Superfund and the Swannanoa Community

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With the discovery of toxic waste dumps in the 1970s, a need developed for cleanup and removal of hazardous materials. Waste left behind stays behind, and can pollute soil, water, and air, ultimately leading to human contamination. The Superfund was established in 1980 as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as a means to mandate the cleanup of hazardous waste sites by responsible parties (U.S. Environmental Protection Agency 2012b). Once a hazardous site is placed on the National Priorities List (NPL) due to the threat of hazardous substances, pollutants, or contaminants it is slated for cleanup led by the Environmental Protection Agency (U.S. Environmental Protection Agency 2012a). The Chemtronics site in Swannanoa, North Carolina, was placed on the NPL in 1982.

Swannanoa, North Carolina is home to the Chemtronics Superfund Site. In the spring of 2013, the EPA helped concerned citizens in Swannanoa form a Community Advisory Group (CAG) as a liaison to the Superfund site owners, the EPA, and the general public. Our Advanced Environmental Chemistry class had the opportunity to serve this CAG by researching and presenting the highly technical information regarding the site and the potential dangers it presents to the community. Working with the Chemtronics CAG was so much more than a service project.

Warren Wilson College is one of the few colleges that require service in order to graduate. At the time of my attendance, each student had to complete 100 hours of service as well as a comprehensive reflection of his or her service. By my senior year in 2013, I had completed many hours of service for a wide range of causes and organizations, but this project was something different. Service-learning courses have the unique ability to bring textbook information into a real context with a meaningful purpose. I had participated in other service-learning projects in other classes, but never before in the chemistry department. The study of chemistry is often restricted to the lab or classroom, so having the opportunity to apply serious chemistry in a meaningful way was fantastic.

The Chemtronics Superfund site is located just miles from Warren Wilson College, but is also close to homes within the Swannanoa community. Curiosity and even animosity associated with the site is only natural. While the contamination present on the site is the result of industry, the Superfund in itself has a mixed reputation in many communities. The EPA remediation process is a slow one. Even the initial steps of establishing Potentially Responsible Parties (PRP) to be held accountable can take years, and until that is determined the clean-up process cannot begin. Additionally, there is often suspicion of government agencies working within the community. Superfund in general is an unwelcome presence, indicating contamination and hazardous materials, but the Chemtronics site is one of particular notoriety.

Operating as a manufacturer for the United States Department of Defense, the site saw production of many hazardous chemicals during its years of operation. Chlorinated solvents, a common pollutant at superfund sites, are present in the highest concentrations here, but several unique pollutants are also found onsite. Perhaps the most unusual is 3-Quinuclidinyl benzilate, commonly referred to as BZ. This compound was manufactured in the 1960s and 1970s as a weaponized hallucinogen, but never saw official use. Following government orders, all

stockpiles of this compound were destroyed, and due to its natural instability any remaining traces have long since decomposed into its harmless constituent parts (U.S. Environmental Protection Agency 2008).

A well-known output of the Chemtronics site is the compound 2-chlorobenzalmalononitrile, also known as CS gas, or tear gas. This non-lethal aerosol has a short half-life in both air and water. The half-life of a compound is the amount of time it takes for half of the substance to break down. For example, the half-life of CS in water is just 15 minutes, indicating that after 15 minutes only half of the original material remains, after 30 minutes only a quarter of the original material remains, and so on. This short half-life means that CS is not persistent in air or water. Since the closure of the site, CS in air and water has long since broken down. The half-life in soil is longer however, and so some traces do remain present on the site (U.S. Environmental Protection Agency 2009).

The compound cyclotrimethylenetrinitramine, or RDX, was also produced at the Chemtronics site. RDX is a potent explosive, many times more powerful than TNT, and has negative effects if consumed. In anaerobic, or oxygen-free, conditions RDX biodegrades naturally. This compound is capable of leaching from soil to groundwater, and potentially on to plant or aquatic life (Agency for Toxic Substances and Disease Registry 2012). RDX is present at the Chemtronics site. Since the Chemtronics site was placed on the NPL in 1982 efforts have been focused on preventing the spread of these contaminants found onsite, rather than removing them completely. This prevents spread of unwanted contaminants, without the cost associated with complete remediation.

The priorities of a site on the NPL are primarily to determine what hazards and risks are present, to prevent these hazards from spreading to offsite locations, and to finally remove contaminants altogether through the process of remediation. Environmental remediation is essentially the removal of pollution or contaminants from soil, water, and air. Many methods of remediation exist, on a scale of availability to the area, cost, and effectiveness against a given contaminant. Bioremediation is a method of remediation applied at the Chemtronics site that uses natural processes to remove targeted contamination. This can be accomplished through certain types of plants or bacteria. One method uses emulsified vegetable oil to increase the natural rate of remediation by providing resources for bacterial growth, which in turn reduce the amount of certain types of contaminants. Air stripping is another type of remediation used to treat water contaminated by chlorinated solvents. Water is run through a column where target materials are transferred to air. There they quickly break down, releasing comparatively clean water.

During its years of remediation, the Chemtronics site has undergone intensive testing of soil, water, and air, the results of which are available to the public in the nearby Warren Wilson College Library. This data includes years of reports consisting of thousands of pages of text and numbers. In spring 2013, the Advanced Environmental Chemistry class worked in conjunction with the Chemtronics CAG to process this data, introducing it in a form that the public more easily understands. Students, including myself, chose topics of concern and focused on key questions related to the site. These topics included specific chemical compounds, types of remediation and removal, and EPA processes. Students produced a comprehensive report on their individual topic for the class, as well as a group PowerPoint and individual poster presentations for the CAG.

My topic was on risk assessment practices as carried out by the EPA. This method of risk assessment is a four-step process, beginning with identification of any possible contaminants onsite. The next step is dose-response assessment, analyzing the way in which any given amount

of a contaminant will affect human health. Following this step, exposure assessment determines current risk of exposure, testing air, water, and soil near the contaminated site. The final step is risk characterization, taking all the previously collected information into account. This end product is a detailed assessment of the current and potential risk posed by a contaminated environment, such as the Chemtronics site (Office of Emergency and Remedial Response 1989).

The research process began with students gathering information on the site as a whole. The sheer volume of data available in the library archives was almost overwhelming, and the class worked together a great deal during this process, comparing notes, suggesting resources, and helping each other find and understand data. This exploration into the history of the site provided a framework for students to begin their own research on individual topics, while placing information into a local context. A group PowerPoint was created in order to bring together each of the individual topics for presentation to the Swannanoa community. Each student presented a PowerPoint to the rest of the class on his or her specific topic for initial feedback and to determine the best possible order of topics. The presentations were then combined into one document. One of the most helpful parts of the process was a practice presentation to the Environmental Policy class, a group of students interested in the site, who were able to offer advice on presenting to the general public. It was important to keep the final audience in mind when carrying out research, and especially when preparing the PowerPoint presentation. After this practice session, final feedback was collected and used to create posters for the Chemtronics CAG.

As a student I put more time into this project than any other service project I participated in during my four years at Warren Wilson College. The first part of the task, finding the information, may have taken the longest, especially considering the sheer volume of data that each student had to search through, but for me at least, this step was not the most difficult. As a student of both environmental chemistry and environmental policy, I was not new to the language of the EPA. Avoiding technical language that might be unclear or confusing to those who are less familiar with the subject matter was a challenge for me. In the process of drafting, proof-reading, and discussing the project with others in and out of the chemistry department, it became easier to discuss the topic from a variety of viewpoints, rather than focusing on the technical or political aspects of the issue that come more naturally to me. During this process I learned to closely analyze my own work, asking myself if I was being clear, or if I could answer questions on this topic as needed. Unlike typical class presentations I could not expect my audience to have a background in environmental sciences or chemistry. It was very important that I make no assumptions.

The cumulative moment of this project was the night of our presentation for the Chemtronics CAG. It was at this point in the project that we actually interacted with community members, an experience that brought our studies outside the classroom in a real, beneficial way. We were able to hear their concerns, questions, and thoughts on the Chemtronics site, and the Superfund presence there. As a policy student I have studied the importance of community involvement, but actually taking part in it was something else entirely. It was taking this final step that brought everything else together, all of our research, time, and work had brought us to this final point of interaction, and it was there that we were able to make a difference. We arrived early to the meeting so that we could set up our posters and prepare for our presentations. We were scheduled to speak toward the end of the meeting, and were able to sit and observe before our turn came. Those participating in the CAG were community members from all walks of life.

While a few of those present had a true understanding of the site, many more knew only the rumors that have flooded the community for years.

I observed the difficulty of keeping participants focused on the task at hand, allowing questions without getting off topic, and making sure every voice was heard. I was impressed by the group leaders, and took away valuable tips on coordinating such a diverse group of concerned citizens. When it came time to present our data, the meeting was reaching its close. The first student gave an oral overview of the project, outlining the history of the site, and providing some definitions on the "Reference" slide of the PowerPoint. This slide was projected during the poster presentations to help the audience understand some of the more technical terminology used on the posters. Most importantly, she explained the current status of the Superfund site. While contaminants are still present on the site, extensive testing has shown that none of the contaminants present are traveling offsite (U.S. Environmental Protection Agency 2007). While there is still a great deal to be done before the site itself is fully remediated, the EPA has succeeded in containing contamination.

She then introduced the topic of each succeeding student, and we took questions as a group, before inviting participants to come forward and ask questions of us individually. Each student had a poster prepared and was ready to answer questions and explain his or her topic. The community was interested, positive, and very kind to us. All of us were able to have conversations with members of the community and provide the positive news that those chemicals researched by this group are not leaving the superfund site and currently presented no threat to those living in the area. I know that my own experience was a very positive one. I was able to connect to a part of my own community and those living near me, and I felt that we were able to ease some of their concerns with the research we had carried out.

The Chemtronics site will be a part of the Swannanoa community for many years to come, and I would love to see the CAG and the Warren Wilson College Chemistry Department continue this relationship. Not only would this relationship provide a service to the community, but would also greatly benefit participating students and provide them with a true sense of accomplishment. As remediation continues on the site, more and more data will become available, hopefully showing a downward trend in contamination.

On a personal level, conducting research and finding answers for this project helped to sharpen my skills in thorough record keeping and careful note taking, and my experience working with the community allowed me to continue developing my interpersonal skills. Presenting a difficult subject to the community helped me make challenging concepts clearer and understandable. I was lucky to be a part of this service-learning project, which also received very positive feedback from the class as a whole. Comments from my classmates spoke very highly of the program, explaining that they saw their research and communication skills grow, all while learning to apply course materials in a real-world setting. While service learning has been a part of my college experience from the beginning, I couldn't have planned a better note to finish my final semester on, and I hope that those who come after me in the environmental studies department can share this empowering experience.

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