pact to meet the water challenge together. This combination of hard science, used in the institute to study water, and peace studies, seen in the collective protection of water security, demonstrates a convergence between disciplines of peace and chemistry. Both areas of study are necessary for this pact to be successful.

As students of chemical engineering use their knowledge to instigate change to solve a conflict at its foundation, they actively engage in peace-building. Nations combine brain-power to secure water for their people; peace and science become interdependent. The hard sciences and the non-sciences become complementary to one another, as demonstrated by the relevance of chemical technology to the peace process.

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