

Recreation Management Tech Tips

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Cold Weather Cleaning Solution

by

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Introduction

Maintaining toilet facilities during the high-use winter recreation season offers numerous challenges including the often frustrating task of attempting to clean soiled surfaces with a traditional 3-D (detergent, disinfectant, and deodorant) cleaning solution. The solution freezes upon contact with subfreezing surfaces, making the task difficult to accomplish.

Purpose

San Dimas Technology and Development Center (SDTDC), a National Technology and Development Center of the Forest Service, U.S. Department of Agriculture, was asked to find a user-friendly (noncaustic) cleaning solution that could be applied easily in subfreezing conditions, which also would deodorize and disinfect. SDTDC staff explored using magnesium chloride ($MgCl_2$) to prevent toilet vaults from freezing in 2008 (0823 1301—SDTDC, "Magnesium Chloride Toilet Vault Treatment: A Means To Inhibit Freezing in Outdoor Toilet Vaults"). Magnesium chloride is used as a road and sidewalk deicing agent. It has the lowest freezing point of the salts that are generally used by State and municipal road maintenance agencies. It dissolves readily in water and is nonflammable. SDTDC recommended adding $MgCl_2$ as antifreeze to the standard cleaning solution.

Scope

The Deschutes National Forest tested using $MgCl_2$ as an antifreeze addition to their standard 3-D solution. The $MgCl_2$ was added to the water before mixing their 3-D cleaning solution. Bob Hennings, the recreation operations assistant on the Deschutes National Forest, tested the 4-D solution (detergent, disinfectant, deodorant, and deicer).

Table 1. $MgCl_2$ concentration versus freezing point

Concentration $MgCl_2$ (lb/gal)	Freezing Point Degrees	
	F	(C)
0.0	32	(0)
0.5	26	(-3)
1.0	18	(-8)
1.5	0	(-18)
2.0	-20	(-29)

SDTDC staff recommended a starting ratio of 1 pound $MgCl_2$ to 1 gallon water. One pound $MgCl_2$ crystals equaled approximately 3 cups. The 1-pound-per-gallon mix should stay liquid to about 18 degrees Fahrenheit ($^{\circ}F$). If it were colder than 18 $^{\circ}F$, more $MgCl_2$ could be used, up to 2 pounds per gallon. At 2 pounds per gallon, the solution stays liquid to -20 $^{\circ}F$.



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The Test

Bob Hennings mixed the first batch at the recommended starting $MgCl_2$ -to-water ratio of 1 pound per gallon. The crystals mixed well with the water and they dissolved fully. He added standard General Services Administration-issue pine-oil cleaning solution (60 percent pine oil/detergent) at the recommended 1/4 cup per gallon to the $MgCl_2$ /water solution. The pine oil did not mix as well as with just water, but shaking/stirring the solution just prior to use worked.

Application Methods

For routine cleaning of the outside surfaces of the toilet risers, walls, hand rails, etc., he applied the solution using an industrial 20-ounce spray bottle and wiped all surfaces dry with paper towels. The solution worked very well. It did not freeze on the riser surfaces when applied. It seemed to clean well and wiped off easily with no sign of residual deposits left on the cleaned surface(s).

For tough cleaning inside of the riser, and for messy jobs on the outside of the riser/seat, he simply poured a premixed solution into a bucket and used a toilet brush to scrub/rinse the riser. That worked well for the heavy soil. He did try a 1.5-pounds-per-gallon mix for the brush work and that worked well, but at that ratio the mix was a little "thick" and did not work well in the spray bottle.

Bob did not attempt to clean/mop floors during the really cold weather.

Transportation Methods

Warmer is always better when cleaning frozen surfaces, so he transported the cleaning solution in an ice chest containing a jug of hot water. Probably not necessary, but it didn't hurt.

Test Conditions

The coldest temperature during the test period was 5 °F. The new 4-D solution worked well at that temperature and was a great improvement from the 3-D solution he had been using.

Personal Protective Equipment (PPE)

When using the 4-D solution to clean toilet facilities, wear standard waterproof gloves and goggles/face shield, as noted on a typical job hazard analysis.

The job hazard analysis also should address the potential of a cold-weather injury when working in freezing conditions. Caution: A -20 or even a 0 °F liquid is really cold and will cause damage to the skin. Handle accordingly. Wear waterproof gloves.

Conclusion

It appears that the $MgCl_2$ 4-D cleaning solution concept is viable and is a considerable improvement over traditional 3-D cleaning solutions for use in subfreezing conditions.

Magnesium chloride is used as a road and sidewalk deicing agent. It may be available in hardware stores, or grocery stores in areas that get frequent freezing weather. It is also available from chemical supply companies.

Integra Chemical (800-322-6646) was the source of the $MgCl_2$ used during the test. It was 99 Plus grade in flake form instead of crystal form, so it dissolved easier in water.

SDTDC wishes to thank Bob Hennings, Ellen Eubanks, and Kathy Snodgrass for their review of this document.

For further information on using $MgCl_2$ as a cold weather deicer, contact Bob Hennings, recreation operations assistant, Deschutes National Forest, at 541-549-7704 or by email: bhennings@fs.fed.us.

The National Technology and Development Center's national publications are available on the Internet at <http://www.fs.fed.us/eng/pubs/>

USDA Forest Service and U.S. Department of the Interior, Bureau of Land Management employees also can view videos, CDs, and National Technology and Development Center's individual project pages on their internal computer network at <http://fsweb.sdtc.wo.fs.fed.us/>



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