



June 15, 2009

Memorandum

To: Nevada Environmental Commission

From: Glenn Miller, Professor
Natural Resources and Environmental Science
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Re: Disagreeable Odors in Silver Springs

I have worked on odor issues as an academic sideline for several years, and have been involved with odor problems at both the Nevada Wood Preservation site in Silver Springs, and also the Bango Oil site in Fallon for nearly two years. I was asked by citizens in Silver Springs (Silver Springs Clean Air Task Force) to provide a brief memorandum to the Environmental Commission summarizing the work we have done on air sampling at homes around the Nevada Wood Preservation site.

At the outset, let me say that I am pleased that the Environmental Commission is listening to the concerns of citizens at both sites. Despite a large amount of staff time expended by the NDEP, both odor problems remain, and the NDEP may not have sufficient regulatory authority to restore the air quality. Since 2007, I have interacted with residents around each site, and it is my opinion that their concerns are very real, and they are experiencing substantial and recurring odor problems that are, at a minimum, negatively affecting their quality of life. Because the odors have not been completely characterized, potential health concerns exist for the residents, particularly at the Silver Springs site.

At the Silver Springs site, we were interested in collecting integrated air samples, with a goal of determining what types of chemicals were present in the air surrounding the wood preservation site, and potentially determine if there was a single useful marker for the chemicals used in the wood treatment. Our efforts have been a rather low budget study, and the costs were funded out of discretionary funds within my laboratory. These costs are relatively small, however, since we have other funded studies, primarily associated with organic air contaminants, that have provided equipment to conduct these types of studies. We have a thermal desorption system coupled to a gas chromatograph mass spectrometer, that is well suited for determining the contaminants in the air. We are also using passive samplers to gather week-long integrated air samples.

During 2008 we collected and analyzed two sets of air samples. This involved placing passive samplers (Radiello samplers) for approximately 1 week around the wood preservation site at the homes of residents who had complained of odors, which they argued were coming from the site. This type of passive sampler is designed to collect and trap organic compounds from the air. Similar systems are used for mercury collections, although the trapping medium is different. This air sampling technique allowed us to determine the identity of certain volatile compounds in the air, and provided a sense of the relative amounts of compound at the various sites; however, we are not able to determine the averaged concentration in the air, since that would require a much more extensive (and expensive) monitoring program, which is beyond the scope of what we were trying to accomplish.

First of all, a brief comment on odors and odor detection. Odors are a human-defined physiological response. Odors can be composed of as few as one chemical, but are more often a very complex array of chemicals. I have a grade school demonstration lecture where I allow students to smell individual chemicals and ask them to tell me what they associate the chemical with. For example, the chemical limonene is a lemon fragrance and is used commercially in a variety of products, such as the cleaner, Pledge. While most objectionable odors are objectionable to most people, the response to a specific odor can vary with individual personal preference. We all have examples of odors that may be objectionable to others, but not to ourselves.

The science of smells is complex and individuals can be trained to characterize various smells. Certain companies provide that training and have instruments that allow a trained person to estimate the “odor concentration”. The St. Croix instrument (used in Fallon) is a simple dilution instrument that determines how much dilution of the sample is required for a trained individual to no longer be able to smell the odor. From a strictly chemical perspective, we do not commonly identify odors, using our specific methods and instruments; rather, we identify chemicals in the air that may contribute to the odor. This difference is important for interpreting the information that can be gathered using specific instrumental techniques. The nose is still the best indicator of where an odor is coming from, and it is also very cost effective.

Here is what we have observed to date.

1. Both Patrick Joyce (the student working on the project) and I have detected the odor on each visit we have made to the Silver Springs Nevada Wood Preservation site. It is indeed an objectionable odor, and it is our strong opinion that it comes from the Nevada Wood Preservation site. We can drive around most of the site, and when we are upwind, there is no odor; when we are downwind, the odor is strong and has a characteristic that makes it readily identifiable by us. I might add, however, that it does not take a Ph.D. chemist to make this determination. The citizens that we have met during our sampling trips have the same capability (and probably better) to detect the odor, and determine where it is originating. They continue to also argue that it is coming from the site, and is most problematic when there is very little wind. I have read suggestions from others

that it is coming from a different source, including manure, sewage treatment facilities or other sources. From my experience working on atmospheric chemistry problems and smelling more chemicals than is probably advisable, this odor definitely has the characteristics of synthetic organic chemicals, and does not have the characteristics of any biological odor that I have ever smelled.

2. We have detected at least one chemical (butyl butyrate) at over 10 sites near the wood treatment facility that is also present in the formulation used to preserve the poles. The relative amount of butyl butyrate at each site had a general relationship of distance from the wood treatment site and prevailing wind conditions. This chemical was not detected at control sites distant from the facility. The MSDS information from the manufacturer indicates the liquid formulation used at the site is composed of aliphatic esters, without much additional information on the specific chemicals in the formulation. We were able to obtain a small amount of the formulation specified in the MSDS sheets, and determined that one of the major volatile constituent in the formulation was indeed butyl butyrate. Thus, we state with reasonable certainty that at least one of the compounds present in the formulation was detected in the nearby homes, particularly on the second sampling trip. I might add, however, that the smell from this specific compound is not particularly objectionable. One of the hydrolysis products of butyl butyrate is butyric acid, which is the smell that nearly everyone will associate with vomit. (I also sometimes use this chemical in my smell demonstration). On one of the initial visits to the site, I detected an odor which had a characteristic of vomit, and after reading the MSDS sheets, I felt that butyl butyrate may indeed be a suspect chemical. During the wood treatment process the poles to be treated and the pentachlorophenol formulation (containing the aliphatic esters) are heated under pressure, and it is highly probable that both hydrolytic and oxidative reactions are occurring to the aliphatic ester formulation. It is probable that the subsequent outgassing that occurs following the treatment releases volatile compounds into the air. I might add that we passed a truck containing treated poles in Silver Springs on one of our sampling trips and the unmistakable odor was coming from those treated poles.

I also need to mention that our air samples were not regulatory samples, but they do supply strong evidence that contamination of the air around the site is occurring, and is very likely due to the pentachlorophenol wood treatment process.

3. A reasonably inexpensive solution to this problem is available, based on an effectively identical problem at a wood preservation facility in New Brighton, Minnesota. A representative of the St. Croix company mentioned to one of the residents that a similar problem had occurred in Minnesota. I called one of the consultants working on the problem, and he indicated that a severe odor problem existed around their site, using a similar, if not identical formulation. He indicated that the problem was from butyraldehyde, an oxidation product of butanol, which is present in the formulation, but also a hydrolysis product of butyl

butyrate. While I did not ask for or receive any data that may have been generated, the situation was effectively identical to what is occurring in Silver Springs. The solution they came up with was very clever and creative. Instead of using the liquid formulation from the manufacturer (which is convenient from a treatment perspective), they purchased the crystalline pentachlorophenol and dissolved it in biodiesel. I work with biodiesel and know it to also be an aliphatic ester (with slightly different properties) without the objectionable odor. Like the current treatment using the synthetic aliphatic ester formulation, the pentachlorophenol dissolved in biodiesel is then diluted with diesel fuel and used to treat the poles. The gentleman that I chatted with indicated that the biodiesel formulation worked well, and the odor complaints stopped. This would require a modification of the wood treatment process in that the pentachlorophenol would need to first be dissolved in biodiesel fuel, although that process could be developed fairly rapidly.

Finally, I do feel that this is problem that needs to be resolved. The present odor is indeed objectionable and creates a stressful and potentially health-impacting environment for the residents. Neither the state NDEP or Lyon County have been able to resolve the problem. I (and I suspect staff at the NDEP) have found the regulations on odor control to be very cumbersome and effectively useless for resolving this problem for the residents of Silver Springs. I know that these residents are hopeful that you could help by strengthening the odor regulations in Nevada that would allow residents to live in their homes without the oppressive presence of objectionable odors.