Magnesium Chloride- “Know the Facts!”

Much has been printed about the use of magnesium chloride as a de-icer on our nation’s roads during the winter and as a soil stabilization and dust control agent on unimproved roads. It has been suggested that the use of magnesium chloride has negative impacts on our environment and human health. The continued references by “Mr. Spangler and or others to magnesium chloride as being a “hazardous chemical” are inaccurate and unacceptable. There is nothing in the product that requires a hazardous label by any Government agency. In one article a studied and responsible reporter from a newspaper in Glenwood Springs, Colorado reported that “there seems to be a lot of complaints and innuendoes - but very little science”. In the spirit of that article let us strive to dispel such fiction and rumor, and replace it with fact and science. This document will review several areas from a factual, practical and scientific basis. We will discuss effects on human health, effects on vegetation and streams, metal corrosion, and roadway safety.

What is Magnesium Chloride

Simply put, magnesium chloride is “salt water”. It is only slightly different than the salt water made from combining table salt and warm water for a gargle as a remedy for a sore throat. Magnesium chloride is a naturally occurring compound that exists in the waters of the Great Salt Lake, salt bearing aquifers deep under ground and also salt flats in Western Utah. To harvest the product it is simply collected, allowed to purify naturally by solar evaporation and transported to a needed location use on roads.

Effects on Human Health

The Colorado Department of Health (CDOH) recently undertook an extensive study to determine if airborne particulates from magnesium chloride could be detected. The study took place in Aspen, Colorado. The community was concerned about the use of the product in their community. Complaints of severe headaches and sinus irritation were leveled at the Colorado DOT claiming the use magnesium chloride to keep roads free from snow and ice was the cause. These complaints prompted the CDOH study, which provided conclusive results. During the course of the study, magnesium chloride could not be detected in the air before, during or after applications to the roadway. There were, however, minor levels of metals and other natural salts detected. The CDOH study also reported that the levels of these particulates were well within the safe or “normal” range.

One of the quotes from the Storm Mountain News as detailed above is that “A seven year old girl is suffering from magnesium chloride poisoning because she is breathing the dust”. First, if there was magnesium chloride present in the soil, there would be no dust because the magnesium chloride would keep the dust particle moist (translation: heavy) and the particle would be too heavy to be airborne. Further, in order to get high enough levels of magnesium chloride into your system to be poisoned, you would have to ingest large quantities. It is submitted that any human being with a functioning gag reflex would vomit, and violently so long before reaching poisonous levels.

There are health complaints blamed on magnesium chloride “vapor” which is then breathed in by “unsuspecting citizens”. This is another misconception based on speculation that is, in fact, scientifically impossible. The scientific definition of a vapor is “a substance in a gaseous state”. Magnesium chloride is extremely hygroscopic, which is a scientific term that means the product attracts water. The fact here is that at normal atmospheric conditions, magnesium chloride cannot exist as a gas; it can only exist as a liquid. It is for this. reason it is used extensively in dry weather as a dust control agent. The product remains liquid and maintains a damp road surface. Therefore, any claims of magnesium chloride “vapor” causing ill health are best described as misguided.

While on the topic of air quality, let us not forget the infamous “brown cloud” that engulfed the city of Denver for a number of years. This “cloud” can be linked to several impacts to human health as documented by a number of agencies. Not the least of which, is the EPA. The primary cause of the cloud was determined to be sand and other traction enhancing aggregates used during snow events. The sand is ground to a fine powder by traffic and lifted into the atmosphere. With temperature inversions, which happen naturally, this fine dust remains in the air and we breathe it. This fine powder can then be measured and is defined as “particulate matter 10 microns” (PMIO). The EPA has identified PMIO as a significant source of respiratory ailments. Due to the elevated levels of PMIO, the EPA designated the Denver area as a “Non-Containment” area which meant they were mandated to take action to reduce the PMIO levels in the atmosphere. The containment levels designated were met and exceeded through the use of liquid magnesium chloride used in a technology known as anti-icing. Additionally, the end result also provided a better level of service to the traveling public. Some have suggested that perhaps we should return to the use of ordinary rock salt. It should be noted here that rock salt, or sodium chloride, is not hygroscopic. Therefore, it will dry out on the road surface and produce a powder that is lifted into the atmosphere and contribute to air pollution, exacerbating the PMIO issues. Magnesium chloride’s use as a dust arrester on unimproved roads clearly contributes quite significantly to the control of airborne pollution. It is clearly a benefit not a detriment.

For some time now, complaints have surfaced of burning eyes and hands due to the use of magnesium chloride. This certainly can and does happen with magnesium chloride, as well as all other chloride based products. If you have any sort of perforation in your skin where the product can penetrate, you will notice a burning sensation. If, for example, an auto mechanic uses solvents and harsh cleaners to clean the grease from his hands, they can and usually do get chapped. This occurs because solvents and cleansers “de-fat” the skin subjecting it to dryness and leading to susceptibility of cracking especially during cold, wet weather. When the mechanic then removes auto parts fresh in from roads wet with a magnesium chloride brine, a burning sensation can occur. That does not necessarily dictate that all complaints of skin irritation can be attributed to magnesium chloride. Recently a mechanic in Summit County Colorado made this complaint. It’s interesting, however, that the only magnesium chloride in the area was on Interstate 70, not the city streets. However, ordinary salt was applied along with sand to those very same streets where the mechanic claimed magnesium chloride was not only burning his hands but mining the cars. Incidentally, the effects to cars of contact with magnesium chloride is approximately 70% less likely to cause corrosion to mild steal that would be the same amount of contact to sodium chloride the most widely used winter road de-icer.

Environmental Impact

Several years ago, Dr. Bill Lewis from the University of Colorado was commissioned by the Colorado Department of Transportation (CDOT) to perform a study of the effects of magnesium chloride on the environment. His study discovered ill effects on certain types of sensitive toads and crustaceans that are found in the Colorado high country. These ill effects were prevalent in the laboratory at high concentrations with WATER. After completing the laboratory evaluations, Dr. Lewis proceeded to the open environment to determine if the high level of contamination required to produce the ill effects to the toads and crustaceans existed in areas where magnesium chloride was being applied to the road. What he found was no detection of magnesium chloride what so ever beyond three feet from the edge of a paved road. WHAT IS IMPORTANT TO NOTE HERE IS THAT when used on dirt roads for dust control and road stabilization the brine is either worked into the surface or penetrates the same from a topical application and the amount of migration off the roadway would be expected to be much less than when applied in the winter to paved surfaces for anti-icing. In many cases, the levels of metals or other contaminants found in drinking water are higher than those allowed in magnesium chloride de-icers.

There are also claims that the use of magnesium chloride will “burn” vegetation along the roadside. Typically, the shoulder of the road is 3 feet wide. Dr. Lewis’ study demonstrated that magnesium chloride could not be detected beyond that distance. Therefore, if magnesium chloride cannot be detected at that distance, how can it “burn” vegetation? Certainly, magnesium chloride in sufficient quantities can harm plants.

Recently CDOT commissioned a University of Northern Colorado professor (Dr. Peterson) to further investigate these same effects on vegetation and Dr. Peterson has also indicated that it takes very high levels of the product to have any adverse effect on the vegetation. Further, it is the chloride that has the effect on vegetation not magnesium. Magnesium is required by the trees for healthy growth. Drought, insects and disease carry more likelihood of and the burden for the browning of the trees. Studies after study conducted by various scientific institutions have determined that magnesium chloride does not pose a threat to the environment. Levelton Engineering in British Columbia, one of the most water sensitive areas of our planet, has published studies extolling the safety to the environment and human health through the use of magnesium chloride.

Roadway Safety

The City of Denver, the Colorado DOT, the State of Idaho and many other agencies have studied the positive effects of magnesium chloride on road safety essentially in the winter months. In areas where magnesium chloride is used, up to 70% fewer accidents occur. These are not isolated cases. The Insurance Company of British Columbia (ICBC) has conducted several studies into accidents, fatalities, and accident claims. The most recent study showed that fatalities were down from 65 to 42 and claims for accidents are down from $165 Million to $ 127 Million. Prior to anti-icing with magnesium chloride, 35% of all accidents in the province of British Columbia occurred during winter conditions. Under the practices of anti-icing with magnesium chloride, only 17% of the total accidents were during winter conditions. Saved money, and certainly, saved lives. Furthermore, all the agencies as were contacted in this particular case have in the past Used the same or very similar products (magnesium chloride or in combination with Other products like Lignin Sulfonate) on unimproved roads under their jurisdiction long prior to the 2003-2004 time period in question. This includes in Rocky Mountain National Park.

Miscellaneous

Claims of high levels of Barium, Selenium, and Arsenic in soil and claims it comes from the chemicals is scientifically unmerited. The drinking water standard for Barium is 2.0 ppm. A typical analysis of the magnesium chloride as used on the Storm Mountain Roads would demonstrate a Barium level of 0.23 ppm.That is one tenth the allowable limit in drinking water. The drinking water standard for Selenium is 0.05 ppm. A typical analysis of the magnesium chloride as used on the Storm Mountain Roads would demonstrate a Selenium level of 0.02' ppm. That is more than one half lower than the allowable limit in drinking water. The drinking water standard for Arsenic is 0.01 ppm. A typical analysis of the magnesium chloride as used on the Storm Mountain Roads would demonstrate an Arsenic level of 0.74 ppm. Colorado ground and surface water standards list 0.340 ppm as the Acute level for Aquatic Life. Now remember, that this is the level in water. Therefore, at the levels in the product, we would need a I: I blend of magnesium chloride with the surface water before aquatic life was at risk from Arsenic. Certainly they would die from the chloride long before Arsenic.

In the development of this document, studies conducted by the following agencies were consulted:

1. Dr. Bill Lewis Study
2. USEPA Clean Water Act and Resource Conservation and Recovery Act (RCRA)
3. Levelton Engineering Report on the Environmental Impact of De-icing Chemicals
4. OSHA Dermatitis Study of Factory Workers
5. Various studies conducted by MnDOT, WSDOT, IDOT, and CDOT
6. Dale Keep, Washington State Department of Transportation (WSDOT)(Retired)
7. Marion Fishel - Sea Crest Group Colorado ground water standards are: