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THE SALTY TRUTH: REVEALING THE NEED FOR STRICTER ROAD SALT APPLICATION AND STORAGE REGULATIONS IN THE UNITED STATES

I. Introduction

Each year during the winter months, salt trucks apply billions of pounds of road salt to icy roads across the United States.[1] For individuals traveling on these roads, road salt is a life-saving, road-clearing device that allows for a safer commute.[2] With the widespread use and perceived necessity of road salt, it is easy to overlook the many negative impacts this chemical compound has on the environment, especially the nation's water systems.[3] Recent research has revealed just how damaging the use of high quantities of road salt truly is.[4]

Although many view road salt as the most "economical and effective" way to deice roads during the winter, the detrimental results of its use are beginning to appear.[5] Most notably, road salt directly affects the toxicity of rivers and streams as well as the quality of human health, wildlife, soil and vegetation, and infrastructures across the nation.[6] Currently, "[s]even out of [twenty] U.S. rivers- four in Wisconsin, one in Ohio and two in Illinois- have average chloride levels that approach or exceed the Environmental Protection Agency's (EPA's) guideline for protecting aquatic life."[7]

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1. Brian Bienkowski, *Rivers in Wintry Cities Remain Salty Year-Round*, Sci. Am. (Dec. 19, 2013), http://www.scientificamerican.com/article/rivers-in-wintry-cities-remain-salty-year-round/ (drawing attention to large amount of road salt used annually).

2. Jessica Marshall, *Road Salt's Damaging Effects Prompt Tech Alternatives*, Discovery News (Jan. 7, 2010, 11:20 AM), http://news.discovery.com/autos/salt-roads-environment-technology.htm (stating importance of road salt to those who travel).

3. *See generally id.* (noting lingering effects of road salt long after its application); *see also Environmental, Health, and Economic Impacts of Road Salt*, N. H. Dept. of Envtl. Servs. (last visited Sept. 29, 2014), http://des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm (listing numerous negative environmental effects of road salt).

4. *See* Bienkowski, *supra* note 1 (stating research has shown that road salt in rivers stays toxic most of year).

5. *See generally id.* (noting Vice President of Salt Institute feels salt is necessary to safety of individuals living in wintry climates).

6. *See*, *Environmental, Health, and Economic Impacts*, *supra* note 3 (recognizing widespread effects of road salt).

7. Bienkowski, *supra* note 1 (detailing recent, unpublished U.S. Geological Survey (USGS) study). The USGS study also found the rivers reached these high

These high chloride levels may cause many water species vulnerable to chloride to become extinct in the near future.[8]

The reason for these extensive consequences is that road salt does not disappear after its application; rather, it remains in rivers and groundwater for years.[9] Because of this characteristic, citizens should be concerned with the continued use of high levels of road salt each year.[10] Researchers have already reported significant negative impacts relating to the use of road salt across the nation, and the repeated annual use of billions of pounds of road salt will only make the situation worse.[11]

Some states have begun to recognize a number of alternatives to using high levels of road salt.[12] Many of these techniques, however, are only in their beginning stages of development, and several of them may prove to be very costly.[13] Still, some communities remain determined to find an appropriate solution to this growing environmental problem.[14] Individuals can also help combat this problem by taking their own small steps toward reducing the damaging effects of road salt.[15]

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levels on more days in 2006 than in 1991, showing the increasing impact of road salt on waterways. *Id.*

8. *Id.* (quoting research hydrologist from USGS).

9. *Id.* (quoting researcher's prediction that even if road crews stopped using salt now, it would still take decades to completely rid ecosystems of salt).

10. For a reference describing road salt's harmful lasting quality, see *generally id.* and accompanying text.

11. *See* Theresa J. Lins, *Keeping roads on a low-salt diet*, WIS. NAT'L RES. MAG. (Feb. 2010), http://dnr.wi.gov/wnrmag/2010/02/salt.htm (noting that chloride levels continue to increase every year). Roger Bannerman, a water resources management specialist at the Wisconsin Department of Natural Resources, referred to road salt use as a "'sleeping giant'" that will certainly contribute to chloride's damage to the nation's waterways. *Id.*

12. Marshall, *supra* note 2 (stating communities in Indiana and Minnesota have started to utilize more technological alternatives, attempting to be more environmentally conscious).

13. *See* William Wegner & Mark Yaggi, *Environmental Impacts of Road Salt and Alternatives in the New York City Watershed*, STORMWATER (June 30, 2001), http://www.stormh2o.com/SW/Articles/Environmental_Impacts_of_Road_Salt_and_Alternative_216.aspx (noting biggest problem with two most popular alternatives, calcium magnesium acetate and potassium acetate, is their expense).

14. *See* Beth Daley, *Low-salt diet has some roads getting greener*, BOSTON GLOBE (Jan. 17, 2011),http://www.boston.com/business/technology/articles/2011/01/17/low_salt_diet_has_some_roads_getting_greener/?page=1 (explaining some municipalities in Massachusetts have returned to using brine).

15. *Road Salts & Alternatives*, GREEN VENTURE, http://water.greenventure.ca/road-salts-alternatives (last visited Sept. 29, 2014) (providing tips for reducing amount of salt needed outside of residences). Suggestions for individuals include inspecting deicer labels to find least damaging chemicals, shoveling sidewalks early and frequently, and taking note of plants in the "salt risk zone" around one's property to avoid killing "salt sensitive" plants. *Id.*

Section II of this Comment first describes the chemical composition of road salt and why it is so damaging to the environment.[16] Next, Section III explains the country's current regulatory system (or lack thereof) regarding deicing chemicals.[17] Then, Section IV discusses the pros and cons of new techniques and alternatives to the use of road salt.[18] Further, Section V examines whether road salt can ever cease to exist as a deicing product and discusses what the best approach to the problem may be.[19] Finally, Section VI discusses how lawmakers and state transportation officials should proceed in the future and analyzes potential problems facing those individuals looking to better regulate road salt use.[20]

II. BACKGROUND

A. Use and Origin of Road Salt

More than seventy percent of the United States' roadways are located in "snowy" regions receiving more than an average of five inches of snow per year.[21] Almost seventy percent of the United States' population lives in these regions.[22] Every year, more than 1,300 people are killed and over 116,800 are injured in automobile collisions on snow-covered or icy roadways.[23] Researchers believe the use of road salt decreases the cost of accidents caused by snow or ice by eighty-eight percent.[24] Maintenance of snowy and icy roads during the winter months makes up approximately twenty

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16. For a discussion of road salt chemicals and their effects, see *infra* notes 21-77 and accompanying text.

17. For a discussion of the system that regulates deicing chemicals, see *infra* notes 78-116 and accompanying text.

18. For a discussion of alternatives, see *infra* notes 117-151 and accompanying text.

19. For a discussion of how to approach to problems associated with deicing, see *infra* notes 152-162 and accompanying text.

20. For a discussion of the future of road salt, see *infra* notes 163-180 and accompanying text.

21. *Snow and Ice*, U.S. DEP'T OF TRANSP. FED. HIGHWAY ADMIN. (July 2, 2013), http://ops.fhwa.dot.gov/weather/weather_events/snow_ice.htm (providing statistics related to snowy weather across nation).

22. *Id.* (providing statistic showing need for deicing chemicals in populated regions across nation).

23. *Id.* (drawing attention to severe state of roadways and need for maintenance).

24. DAVID A. KUEMMEL, P.E. & RASHAD M. HANBALI, Ph.D., MARQUETTE UNIV. DEPT. OF CIVIL & ENVTL. ENG'G, ACCIDENT ANALYSIS OF ICE CONTROL OPERATIONS 12 (Jun. 1992), http://www.trc.marquette.edu/publications/IceControl/ice-control-1992.pdf (noting findings pertaining to two-lane highways).

percent of state Department of Transportation maintenance funds.[25]

In 1940, Detroit was the first city in the world to use salt to deice its roads.[26] Since then, the amount of road salt used annually has steadily increased, with now over twenty-two million tons of road salt used across the United States every year.[27] Road salt sales represent sixty-five percent of salt sold in the United States, accounting for a national industry worth nearly two billion dollars.[28]

Public works departments across the country usually start the winter season with approximately twenty-five percent more road salt than they estimate they will require for the season.[29] The salt for roads comes from mines located in various regions around the world.[30] In the United States, salt mines exist under Detroit, near Cleveland, and in New York, Louisiana, and Kansas.[31]

Salt is mined "dry" from "underground seams of crystal salt, which formed from the evaporation of ancient seas."[32] Once mined, the salt is transported to a factory where workers combine it with other chemicals and place it into bags for sale.[33] Trucks then deliver the bags to various retail and hardware stores.[34] If the salt is intended for bulk sale, factories typically store it under tarps or in storage facilities.[35]

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25. *Snow and Ice*, *supra* note 21 (showing how much departments spend to keep roads safe). State and local departments spend an estimated $2.3 million every year on "snow and ice control operations." *Id.*

26. Brian Clark Howard, *The Surprising History of Road Salt*, NAT'L GEOGRAPHIC (Feb. 12, 2014), http://news.nationalgeographic.com/news/2014/02/140212-road-salt-shortages-melting-ice-snow-science/ (giving history of Detroit salt mine).

27. *Road salt keeps America's roads safe, but threatens the environment*, PBS NEWSHOUR (Jan. 7, 2014), http://www.pbs.org/newshour/rundown/road-salt-keeps-americas-roads-safe-but-threatens-wildlife-and-environment/ (equating this number to about 139 pounds of road salt per person).

28. Marshall, *supra* note 2 (providing statistic about sales); *see also* Matt Hongoltz-Hetling, *Maine's road salt comes from unexpected places*, MORNING SENTINEL (Nov. 30, 2013), http://www.onlinesentinel.com/news/Maine_s_road_salt_comes_from_unexpected_places_.html?pagenum=full (stating salt sales represented $1.8 billion industry in United States in 2011).

29. Howard, *supra* note 26 (describing ordering process of majority of public works departments).

30. *Id.* (noting road salt is not exclusively mined in United States).

31. *Id.* (showing U.S. locations of salt mines).

32. *Id.* (explaining process by which road salt develops).

33. *See generally* Hongoltz-Hetling, *supra* note 28 (providing account of salt distribution at Maine factory).

34. *See id.* (discussing delivery process).

35. *See generally id.* (stating one storage area in Maine looks like "tent" pulled over large amounts of salt piled for sale).

B. Road Salt's Chemical Composition

The chemical name for road salt is sodium chloride (NaCl).[36] Sodium chloride consists of forty percent sodium ions (Na^+) and sixty percent chloride ions (Cl^-).[37] Because of its solubility, chloride poses a great danger to both aquatic and land organisms and plants.[38] Furthermore, no natural method exists to remove chloride from the environment.[39] It does not "biodegrade, does not easily precipitate (react with other ions to form a solid), does not volatilize (turn into a gas), is not involved in biological processes, and does not absorb (adhere) significantly on mineral surfaces."[40]

Although not as mobile as chloride, sodium can substantially affect the quality of drinking water for both humans and wildlife.[41] In an EPA-mandated study, researchers recognized sodium concentrations from road salt as a potential "problem for drinking water systems" and a developing environmental concern.[42] It is much easier for soil particles to absorb sodium, so it is less likely that sodium will reach as much ground water and surface water as chloride; if absorption does not occur, however, sodium will gradually enter the water systems.[43]

C. How Road Salt Works

Road salt decreases the freezing temperature of water, which helps prevent ice and snow from sticking to the roads.[44] It is an "endothermic" chemical, meaning that it needs to absorb heat from

36. *Environmental, Health, and Economic Impacts*, *supra* note 3 (stating chemical name).

37. *See id.* (describing composition of road salt).

38. *Id.* (explaining how chloride is able to seep into groundwater and enter water systems through runoff and storm drains).

39. *Id.* (detailing why chloride is so dangerous to environment, especially to bodies of water).

40. *Effects of Deicing Materials on Natural Resources, Vehicles, and Highway Infrastructure*, MICH. DEP'T. OF TRANSP., at 33 (Dec. 1993), http://www.michigan.gov/documents/ch3-deice_51440_7.pdf (citing characteristics of chloride).

41. *Environmental, Health, and Economic Impacts*, *supra* note 3 (stating contaminated sodium in drinking water is great concern for individuals with low-sodium diets and animals drinking runoff or ice water).

42. ENVTL. PROT. AGENCY, OFFICE OF WATER, DRINKING WATER ADVISORY: CONSUMER ACCEPTABILITY ADVICE AND HEALTH EFFECTS ANALYSIS ON SODIUM 5 (Feb. 2003), *available at* http://www.epa.gov/safewater/ccl/pdfs/reg_determine1/support_cc1_sodium_dwreport.pdf (discussing effects of sodium in nation's waterways).

43. *See Effects of Deicing Materials*, *supra* note 40, at 39 (discussing characteristics of sodium).

44. Bienkowski, *supra* note 1 (explaining why road salt reduces accidents).

its surroundings in order to dissolve.[45] Road crews deposit road salt on snow-covered roads in amounts that allow it to reach the pavement, breaking the connection between the snow or ice and the pavement, thus making it easier for plows to clear the roads.[46] Road salt, however, does not effectively work at every temperature.[47] At higher temperatures, less road salt is needed to melt a large quantity of snow or ice.[48] At lower temperatures, though, a large amount of salt is needed to melt just a small amount of snow or ice.[49] Further, road salt alone is only efficient at temperatures ranging from thirty-two to about fifteen degrees Fahrenheit.[50]

In temperatures below fifteen degrees Fahrenheit, road maintenance crews add or substitute other chemicals such as magnesium chloride ($MgCl_2$) and/or calcium chloride ($CaCl_2$) to increase the effectiveness of road salt.[51] These chemicals perform much better in temperatures below zero degrees Fahrenheit.[52] Both of these chemicals are "exothermic," meaning that instead of requiring heat from their surroundings in order to dissolve, they emit heat as they dissolve.[53] These chemicals, however, are not any less corrosive or environmentally damaging than standard road salt.[54]

D. The Problem

Deicing chemicals such as sodium chloride enter the roadside environment in a number of different ways.[55] Following its applica-

45. *Choosing the Right Deicer*, OCCIDENTAL CHEM. CORP., http://oxycalciumchloride.com/sidewalk-ice-melting/effective-ice-melting/how-to-melt-ice-effectively/choosing-the-right-deicer (last visited Mar. 7, 2014) (providing characteristics of sodium chloride and comparing it to other forms of deicer).

46. Marshall, *supra* note 2 (telling how road salt is helpful to road crews).

47. *See id.* (noting salt's usefulness fluctuates based on temperature).

48. *Id.* (quoting Kathleen Schaefer of Minnesota Department of Transportation).

49. *Id.* (quoting Schaefer further and describing impact of road salt at various temperatures).

50. *Id.* (highlighting narrow range of temperatures at which crews can make do with salt alone).

51. Marshall, *supra* note 2 (explaining road salt on its own will not work properly in these extremely low temperatures).

52. *Id.* (showing benefit to using these supplemental chemicals). The lowest temperature at which calcium chloride is effective is negative twenty-five degrees Fahrenheit, and the lowest temperature at which magnesium chloride is effective is zero degrees Fahrenheit. *Effects of Deicing Materials*, *supra* note 40.

53. *Choosing the Right Deicer*, *supra* note 45 (comparing road salt's melting process with process of more effective chemicals).

54. *See id.* (stating "little difference" exists among chloride-based deicers regarding their corrosive qualities).

55. *Effects of Deicing Materials*, *supra* note 40, at 25 (discussing each of these ways in detail).

tion to the roadways, road salt may dry and moving vehicles may blow it off the road.[56] It may also remain on the road until a rainfall occurs, combine with the water, and splash off the road when vehicles pass by.[57] The largest quantity of deicer, though, enters the outside environment through runoff.[58] Most often, snowplows push the chemicals off the road, or the deicer forms a solution and trickles off the roadways.[59] The chemical concentration contained in the deicer is greatest in the runoff after the first rainfall.[60] This "roadway runoff" can then accumulate in ditches, drainage pipes, or any other permeable area and enter the nation's lakes, rivers, streams, and soil.[61]

Presently, many streams in the northeastern part of the United States are in danger of becoming toxic to "sensitive freshwater life" within the next 100 years due to high levels of chloride.[62] Much of the chloride contamination in the waterways is because of the use of road salt in these areas.[63] According to Sujay Kashual, a researcher at the University of Maryland's Center for Environmental Science's Appalachian Library, and several other researchers, "Salt contamination is 'one of the most significant threats to the integrity of freshwater ecosystems in the northeastern United States.'"[64] Kashual and a team of researchers studied thirty years of data from rural streams in Baltimore County, Maryland, the Hudson River Valley, New York, and the White Mountains, New Hampshire, as well as five years of data from streams in the urban regions of Baltimore, Maryland.[65] The results of the study showed an increase in

56. *Id.* (describing first, but not most common, way road salt ends up in waterways and soil).

57. *Id.* (referring to this type of material as "residual material"). The quantity of deicer splashed off the road will often depend on how fast traffic is going and how much traffic is present on the road. *Id.*

58. *See id.* (discussing process by which "largest volume" of deicing chemical ends up off the roadways).

59. *Id.* (describing two most common paths). When plows push snow off the roads, they also push all of the deicing chemicals contained in that snow onto the roadside, where the chemicals will then combine with soil and groundwater. *Id.*

60. *Effects of Deicing Materials, supra* note 40, at 25 (comparing concentrations). The concentration quickly reduces as rain keeps falling and time passes. *Id.*

61. *Id.* (illustrating ease with which chemicals from road salt and other deicers combine with roadside environment).

62. Robin Meadows, *Road Salt Turns Streams Toxic*, CONSERVATION (July 29, 2008), http://conservationmagazine.org/2008/07/road-salt-turns-streams-toxic/ (discussing urgent state of U.S. waterways regarding chloride levels).

63. *Id.* (citing reason for stream contamination).

64. *Id.* (quoting findings from research study). Chloride levels of only 0.25 grams/liter are potentially dangerous to freshwater organisms. *Id.*

65. *Id.* (explaining how researchers conducted study of chloride levels).

chloride levels in rural streams over the past twenty years, with levels doubling in areas of New York and New Hampshire, and quadrupling in Baltimore County.[66] In addition, urban areas of Baltimore contained many streams with chloride levels over the 0.25 gram/liter limit, which are levels dangerous to freshwater organisms.[67]

In Pennsylvania, researchers have discovered that sodium levels in the Delaware River have almost tripled over the past sixty years, and chloride levels have increased by five times.[68] Hongbing Sun, a professor of geological and environmental sciences at Rider University, concluded that road salt is primarily responsible for the increasing levels of sodium and chloride in the Delaware River.[69] Furthermore, the Schuylkill River has experienced increases in its salt content as well.[70] In fact, Chris Crockett, the director of planning and research at the Philadelphia Water Department, estimates that "'[I]n my lifetime, we'll see the Schuylkill hit its carrying capacity.'"[71]

Pollution from road salt can cause a host of problems for animal and plant species living near roadway areas and in contaminated waterways.[72] Studies have shown that chloride contained in road salt has the potential to "negatively impact the survival rates of crustaceans, amphibians such as salamanders and frogs, fish, plants,

66. *Id.* (citing results of study of chloride levels).

67. Meadows, *supra* note 62 (describing further results of study). Researchers hypothesized that streams in more northern parts of the country would probably contain even higher levels of chloride because those regions most likely use more road salt during the winter months. *Id.*

68. *See* Sandy Bauers, *Salt on the roads: Good for safety, bad for environment*, PHILADELPHIA INQUIRER (Dec. 29, 2010), http://articles.philly.com/2010-12-29/news/26356473_1_sodium-chloride-salt-roads (drawing attention to chemical problem in Pennsylvania's waters).

69. *Id.* (noting that findings showed chemical content not only increased after winter storms but also in summer months). Sun's conclusion has led his research team to study both the accumulation process of salt as well as the length of time salt stays in the ground. *Id.*

70. *Id.* (describing increase in chloride levels in Schuylkill River). Concern exists about the possibility that an increase in chloride levels will cause Schuylkill's plant and animal life to change in future years. *Id.*

71. *Id.* (quoting prediction about Schuylkill River's chloride levels). Crockett believes that over time, salt will not only affect the rivers, but also the rivers' entire ecosystems. *Id.*

72. *See* Joseph Stromberg, *What Happens to All the Salt We Dump On the Roads?*, SMITHSONIAN.COM (Jan. 6, 2014), http://www.smithsonianmag.com/science-nature/what-happens-to-all-the-salt-we-dump-on-the-roads-180948079/?no-ist (comparing consequences of road salt pollution for humans to those for organisms in surrounding roadway environments). While road salt pollution poses a significant threat to humans, the consequences facing organisms in the surrounding roadway environment are perhaps even greater. *Id.*

and other organisms."[73] High amounts of chloride are dangerous to these organisms because chloride affects the organisms' ability to control their salt intake.[74]

Additionally, "highly concentrated road salt" may bring about the dehydration and death of nearby plants and trees because it inhibits their ability to absorb water.[75] One study even found that chloride from road salt can cause "invasions of non-native plant species" that are much more tolerant of salt than the plants presently located by the roadsides.[76] Taken together, all of these existing and potential problems are now prompting individuals and communities around the nation to ask what they can do to help slow the contamination process.[77]

III. PRESENT STATE OF REGULATIONS

A. Federal Regulations

The Federal Water Pollution Control Act of 1948 was the first key federal law concerning water pollution.[78] In 1972, due to increasing knowledge and apprehension surrounding water pollution, Congress amended the statute to include a number of additional regulations.[79] This new law became known as the Clean Water Act (CWA).[80]

The CWA includes provisions which "maintain[ ] existing requirements to set water quality standards for all contaminants in surface waters" and "ma[ke] it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions."[81] Under the CWA, the

73. *Id.* (illustrating just how damaging chloride can be to environment).

74. *Id.* (noting chloride levels above 800 ppm are dangerous to freshwater organisms). Wet areas adjacent to roadways can exceed this amount after snow begins to melt. *Id.*

75. *Id.* (emphasizing effect road salt contamination has on plant life). Road salt contamination does not only affect water systems, but also various other systems in the environment. *Id.*

76. *Id.* (citing study that addressed impact of high salt concentrations on vegetation in marsh area by Massachusetts Turnpike).

77. *See generally*, Stromberg, *supra* note 72 (stating some communities are now starting to consider alternative measures).

78. *History of the Clean Water Act*, ENVTL. PROT. AGENCY (last updated July 8, 2014), http://www2.epa.gov/laws-regulations/history-clean-water-act (providing background information about Clean Water Act).

79. *Id.* (describing how Clean Water Act developed over time).

80. *Id.* (discussing history of CWA).

81. *Id.* (detailing many provisions of new 1972 amendments); *see also* Clean Water Act §§ 402, 502, 33 U.S.C. §§ 1342(a)(1), 1362(12) (2012) for the exact language of the statute. Additional amendments contained in the CWA are those

term "point source" refers to any identifiable source, such as a pipe or drain.[82] The term "navigable waters" is defined as the "waters of the United States."[83]

The CWA requires states to separate waterways according to their "intended use" and to create a State Implementation Plan (SIP) to make certain the quality of the water meets the CWA's standards.[84] The amount of pollution in each separate waterway must be low enough that the water is able to support its "designated use."[85] The CWA mandates that states must update their water quality standards every three years.[86]

Although environmental groups in Pennsylvania concerned about chloride's effects have brought their concerns to the Pennsylvania Department of Environmental Protection (PA DEP), chloride is still not a regulated substance in Pennsylvania.[87] In Pennsylvania and in many other states, chloride level regulations remain absent from the water quality standard updates.[88] Addition-

creating a basic regulation structure for pollutant regulation and those granting the EPA "authority to implement pollution control programs." *History*, *supra* note 78.

82. *Clean Water Act*, CAMPUSERC, http://www.campuserc.org/compliance-guides/epa-environmental-protection-agency (click on "Clean Water Act") (last visited Oct. 2, 2014) (providing definitions pertaining to CWA); *see also* Clean Water Act § 502, 33 U.S.C. § 1362(14) (2012) (defining term "point source").

83. Clean Water Act § 502, 33 U.S.C. § 1362(7) (2012) (defining term "navigable waters"). Whether particular bodies of water such as wetland areas should be categorized as "waters of the United States" has repeatedly been a point of contention within the courts. *See* Rapanos v. United States, 547 U.S. 715 (2006).

84. *Clean Water Act (CWA)*, LEGAL INFO. INST., CORNELL UNIVER. LAW SCHOOL, http://www.law.cornell.edu/wex/clean_water_act_cwa (last visited Feb. 10, 2014) [hereinafter CORNELL CWA] (describing ways in which CWA regulates quality of waterways). Classifications of intended use include "swimming, fishing, water supply, navigation, and industrial waste disposal." *Id.*

85. *See* CORNELL CWA, *supra* note 84 and accompanying text.

86. *See* Susan Phillips, *Chloride Levels Remain Unregulated in Pennsylvania Waters*, STATEIMPACT (June 21, 2013 6:00 PM), http://stateimpact.npr.org/pennsylvania/2013/06/21/chloride-levels-remain-unregulated-in-pennsylvania-waters/ (noting chloride monitoring requirements absent from recent three-year water quality update).

87. *Id.* (showing obstacles individuals face in attempting to implement chloride regulations). Members of these environmental groups were worried about the discharge of chloride into Pennsylvania's waterways as a result of natural gas drilling. *Id.*

88. *See id.* (stating new water quality standards not adopted in Pennsylvania concerning chloride levels). The author hints that this decision may be related to the widespread opposition from the coal and natural gas industries regarding the inclusion of chloride standards. *Id.* *See also* Christine A. Fazio & Ethan I. Strell, *Environmental Impact of Road Salt and Deicers*, N.Y.L.J. (Feb. 24, 2011), *available at* http://www.clm.com/publication.cfm?ID=321#_edn4 (reporting no known cases where use of deicers required State Pollutant Discharge Elimination System (SPDES) permit).

ally, many states treat road salt as non-point source pollution, because trucks apply it to roads where water then washes it away.[89] States, therefore, do not need to obtain a permit for its application or discharge.[90]

B. State Regulations

Road salt storage is a regulated activity in many, but not all, states.[91] In states like Ohio where road salt storage is not presently regulated, reports have emerged describing road salt's pollution of the water systems.[92] An article from Columbus, Ohio, reported that the Ohio EPA found five instances of polluted wells due to salt contamination.[93]

In response to findings like those in Ohio, states have begun to take road salt contamination more seriously and are now looking at how to improve road salt storage and application.[94] Following the recent discovery of contaminated waters in Ohio, the Ohio Water Resources Council formed a committee to determine how other states have handled salt storage and what Ohio should do going forward.[95] The committee examined regulations in sixteen states across the United States, including the mid-Atlantic states of Pennsylvania, New Jersey, and New York.[96] Specifically, it analyzed which regulations existed regarding storm water programs, water supply protection, and groundwater protection.[97]

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89. *See* Fazio & Strell, *supra* note 88 (illustrating problems with classification).

90. *See id.* (noting CWA does not require permit for road salt use).

91. *See id.* (stating road salt storage regulated in New York); *see also* Kevin Osborne, *City manager: All rules followed in stockpiling road salt, no threat posed*, WCPO CINCINNATI (Dec. 24, 2013, 3:31 PM), http://www.wcpo.com/news/political/local-politics/city-manager-all-rules-followed-in-stockpiling-road-salt-no-threat-posed (stating Ohio does not have road salt storage regulations).

92. *See generally* Spencer Hunt, *Road salt is polluting Ohio drinking water*, COLUMBUS DISPATCH (Dec. 12, 2010, 8:00 AM), http://www.dispatch.com/content/stories/local/2010/12/12/road-salt-is-polluting-ohio-drinking-water.html (noting road salt's contribution to contamination of Ohio water).

93. *See id.* (describing state of Ohio water wells and what Ohio EPA is doing to remedy situation).

94. OHIO DEP'T OF NATURAL RES., STATE OVERSIGHT OF ROAD SALT STORAGE IN MIDWESTERN AND NORTHEASTERN U.S. 2 (Feb. 12, 2013), *available at* http://ohiodnr.gov/Portals/0/pdfs/owrc/Summary%20of%20How%20States%20Oversee%20Salt%20Storage.pdf (describing recent steps that sixteen states have taken in regulating road salt storage).

95. *Id.* at 1 (describing committee's purpose).

96. *Id.* at 2 (listing states included in analysis). The other thirteen states encompassed in the study were Ohio, Vermont, Minnesota, Indiana, New Hampshire, Illinois, Connecticut, Massachusetts, West Virginia, Kentucky, Michigan, Wisconsin, and Maine. *Id.*

97. *Id.* at 2-12 (dividing analysis into categories by state).

Many states consider the mixture of water and salt formed when rain or melted snow travels down salt piles to be contaminated storm water, thus falling under storm water permitting requirements.[98] Seven of the sixteen states employ a "basic approach" to road salt storage.[99] This "basic approach" involves using the state's storm water program in some capacity to regulate storage of road salt.[100] These storm water programs usually include the following: "(1) [a] municipal separate storm sewer permit (MS4); (2) [an] industrial multi-sector general storm water permit; (3) discretionary authority; and (4) [a] characterization and abatement of unpermitted discharge."[101] The remaining nine states use either a modified "basic approach" or a wide-ranging regulatory system that does not require storm water regulations.[102]

Pennsylvania restricts its regulatory coverage of salt storage to storm water programs and responses to unauthorized discharges.[103] In Pennsylvania, the PA DEP is responsible for promulgating regulations regarding salt storage.[104] The authority for the PA DEP's requirements comes from its National Pollutant Discharge Elimination System (NPDES) permit.[105] Under the PA DEP's regulations, salt piles weighing less than 3,000 tons must be regulated according to the Salt Institute's *Salt Storage Handbook*.[106] At the very minimum, a "permanent structure" must cover these piles, and the piles must be located on an "impermeable base."[107] For piles weighing over 3,000 tons, regulations must follow the Salt Institute's guidelines in its *Voluntary Salt Storage Guidelines for Distribution Stockpiles*.[108] At a minimum, "these piles should be covered with canvas, polyethylene, or other synthetic material, except when receiving salt, building the stockpile, or loading out to customers."[109] Like the lighter piles, these piles must also have an "impermeable base."[110]

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98. *Id.* at 1 (telling why salt storage is subject to storm water regulations).

99. STATE OVERSIGHT, *supra* note 94, at 2 (describing how approaches vary among states).

100. *Id.* at 10 (detailing what "basic approach" constitutes).

101. *Id.* at 1-2 (providing elements of "basic approach").

102. *Id.* (noting alternatives to "basic approach").

103. *Id.* at 11 (categorizing Pennsylvania and others under this classification).

104. STATE OVERSIGHT, *supra* note 94, at 3 (focusing on Pennsylvania's current regulations).

105. *Id.* (citing source of authority).

106. *Id.* (describing regulations).

107. *Id.* (setting forth requirements for salt piles of this size).

108. *Id.* (showing difference in regulations depending on size of salt pile).

109. STATE OVERSIGHT, *supra* note 94, at 3 (illustrating requirements for larger piles).

110. *Id.* (showing some regulations are similar).

New Jersey, like Pennsylvania, does not have a specific program in place for the regulation of salt storage.[111] New Jersey follows a MS4 system in which crews must store certain piles in a permanent storage building.[112] As of February 2013, the State was negotiating with the salt industry to create permit requirements for five commercial piles that had escaped regulations.[113]

In contrast, New York enacted a program separate from its storm water program to regulate salt storage in the state.[114] Under this approach, regulations exist pertaining to certain point and non-point sources in limited municipal water supply watersheds.[115] These regulations only provide that piles located in those areas "may" require some type of covering, not that a covering is mandatory.[116]

IV. NEW DEICING TECHNIQUES

In light of the many problems caused by the substantial use of road salt, communities have attempted to develop and implement more environmentally friendly deicing methods.[117] In order to decrease their reliance on road salt, various agencies are using what is known as "anti-icing" or "pre-wetting" techniques.[118] These methods involve pre-treating the roads with "salt brines" before a winter storm arrives.[119] Wetting the salt before use helps more of it stay on the roads, instead of running off into the wayside.[120] This method

111. *Id.* at 11 (listing New Jersey under first category of states following "basic approach"). Other states in this category include Ohio, Vermont, Minnesota, Indiana, and New Hampshire. *Id.*

112. *Id.* (describing what MS4 permit entails).

113. *Id.* (noting present state of regulation process).

114. STATE OVERSIGHT, *supra* note 94, at 12 (placing New York in second category of states following alternative approach). Other states in this category include Illinois, Connecticut, Massachusetts, and West Virginia. *Id.*

115. *Id.* (noting that NY does not clarify any aspect of the "basic approach" but instead enacted broad program).

116. *Id.* (showing differences among states). New York will most likely only require a covering in "specific cases if a site is determined to be the cause of ground water or drinking water standard violations." *Id.*

117. *See generally* Marshall, *supra* note 2 (describing techniques agencies across the country are utilizing to obtain environmentally friendly result).

118. *Id.* (discussing successful measures to decrease amount of salt used); *see also Rock Salt Versus Salt Brines: What's Best for Road Safety?*, ACCUWEATHER.COM (Jan. 27, 2014, 3:25 AM), http://www.accuweather.com/en/weather-news/rock-salt-vs-salt-brines-whats/22352942 (comparing usefulness of road salt to other, more effective techniques).

119. *Rock Salt*, *supra* note 118 (noting terminology). Salt brine refers to "any liquid salt mixture." *Id.* Salt brine is usually a twenty-three percent salt solution. *Id.*

120. Marshall, *supra* note 2 (noting benefits of this anti-icing method).

is also more cost-effective because it begins to work immediately, thus helping to prevent ice from forming and lessening the amount of salt needed.[121] Sand is also a common material used in combination with road salt, especially at very low temperatures.[122] Sand increases automobile traction and allows for better travel when roads become very icy.[123]

Another increasingly popular technique is the use of beet juice on the roads.[124] Recently, the Pennsylvania Department of Transportation (PennDOT) announced that it was experimenting with beet juice as a way to melt ice and snow when temperatures dip close to zero degrees.[125] Bob Skrak, a PennDOT spokesperson, stated that mixing beet juice with road salt could greatly increase the effectiveness of road salt at temperatures even "'. . .well below zero— maybe 15, 20 below.'"[126] In addition to Pennsylvania, about 175 municipalities in the Midwest have begun to use a product called "Beet Heet" to help fight the large amounts of snow and ice received this past winter.[127]

A number of communities have turned to even more bizarre alternatives to using road salt.[128] In some parts of Wisconsin, residents have used cheese brine mixed with salt as a deicer.[129] Representatives from Polk County, Wisconsin, reported a savings of $40,000 in its first year of use and have stated that this method

121. *See Rock Salt*, *supra* note 118 (stating brines are four times more cost effective than rock salt alone).

122. *Using Salt and Sand for Winter Road Maintenance*, ROAD MGMT. J. (Dec. 1, 1997), http://www.usroads.com/journals/p/rmj/9712/rm971202.htm (noting helpfulness of sand at low temperatures).

123. *Id.* (noting reason communities have turned to abrasives like sand). In addition to sand, other common abrasives that help traction in icy weather include "slag, cinders, and bottom ash from plants." *Id.*

124. *DOT Uses Beet Juice to Battle Icy Roads*, NBC10.COM (Jan. 3, 2014), http://www.nbcphiladelphia.com/traffic/transit/Beet-Juice-Icy-Roads-PennDOT-238588071.html (citing new development in Pennsylvania's fight against wintry roads).

125. *Id.* (explaining how beet juice mixture is more effective than road salt alone at lower temperatures).

126. *Id.* (quoting PennDOT opinion regarding use of beet juice).

127. Maya Rhodan & Josh Sanburn, *How Beet Juice Is Helping Keep Roads Safe This Winter*, TIME (Feb. 10, 2014), http://nation.time.com/2014/02/10/salt-shortage-triggers-beet-juice-cheese-brine-alternatives/ (describing alternatives these communities have turned to because of shortages of road salt). Like regular beet juice, "Beet Heet," when mixed with road salt, helps road salt become more effective at lower temperatures. *Id.*

128. *Road salt alternatives include cheese brine, molasses*, CBCNEWS (Dec. 18, 2013, 1:02 PM), http://www.cbc.ca/news/road-salt-alternatives-include-cheese-brine-molasses-1.2468744 (highlighting more creative steps states have taken).

129. *Id.* (detailing how Wisconsin is using one of its most popular products to its benefit). Cheese brine is an appealing alternative to road salt because it is comes from factory byproduct, which makes it free to use. *Id.*

"saves 30% of salt by eliminating the bounce factor."[130] Other towns have been experimenting with molasses, mixing it with a salt brine solution to help salt stick to roads.[131] Molasses also helps to decrease the "corrosive qualities" of chloride.[132] Even more interestingly, a town in Iowa used a mixture of garlic and table salt to deice its roads.[133] Additionally, a company in Canada has developed a product called "EcoTraction," which is made from non-toxic volcanic rock.[134] The granules of this product implant themselves into snow and ice, producing a "solid, non-slip surface."[135]

Some communities have also experimented with or considered the use of much more expensive techniques to deal with the detrimental environmental effects of road salt.[136] For example, the state of Indiana has developed computers for its plowing trucks that tell operators the exact amount of salt they should apply under specific weather conditions.[137] The State reported that this new technology saved it 228,000 tons of salt and thirteen million dollars in salt and overtime costs in just one winter.[138] One town in Minnesota is currently experimenting with a "pervious pavement surface" that would allow for melting snow and ice to sink right through the roads instead of running off into the roadside.[139] Further, some

130. Larry Copeland, *Communities seek a substitute for road salt*, USA TODAY (Feb. 23, 2013, 9:50 AM), http://www.usatoday.com/story/news/nation/2013/02/23/road-salt-substitute/1939793/ (noting effectiveness of cheese brine as alternative to road salt). The bounce factor refers to the amount of salt that bounces off the roads after application. *See Effect of road salt on local environment unknown*, DAILY PROGRESS (Mar. 31, 2014, 7:35 pm) http://www.dailyprogress.com/news/effect-of-road-salt-on-local-environment-unknown/article_24a59a34-b92d-11e3-ac85-001a4bcf6878.html.

131. Ilan Brat & Timothy Martin, *As Salt Prices Rise, Frozen Towns Reach for Molasses*, WALL ST. J. (Jan. 2, 2009, 12:01 AM), http://online.wsj.com/news/articles/SB123084701287847257 (noting officials in Washington state used this technique, saving significant amounts of money). Officials for the state of Washington's transportation department assert that this molasses mixture can keep roadways clear for about three to four days. *Id.*

132. *See Road salt alternatives*, *supra* note 128 (detailing benefits of molasses mixture).

133. *Id.* (noting this method was used after spice factory needed to get rid of excess product).

134. *Id.* (describing how EcoTraction works). Mark Watson, the founder of EcoTraction, created the product after his dog passed away from cancer, which could have been linked to toxic chemicals contained in road salt. *Id.*

135. *Id.* (explaining why EcoTraction is effective).

136. *See* Marshall, *supra* note 2 (detailing measures some communities have taken to decrease salt use and salt cost).

137. *See id.* and accompanying text. These computers use local weather, storm conditions, and road temperatures to determine the perfect amount of salt needed. *Id.*

138. *Id.* (describing benefits of these computers may be worth cost).

139. *Id.* (showing way to deal with snow and ice in non-chemical manner).

researchers have suggested developing newer and more efficient plow blades as well as creating heat-tubing systems under roads to melt snow and ice more effectively.[140]

Lastly, engineers and scientists have considered the idea of developing roads equipped with solar panels that would assist in melting the snow and ice, making it easier for crews to clear the roads.[141] Solar Roadways, an Idaho company, is using a $750,000 research contract from the Federal Highway Administration to help develop this solar powered pavement technology.[142] Researchers estimate that this technology could be available within the next three to five years and would be primarily used in large spaces like parking lots.[143]

These environmentally conscious techniques, however, are not without their faults.[144] In communities experimenting with beet juice, for instance, residents have complained that the juice stains their tires and roads and smells like "rotting vegetables."[145] Bacteria that decompose the beet juice also use up oxygen, which contributes to the already low oxygen levels in many urban areas.[146] Furthermore, substituting beet juice for cheaper materials like salt brine may cost communities nearly ten times more.[147]

Cities that use sand have found that it requires specific conditions to work properly.[148] Specifically, crews can only apply sand to areas of low traffic because high volumes of traffic will cause sand to fly off the roads.[149] In addition, sand may cause damage to automo-

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140. *Id.* (reporting ideas of researcher at University of Minnesota).

141. *Road salt alternatives*, *supra* note 128 (indicating this is not yet viable option, but may be in next few years).

142. Copeland, *supra* note 130 (noting efforts across country to develop this system). Unrelated to the Solar Roadways project, a team at Worcester Polytechnic Institute is also working to create these solar powered systems. *Id.*

143. *Id.* (providing prediction from research team leader at Worcester Polytechnic). This technology will be first tested in areas that are less crowded than normal roadways. *Id.*

144. *See generally infra* notes 145-151 and accompanying text.

145. *See* Bauers, *supra* note 68 (noting downfalls exist to salt "alternatives").

146. *Id.* (explaining why beet juice may not be ideal solution).

147. *Id.* (citing results of Wisconsin study).

148. Lins, *supra* note 11 (describing various instances when sand is effective and when it is ineffective).

149. *Id.* (stating when snow and ice are melting, heavy traffic may pound sand into that melting material, causing sand to lose its ability to provide traction). Sand can also contribute to the blocking of drains and pipes along the roadside. Susan Kelleher, *Latest storm headache: Seattle sand clogs sewer plant*, THE SEATTLE TIMES (July 15, 2009, 12:10 PM), http://seattletimes.com/html/localnews/2009127486_sand27m.html.

biles by cracking their windshields and deteriorating rusty metal.[150] Crews using sand also need to remember that it only improves vehicle traction; it cannot contribute to the actual deicing of the roadways.[151]

V. THE REAL QUESTION: WHAT IS THE BEST APPROACH?

The reality of the situation is plainly that salt is just the least expensive and effective solution available.[152] With the high demand for clear roads and expectations of a quick deicing process, salt has proven to be the most appropriate material for the job.[153] It is unlikely that salt will ever completely vanish from the United States' winter deicing scheme.[154] Municipalities and researchers, therefore, must focus on ways to decrease its use, without attempting to entirely eliminate salt use from the nation's winter deicing routine.[155]

A 2011 study concluded that a "'reduction in usage appears to be the only effective road-salt-runoff management strategy.'"[156] Many of the aforementioned methods of deicing fulfill this need, but they are only in the early stages of development.[157] Thus, researchers and engineers need to continue to study these new practices in order to improve their effectiveness and practicality.[158]

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150. Lins, *supra* note 11 (illustrating traction problems are not only thing to worry about regarding sand).

151. *See id.* (believing sand is often not "adequate substitute" for replacement of road salt).

152. *See* Bauers, *supra* note 68 (noting no alternatives have been established as better solution).

153. *See id.* (discussing increase in road salt's popularity as deicer as country developed more roads, cars, and infrastructures).

154. *See* Copeland, *supra* note 130 (predicting likelihood of salt use in coming years).

155. *See generally id.* (noting various ways to continue using road salt, but in smaller amounts).

156. *Id.* (quoting study results published in the *Annals of The New York Academy of Sciences*).

157. For a discussion of these new alternative methods, see *generally*, *supra* notes 136-143 and accompanying text.

158. *See generally* Shannon Fiecke, *New Study to Shed Light on Environmental Impacts of Deicers*, CROSSROADS (Jan. 2, 2014), http://mntransportationresearch.org/2014/01/02/winter-salt-alternatives-studies-for-environmental-impact/ (stating in January of 2014, researchers in Minnesota expected to release comprehensive study of environmental impact of popular alternative deicers). The purpose of this study is to help workers at the Minnesota Department of Transportation choose proper alternative deicing chemicals during winter storms. *Id.*

Another way to possibly decrease the amount of salt applied to the roads is through training programs for salt crews.[159] During this training process, supervisors should advise their crews of the dangers of over-applying road salt when they are uncertain about how much to use.[160] Steven Lund, maintenance engineer at the Minnesota Department of Transportation, stated that the state has seen its "biggest return on efforts to protect the environment" from its preparation of salt crews.[161] Similarly, Roger Bannerman, water resources management specialist at the Wisconsin Department of Natural Resources, agrees that the only way to decrease road salt use is to, "'educate, educate, educate.'"[162]

VI. FUTURE IMPACT

Despite the overwhelming evidence that salt contamination is a very real and current problem, not everyone is willing to recognize it as such.[163] In fact, the PA DEP has stated that salt is "not really" a problem in the quantities crews apply it to the roads.[164] The PA DEP asserts that winter water levels are high enough to dilute the salt content.[165] It seems likely that similar attitudes toward salt contamination have contributed to the non-existent or sparse chloride and salt storage regulations across the country. Lawmakers need to better monitor each state's use of road salt and recognize the need for more specific regulations.[166]

In addition, lawmakers should remember that private operators also apply road salt to various other types of properties, such as

159. Copeland, *supra* note 130 (discussing benefits of plow operator training program).

160. *See id.* (describing what Minnesota plow operators hear in their training sessions).

161. *See id.* (illustrating advantage of training programs).

162. Lins, *supra* note 11 (focusing on importance of making individuals and road crews aware of dangerous possible future effects of road salt).

163. *See* Chris Papst, *Where does all this salt go? And does it harm the environment?*, CBS 21 NEWS, http://local21news.com/news/features/top-stories/stories/where-does-all-salt-go-does-harm-environment-6102.shtml#.UwObRqBOTww (last visited October 11, 2014) (detailing lack of concern of PA DEP regarding road salt application).

164. *Id.* (providing PA DEP's answer when asked about whether salt is damaging to water systems).

165. *Id.* (describing PA DEP's reasoning for not being so concerned about salt levels).

166. *See* James E. Alleman et al., INNOVATIVE ENVTL. MGMT. OF WINTER SALT RUNOFF PROBLEMS AT INDOT YARDS 66 (Dec. 2004), *available at* http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1601&context=jtrp (recommending state transportation officials discuss ideas and monitor new deicing technologies to help solve salt contamination problem).

private parking lots, streets, and walkways.[167] Private operators contribute significantly to the amount of road salt used in the country each year.[168] In fact, officials in the city of Madison, Wisconsin, found that private operators apply about twice the amount of road salt than the city applies annually.[169] Not only should training and regulatory programs include public road crews, but they should incorporate these private operators as well.[170]

Problems may arise, however, in the implementation of future road salt regulatory policies.[171] One possible major policy debate in the coming years is whether states should mandate that road crews and private operators use more environmentally friendly alternatives to road salt.[172] This decision will most likely involve a thorough cost-benefit analysis, weighing the cost of continued use of standard deicers like road salt against the perceived benefit of using more eco-friendly materials.[173] It is clear that road salt has already begun to substantially impact the nation's ecosystems, so the question remains as to how much environmental damage citizens and lawmakers are willing to tolerate in the future.[174] As of 2004, environmental damage from road salt and other deicing chemicals reached estimates as high as five billion dollars; this number has likely only increased since then.[175]

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167. *See generally* REPORT OF THE SALT USE SUBCOMM. TO THE COMM'N ON THE ENV'T ON ROAD SALT USE AND RECOMMENDATIONS 10 (Dec. 11, 2006), *available at* http://www.cityofmadison.com/engineering/stormwater/documents/SaltUseReduction.pdf (reminding committee that public operators are not only source of road salt).

168. *Id.* (basing conclusion off data obtained from private operators in Madison, Wisconsin). Although salt applied to sidewalks and small residential areas is not such a large concern, salt applied to private parking lots substantially contributes to road salt accumulations. *See id.*

169. *Id.* (noting road crews apply salt at rate of about 150 lbs. for each lane mile, but in parking lots, private operators apply salt at estimated rate of 280-600 lbs. for each lane mile).

170. *See generally id.* (noting people who should be involved).

171. *See generally* Robert Proudfoot, *Using Road Salt During Snow and Ice Conditions: Environmental Impact Versus Road Safety*, KY. J. EQUINE AGRI. & NAT. RESOURCES L. (Jan. 2, 2013), http://www.kjeanrl.com/full-blog/2013/01/using-road-salt-during-snow-and-ice.html (focusing on policy problems associated with new alternative strategies).

172. *See generally id.* (recognizing potential for disagreement).

173. Alleman, *supra* note 166, at 60-62 (noting although most communities find deicing strategies are cost effective, damage to environment can be very costly).

174. For a discussion of the damaging effects of road salt, see *generally supra* notes 61-77 and accompanying text.

175. Alleman, *supra* note 166, at 61 (stating importance of factoring environmental damage into cost benefit analysis).

A further problem may arise if some states do decide to mandate the use of alternative deicing strategies, while others choose not to implement an alternative program.[176] Inconsistency among states can cause traffic problems and concern among drivers who hold differing expectations about how snowy and icy roads should be cleared.[177] To help prevent this problem, lawmakers and state transportation officials must come together to discuss their own alternative deicing successes and attempt to standardize future regulations among states.[178] Although many individuals and officials have begun to recognize the necessity of taking action to remedy the damage created by road salt use, many questions still exist about the true extent of damage and how to best implement a management program.[179] It is likely that future regulatory processes regarding standard deicers such as road salt will depend heavily upon new research and the development of new alternatives.[180]

*Sara Labashosky**

176. *See* Proudfoot, *supra* note 171 (predicting only matter of time before each state decides to implement its own approach).

177. *Id.* (describing "disconnect" between in-state and out-of-state drivers may be potential problem).

178. *See* Alleman, *supra* note 166 (suggesting environmental workers should attend meetings to improve knowledge of storm water regulations, and transportation officials should converse with one another to help bring about new ideas).

179. *See Road Salt and Water Quality*, MINNESOTA POLLUTION CONTROL AGENCY (Aug. 19, 2014, 13:43), http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/metro-area-chloride-project/road-salt-and-water-quality.html (noting many "unknowns" still exist regarding road salt's effect on environment).

180. *See id.* (stating future research will help determine appropriate management strategies).

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