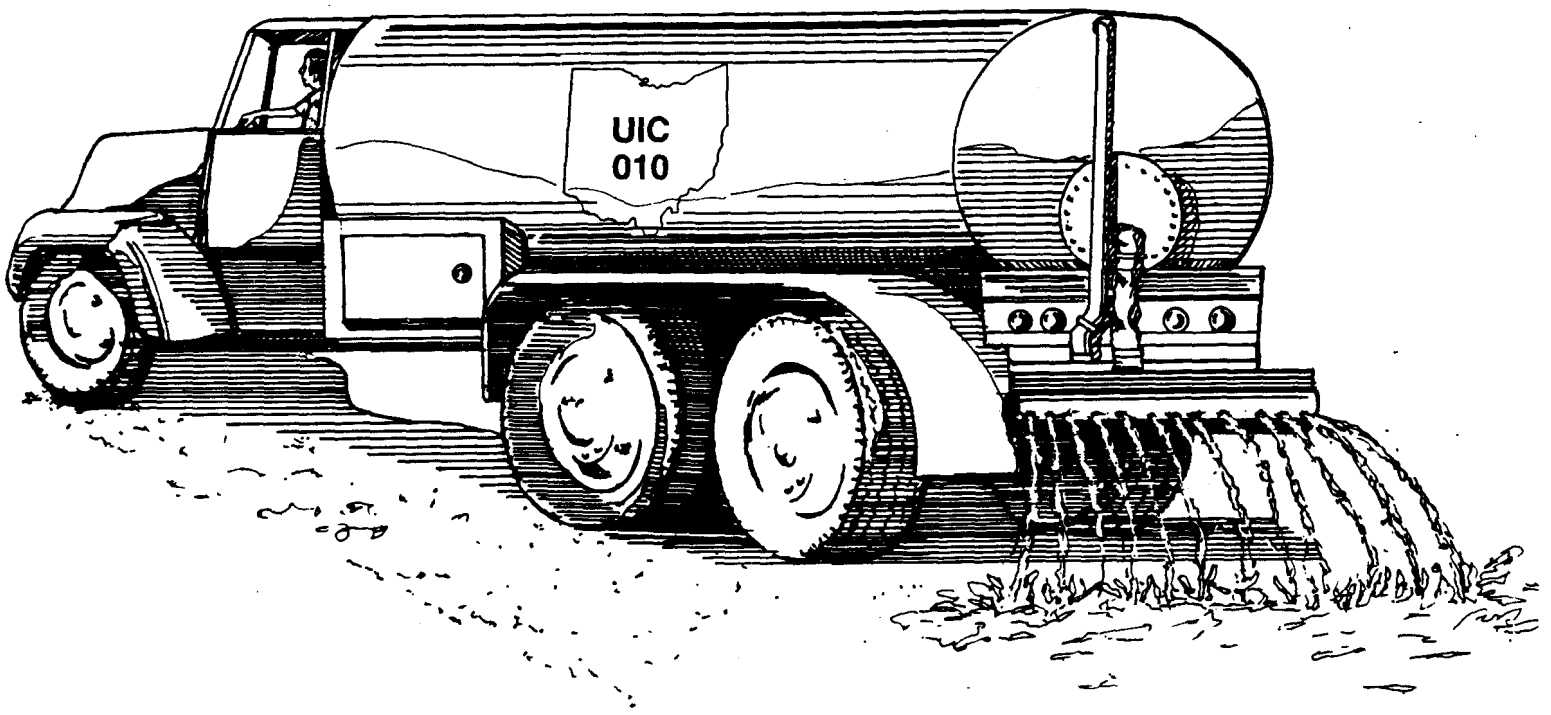
# SPREADING OIL-FIELD BRINE FOR DUST AND ICE CONTROL IN OHIO

# A Guidance For Local Authorities




OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL
RESOURCES MANAGEMENT

Samuel W. Speck, Director

Michael L. Sponsler, Chief

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Prepared for:
United States Environmental Protection Agency
Project No. 90 (h) D-19

Created October 1993
Revised September 2004

## PREFACE

Amended Substitute House Bill 501 (1985) authorized the use of oil-field brine for road spreading to control dust and ice, upon approval by resolution of a local jurisdictional authority. Since 1985, numerous counties and townships have adopted resolutions allowing spreading of brine. Am. Sub. H.B. 501 also established the Brine Management Research Special Account, in part, to fund research concerning potential environmental or public health risks associated with road spreading of brine.

The Ohio Department of Natural Resources, Division of Mineral Resources Management has dedicated nearly $110,000 towards research regarding the environmental effects of road spreading of oil-field brine. Michigan and West Virginia have also funded significant research projects. Outstanding research has been completed, yet the findings and conclusions are largely bound in theses and lengthy technical reports that are not readily available to the user.

The purpose of this guidance is to distill the findings of research completed to date in order to assist local officials in making informed decisions when considering proposed brine spreading resolution. The basic issues regarding road spreading of oil-field brine have been identified and briefly addressed through a question and answer format. References are provided for those who wish to explore selected issues in greater detail.

As Chief of the Division of Mineral Resources Management, I hope that you find this guidance to be useful. If you need additional information, please feel free to call the Division's Underground Injection Control Program at (614) 265-1032.

Michael L. Sponsler, Chief
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## ACKNOWLEDGEMENTS

The authors express their appreciation to Tom Davenport, the Non-Point Source Coordinator of the United States Environmental Protection Agency, Region V, for financial support of this project. We also thank Eloise Robinson for her word processing assistance, Sherry Young and Lana Crabtree for editing this document and, finally, we wish to thank the following members of the Project Advisory Group for their constructive input and direction:

| | |
|---|---|
| Leo Altier | Altier Bros., Inc. |
| John Beeker | Northeast Ohio Areawide Coordinating Agency |
| Mark Cassidy | Lake Township (Stark Co.) Road Superintendent |
| Jack Fishburn | Fishburn Services, Inc. |
| Donald Hill | Licking County Commissioner |
| Dewey Kennedy | Perry County Commissioner |
| Norman Martin | Lake Township (Stark Co.) Trustee |
| Marvella McCluskey | Licking County Commissioner's Office |
| Bill Miller | Miller Water Service |
| Gene Mock | President, Muskingum County Township Trustees |

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## Spreading Oil-Field Brine for Dust and Ice Control in Ohio

### 1. What is oil-field brine?

Brine is a saline by-product generated during oil and gas well drilling, completion and production operations. The salinity, or dissolved salt content, of Ohio brines varies considerably from one formation to another and may vary regionally within a given formation. Ohio brines can be more than ten times as salty as seawater. Evaporation of one barrel (42 gallons) of brine can yield over 100 pounds of salt.

### 2. How is brine produced?

Most brine is generated during well drilling, completion or production operations. During drilling operations rock cuttings must be circulated to surface and contained in a drilling pit. As the drill bit penetrates various brine bearing formations, brine is also circulated to surface. Typically, 1000 to 3000 barrels (42,000-126,000 gallons) of brine, with varying salinity, are generated during each drilling operation.

Brine is also generated during well completion operations through a process known as hydrofracturing. In order to enhance oil and gas production, fresh water or brine is pumped under pressure into the oil and gas reservoir to extend fractures and enhance the recoverability of oil and gas resources. When pressure is released, the flowback will include the injected fluid mixed with brine from the producing reservoir.

Brine is also produced along with crude oil as it is pumped from the reservoir. Brine is separated from the oil-brine mixture by gravity in storage tanks. All studies referenced by this guidance involved oil and gas production brine. Research has not been conducted to characterize the concentration or composition of brines generated during drilling or completion operations.

### 3. Where is oil-field brine produced?

Brine is produced wherever oil and gas drilling and production operations occur. Figure 1 is a map showing the location of counties with oil and gas producing operations.

### 4. Does state law allow use of oil-field brine as an ice or dust control agent?

Yes. In 1985, Amended Substitute House Bill 501 was enacted authorizing local governments to adopt or rescind brine spreading resolutions. Appendix A are copies of Sections 1509.222-226 of the Ohio Revised Code relating to brine transportation and spreading.

**FIGURE 1. Map of Counties with oil and/ or gas production.**

5. **Does state law establish minimum standards for spreading oil-field brine?**

Yes. Section 1509.226 of the Ohio Revised Code establishes the following standards that must be incorporated in all resolutions.

(1) Brine shall not be applied:
   (a) To a water-saturated surface;
   (b) Directly to vegetation near or adjacent to surfaces being treated;
   (c) Within twelve feet of structures crossing bodies of water or crossing drainage ditches; and/or
   (d) Between sundown and sunrise, except for ice control.

(2) The discharge of brine through the spreader bar shall stop when the application vehicle stops.

(3) The applicator vehicle shall be moving at least five miles per hour at all times while the brine is being applied.

(4) The maximum spreader bar nozzle opening shall be three-quarters of an inch in diameter.

(5) The maximum uniform application rate of brine shall be three thousand gallons per mile on a twelve-foot-wide road or three gallons per sixty square feet on unpaved lots.

(6) The applicator vehicle discharge valve shall be closed between the brine collection point and the specific surfaces that have been approved for brine application.

(7) Any valves that provide for tank draining other than through the spreader bar shall be closed during the brine application and transport.

(8) The angle of discharge from the applicator vehicle spreader bar shall not be greater than sixty degrees from the perpendicular to the unpaved surface.

(9) Only the last twenty-five percent of an applicator vehicle's contents shall be allowed to have a pressure greater than atmospheric pressure; therefore, the first seventy-five percent of the applicator vehicle's contents shall be discharged under atmospheric pressure.

6. **What is the role of local authority in approving or denying brine spreading resolutions?**

Brine spreading is lawful only if approved by a resolution adopted by the Board of County Commissioners, Board of Township Trustees or legislative authority that owns or has the right to control a road, street, highway or similar surface. Any person, other than a political subdivision, who owns or has a legal obligation to maintain a street, highway or similar land surface, may submit a plan to the Board of County Commissioners. Prior to voting on a proposed resolution, the local authority must hold at least one public hearing and must publish notice of the time and place of each hearing in a newspaper of general circulation in the political subdivision at least five days before the day on which the hearing is to be held.

If a local authority adopts a resolution, it must submit a copy to the Chief of the Division of Mineral Resources Management within 30 days of adoption. County Commissioners must submit approved plans upon approval. If a resolution contains all of the previously listed minimum standards, the resolution will be deemed effective when submitted to the Chief, without further action by the Chief. If the resolution does not meet the minimum standards, it will be denied. If the resolution contains additional terms or qualifications, the Chief will review and approve or deny the resolution within 15 days. If denied, the local authority may revise and resubmit an adopted resolution.

7. **Can local authorities implement standards for spreading oil-field brine that are more stringent than state standards?**

Yes. Section 1509.226(B) and (D) of the Ohio Revised Code does not restrict local authorities from enacting guidelines that exceed the nine minimum state standards.

8. **Once adopted, can local authorities amend or rescind a resolution?**

Yes. Section 1509.226(B) and (D) of the Ohio Revised Code states that the local authority may amend a resolution and resubmit it to the Chief of the Division of Mineral Resources Management. The amended resolution is not effective until approved by the Chief.

9. **How long is a resolution or plan valid?**

A resolution adopted by a local authority is effective for one year and from month-to-month, thereafter, until the authority terminates authorization to spread brine by resolution. A copy of the termination resolution must be sent to the Chief of the Division of Mineral Resources Management.

A plan approved by the Board of County Commissioners for spreading brine on private property is valid for one year from the date of approval, unless revoked. Requests for renewals must be submitted within 30 days before the anniversary date of the original plan.

10. **If a resolution or plan is approved, what are the legal obligations of the local authority?**

Any local authority that adopts a brine spreading resolution and each person who submits a plan to the Board of County Commissioners has the following obligations:

1) A copy of the resolution or plan, and amendments, must be sent to the Chief of the Division of Mineral Resources Management;

2) An annual report must be submitted to the Chief of the Division of Mineral Resources Management by April 15 of each year documenting the brine applied during the preceding calendar year. Report forms can be obtained by calling (614) 265-1032. The report shall include the quantity of brine transported, brine sources and brine application areas; and

3) A copy of a termination resolution must be submitted to the Chief of the Division of Mineral Resources Management. Sample resolutions are included in Appendix B.

11. **Who enforces Chapter 1509. of the Ohio Revised Code and the guidelines of an approved resolution?**

The Office of the Attorney General can file a civil enforcement action against a brine hauler at the request of the Ohio Department of Natural Resources, Division of Mineral Resources Management. In addition, the county prosecuting attorney can file criminal charges for any brine transportation violation at the request of the Division of Mineral Resources Management or any peace officer. Minimum civil and criminal penalties established by the Ohio Revised Code are listed in Appendix C.

12. **Who has authority to revoke the license of a registered brine hauler?**

The Chief of the Division of Mineral Resources Management may suspend or revoke a brine hauler's registration certificate if evidence shows that they have committed a pattern of violations caused by the hauler's indifference, lack of diligence, lack of reasonable care, or willfulness.

13. **Can a local authority spread brine with its own equipment?**

Yes. Section 1509.226(G) states that any local authority can spread brine with its own equipment without being subject to the registration, bonding, insurance and other requirements of Section 1509.222, 1509.223 and 1509.225 of the Ohio Revised Code that pertain to registered brine haulers. The Division maintains a current list of local authorities who have implemented their own brine spreading programs. The list is available to you upon request and can be obtained by calling (614) 265-1032.

14. **Does the state law allow oil-field brine from any source to be applied to road surfaces for dust or ice control?**

Yes. State law does not establish standards regarding the minimum salinity or content of brine. In addition, the state does not prohibit the use of drilling pit brine or completion fluids such as hydrofracture flow-back.

15. **How can the local authority identify areas that might be more or less sensitive to ground-water contamination?**

The Ohio Department of Natural Resources, Division of Water sells County Ground-water Resource maps and Pollution Potential maps. You may obtain copies by calling (614) 265-6717. If maps are not available for your specific county, valuable insight can be gleaned by review of water well logs for wells located along roads being considered for brine application. Water well logs can be viewed by visiting the Division of Water at ODNR's Fountain Square complex off Morse Road in Columbus.

16. **How can water quality be monitored for wells located along roads approved for brine spreading?**

If residences have concerns that brine spreading will contaminate local water supplies, there are relatively inexpensive water quality testing methods that are available. For example, a Quantab chloride titrator strip is a simple way to determine the chloride concentration in a water supply. Quantabs, and other chloride test methods such as Hach kits, can be purchased from Fisher Scientific in Pittsburgh, Pennsylvania. Instructions for using quantabs can be found in Appendix D.

17. **How can citizens identify illegal dumping?**

It should be noted that registered brine haulers also pick up fresh water and transport fresh water to drilling sites for a variety of reasons. Therefore, the presence of a brine truck at a pond, stream or reservoir does not necessarily indicate that illegal disposal is occurring. If it can be established that brine is being discharged from a truck, the following observations would be indicative of illegal dumping versus lawful spreading:

1) Discharging brine through a valve rather than a spreader bar;
2) Discharging brine while parked or while driving less than five miles per hour;
3) Discharging brine on a surface not approved by resolution; and
4) Discharging brine on a surface in violation of standards established by resolution, such as on a water-saturated surface, or over a water course.

18. **What should a citizen do if he observes possible illegal spreading or dumping of oil-field brine?**

The citizen can play a critical role in ensuring safe and legal disposal of oil-field brine. If a citizen observes a possible illegal brine disposal event, he/she can help by taking the following steps:

1) Record information that will help identify the truck, such as the name of the operator, truck color, the Underground Injection Control (U.I.C.) number on the side of the truck, and the license plate number;
2) Record the precise date and time of the incident;
3) Record information that will accurately identify the disposal site;
4) Photograph the truck, in the act of disposal, if possible;
5) Collect a sample of the disposed fluid, if possible. A brine sample can be collected in a clean glass or plastic container; and
6) Immediately call the appropriate regional office of the Ohio Division of Mineral Resources Management (see Appendix E).

19. **What are de-icing agents?**

De-icing agents are chemicals or compounds used to melt or break-up ice on roadways during the winter months of northern climates. Two categories of materials are available for this purpose. There are conventionally used inorganic minerals called salts and man-made compounds, which although expensive to produce, are environmentally friendly. Some man-made compounds include urea, methanol, calcium magnesium acetate (CMA) and tetra-potassium pyrophosphate (TKPP). Each of these have advantages and disadvantages under various types of road construction, weather conditions and environmental situations (R.W. Eck and W.A. Sack, p.17-18).

20. **What salts are commonly used as de-icing agents?**

Conventional de-icing materials include sodium and calcium chloride normally used in solid form. Sodium chloride (NaCl) is the most commonly used material in Ohio. It is mined from underground salt deposits that lie approximately two thousand feet below the shores of Lake Erie. Sodium chloride will melt ice at temperatures above 10°F and is most effective between 15°F and 25°F. It will also freeze dry on road pavement, which prevents refreezing of road surfaces at lower night-time temperatures (R.W. Eck and W.A. Sack, p.15).

Calcium chloride ($CaCl_2$), although naturally occurring, is manufactured in a flake or pellet form for de-icing road surfaces. Sodium and calcium chloride are hygroscopic (i.e., they readily absorb moisture). When moisture is absorbed, heat is released. Calcium chloride accelerates the melting of ice in a given time period and has a lower effective temperature of minus 31°F (R.W. Eck and W.A. Sack, p.15, 16).

Combining sodium and calcium chloride salts at a ratio of three to one, respectively, enhances the melting effectiveness beyond that of either material alone. The complementary mix increases the melting rate over a large temperature range for a longer period of time (R.W. Eck and W.A. Sack, P.17).

21. **How does oil-field brine work to control ice on road surfaces?**

Brine controls ice on road surfaces in much the same way as commercial de-icing agents. Brine performs the following four (4) main functions to control snow and ice conditions on roadways:

1) It prevents the formation of ice-films;
2) It weakens the bond between the snow/ice and the pavement;
3) It melts new snow as it falls; and
4) It melts compacted snow that remains after plowing.
(R.W. Eck and W.A. Sack, p.9)

22. **What are the advantages of using oil-field brine versus road salt?**

1) Oil-field brine is in a liquid state; therefore, it acts more quickly than road salt, which must dissolve before it can begin melting ice.
2) Liquid brine penetrates the ice pack faster and provides more uniform surface contact needed to break the ice-road surface bond.
3) Liquid brine is not subject to volume reduction by bounce off or blowing wind.
4) Oil-field brine is a natural solution containing sodium and calcium chloride combining the benefits of both as de-icing agents.
5) The cost of oil-field brine can be much less than road salt.
6) Oil-field brine appears to be no worse than traditional de-icers in terms of detrimental effects on Portland cement, concrete or asphalt surfaces (R.W. Eck and W.A. Sack, p.31-33).

23. **What are the disadvantages of using oil-field brine versus road salt?**

1) Brine is not as effective as road salt in melting thick layers of ice.
2) Pavements are momentarily more slippery immediately after applying brine.
3) Oil-field brine is a waste product rather than a commodity. Therefore, economic incentives to spread brine sparingly may be lacking. Indiscriminate application could cause contamination of surface or ground waters.
4) Brine may originate from a variety of sources with highly varying salinities. Application rates necessary to control ice will vary according to the salinity.
5) Brine has a tendency to cause long-term discoloration on pavement markings (R.W. Eck and W.A. Sack, p.31-33, 184).

24. **Under what road conditions are oil-field brines superior to road salt as a de-icing agent?**

Aqueous solutions can be used very effectively for preventive and maintenance purposes to control thin layers of ice or snow. Solutions may be applied either before or during snowstorms and are particularly effective during cold, dry periods (R.W. Eck and W.A. Sack, p.11).

25. **What are the relative application rates, for oil-field brine and road salt, necessary to effectively control ice?**

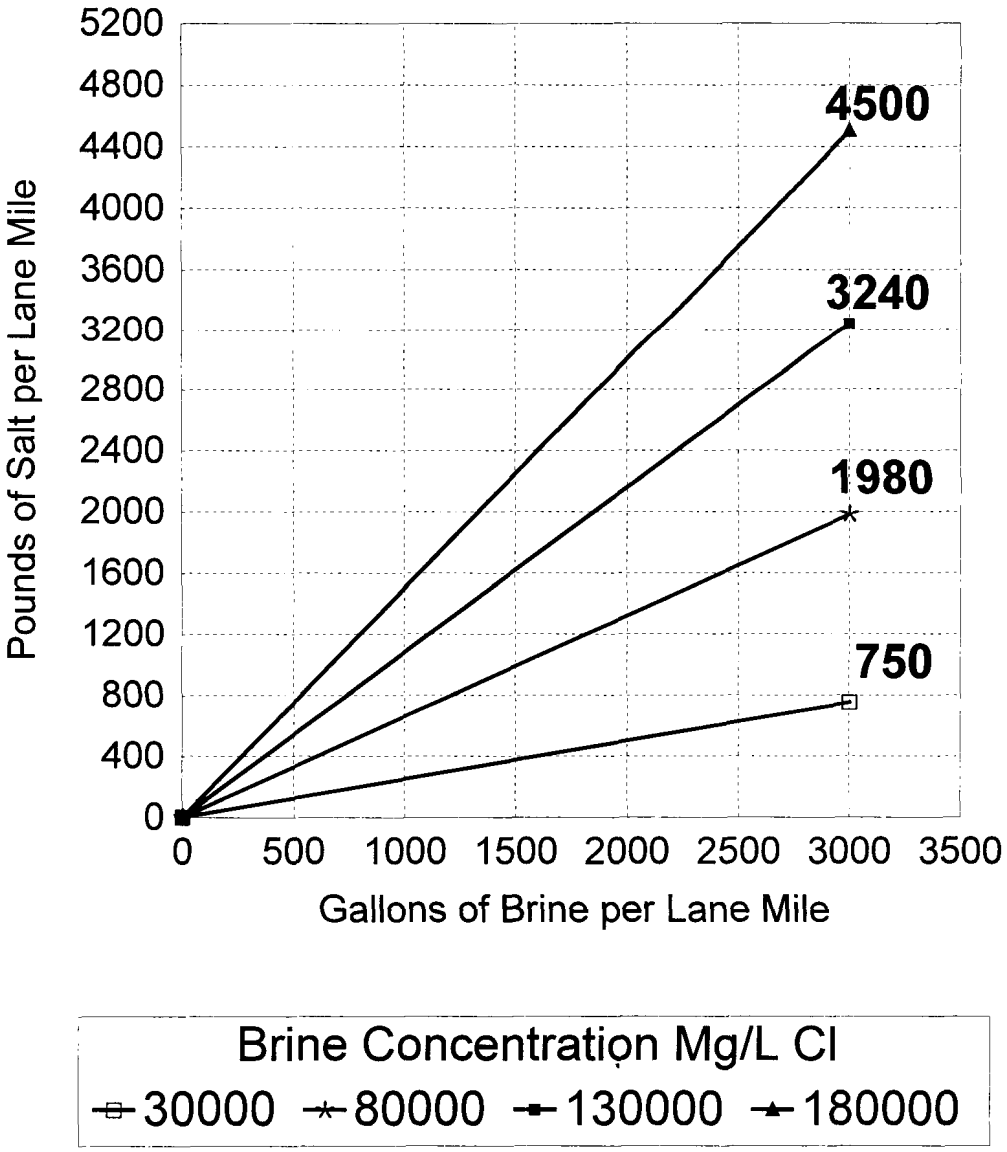
Brines vary in concentration of chloride from approximately 30,000 to 225,000 milligrams per liter depending on the formation from which they were produced. Milligrams per liter is a unit of measure that is roughly equivalent to parts per million. The quantity of brine required to control ice depends on the salinity of the brine that is being used.

According to the Ohio Department of Transportation (personal communication), typical road salt (sodium chloride) application rates range from 150 to 350 pounds per lane mile. Figure 2 is a graph showing the quantity of salt, in pounds per lane mile, at varying application rates for brines with selected salinities. Table 1 shows the quantity of salt, in pounds per lane mile, that would be applied to a road surface at the maximum spreading rate allowed by law, for brine ranging from 30,000 to 225,000 milligrams per liter (mg/l) chloride.

TABLE 1

| Brine Salinity (mg/l Chloride | Pounds of Salt Per Lane Mile |
|---|---|
| 30,000 | 751 |
| 50,000 | 1,252 |
| 75,000 | 1,877 |
| 100,000 | 2,503 |
| 125,000 | 3,129 |
| 150,000 | 3,755 |
| 175,000 | 4,301 |
| 200,000 | 5,007 |
| 220,000 | 5,507 |

Figure 2. Quantity of salt per lane mile at varying application rates for brines with selected salinities.



26. **How saline are typical Ohio oil-field brines**?

Oil-field brine is primarily produced from five geologic zones: the Trempealeau, Trenton, Clinton, Berea and Upper Mississippian/Pennsylvanian sandstones of southeastern Ohio. Figures 3 through 5 show the geographical areas where brine is produced from the Trenton, Trempealeau, Clinton and Upper Mississippian/ Pennsylvanian sandstones, and the typical salinity ranges expressed as the chloride concentration in milligrams per liter. Salinity ranges for these brine producing formations are shown in Table 2.

TABLE 2

| FORMATION | SALINITY (milligrams per liter chloride) |
|---|---|
| Trempealeau | 82,000 - 130,000 |
| Trenton | 35,000 - 125,000 |
| Clinton | 180,000 - 200,000 |
| Berea | 70,000 - 90,000 |
| Upper Mississippian/Pennsylvanian Sandstones | 20,000 - 80,000 |

27. **How can salt application rates be controlled when spreading oil-field brine**?

There are three ways to restrict application rates below the maximum allowable established by law. These are as follows:

1) limit the frequency of spreading events;
2) restrict the flow rate by using nozzles or other reductions in spreader bar hole diameter; and
3) increase the minimum truck speed.

28. **How does oil-field brine compare with other de-icing agents relative to pavement deterioration?**

Bituminous concrete has been tested in the U.S., Great Britain and Germany using conventional de-icing salts under freeze and thaw cycles with no adverse impact. In contrast, studies have shown scaling and pitting of Portland cement concrete. With conventional de-icing salts, the greatest amount of scaling occurred with the application of low concentrations (2 to 4 percent) of salt. Less damage occurs with higher concentrations or the absence of de-icers. The concrete is more resistant to scaling with longer periods of curing and more durable under freeze-thaw conditions if air entrained. Oil-field brine would be expected to have similar levels of impact on concretes. The addition of sulfate at higher concentrations, however, may cause more impact on Portland cement concretes (R.W. Eck and W.A. Sack, p.24-28).

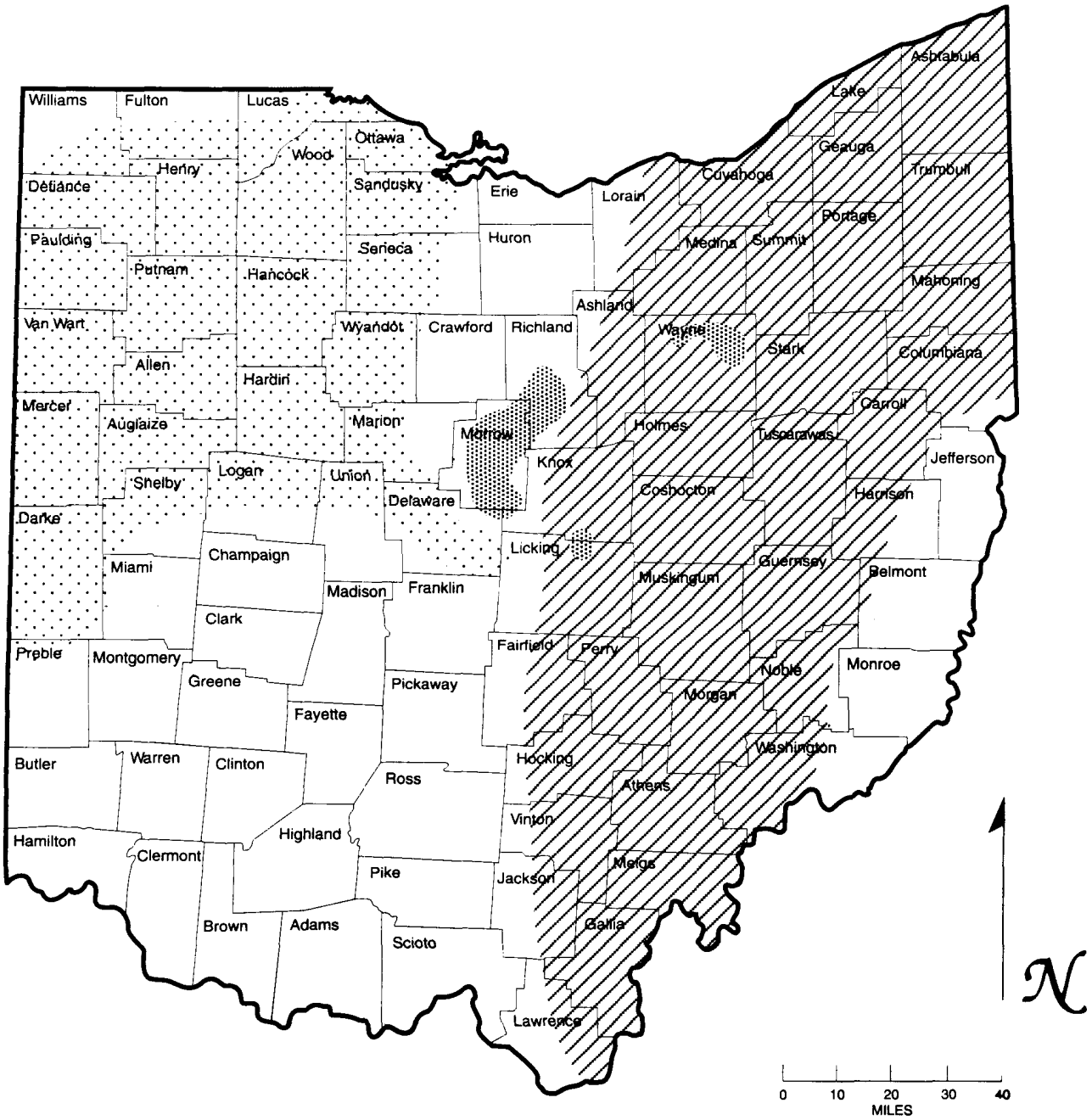
29. **How does oil-field brine compare with other de-icing agents relative to metallic corrosion?**

De-icing salts promote metallic corrosion by increasing the conductivity of solutions on the roadway, bridge structures, vehicles, utility lines and concrete reinforcement. Studies have demonstrated that corrosion rates of steel vary with the concentration of conventional de-icing salt. Corrosion increases with increasing salt concentrations up to approximately 8 percent. At higher concentrations the corrosion rate decreases. The types of salt, whether calcium or sodium chloride, have little affect on corrosion rate. Laboratory studies have shown sodium chloride to be slightly more corrosive than calcium chloride solutions under similar environmental conditions. A West Virginia study concluded that auto-body steel specimens immersed in a sodium and calcium chloride solution lost slightly more weight than specimens immersed in oil-field brine (R.W. Eck and W.A. Sack, p.28-31).

30. **How does oil-field brine work to control dust on road surfaces?**

During the summer months, oil-field brine is applied on unpaved roads and parking lots to provide dust suppression. Summertime heat evaporates the moisture that binds together the soil particles of an unpaved road or parking lot, creating dust problems (J.E. Herrold, p.6, 7).

Oil-field brines reduce road dust in two ways. First, brine wets the road surface, binding fine soil particles to one another. Until the water in the brine evaporates, dust cannot form. Second, brine acts as a dust suppressant due to the hygroscopic nature of sodium and calcium chlorides. An application of brine improves the ability of the road surface to retain moisture, thereby delaying the formation of dust.



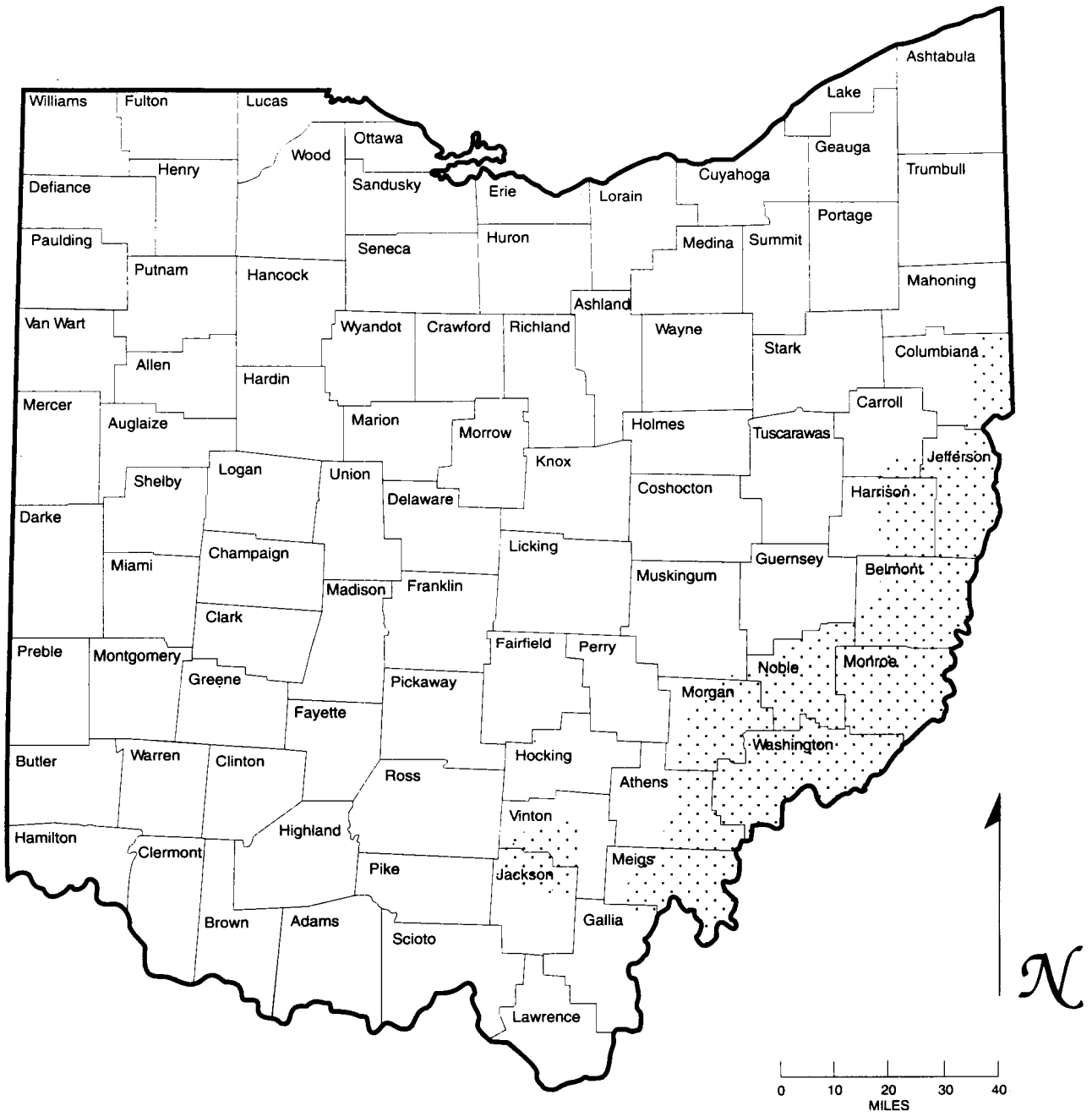

**CLINTON**
**180,000-200,000 mg/l**

**TRENTON**
**35,000-125,000 mg/l**

**TEMPEALEAU**
**82,000-130,000 mg/l**

**FIGURE 3. Map showing the typical salinity in milligrams per liter (mg/l) of chloride and production regions for Clinton, Trenton, and Trempealeau brines.**

**FIGURE 4. Map showing the typical salinity in milligrams per liter (mg/l) of chloride and production regions for Berea Sandstone brine.**




**UPPER MISSISSIPPIAN and PENNSYLVANIAN SANDSTONES**
**20,000-80,000 mg/l**

**FIGURE 5. Map showing the typical salinity in milligrams per liter (mg/l) of chloride and production regions for Upper Mississippian and Pennsylvanian sandstone brines.**

11. **How does oil-field brine compare with other dust control agents in effectiveness of dust control?**

Research has shown that oil-field brine may require four to six applications during the May through September dust control season, whereas, a commercial calcium chloride brine may require one or two applications for the same period of time. The effectiveness of oil-field brine will generally be less than a commercially produced brine (J.E. Herrold, p.9).

Superior dust suppression will be provided by an oil-field brine, which has a relatively high concentration of calcium. In typical Ohio brines, the concentration of calcium can vary from approximately 10,300 milligrams per liter up to 56,000 milligrams per liter.

12. **What are the advantages of using oil-field brine versus other available dust control agents?**

1) Low initial cost.
2) Availability throughout eastern Ohio.
3) Oil-field brine may also be used in the maintenance practice known as road stabilization. When an unpaved road is graded or resurfaced, brine can be incorporated into the top layer of road materials to improve soil retention. The hygroscopic nature of sodium and calcium chlorides helps the road surface retain moisture, reducing erosion and lowering future maintenance costs (J.E. Herrold, p.7).
4) Brine is regenerated by morning dew, fog, or light rain, while many of the other products used rapidly lose their effectiveness (R.W. Eck and W.A. Sack, p.61).

13. **What are the disadvantages of using oil-field brine versus other available dust control agents?**

1) Commercial calcium chloride brine may only require one or two applications per May to September dust season, and thus, may result in lower labor costs than would oil-field brines, which may require up to six applications per season.

2) Excessive use of brine on unpaved roads can ultimately result in damage to the road base, thus, creating a more expensive repair.

3) Reports surfaced as early as 1936 of injury to roadside trees caused by the use of oil-field brines as a dust suppressant. It was discovered that in certain cases when a road surface dries after brining, a fresh layer of dust containing salts can be lifted by the wind or vehicles to coat nearby foliage. The salt, in turn, causes leaf browning (necrosis) which is detrimental to tree growth (J.E. Herrold, p.19).

4) Oil-field brine is a waste product rather than a commodity. Therefore, economic pressures to spread brine sparingly may be lacking. Indiscriminate application could cause contamination of surface or ground waters.

14. **How does oil-field brine compare in composition to conventional de-icing salt?**

Chloride, sodium and calcium are the primary constituents in Ohio brines, generally comprising over 95 percent of all dissolved solids. Brine also contains a variety of dissolved metals and organic compounds. In addition, brine generated during drilling operations may contain suspended sediment and a variety of chemical additives such as biodegradable industrial detergents, caustic soda and soda ash. Brine produced during completion operations may contain various polymers and spent acid.

Table 3 compares the major ion composition of a typical Clinton formation brine and road salt dissolved at an equivalent chloride concentration, in milligrams per liter, which is roughly equivalent to parts per million. Although oil-field brines can vary considerably in concentration of salt, the Clinton formation brines are the most commonly available for de-icing purposes.

TABLE 3

| Mg/l | Typical Oil-field Brine | Conventional De-Icer from the Salina Formation |
|---|---|---|
| Chloride | 150,000 | 150,000 |
| Sodium | 42,800 | 107,300 |
| Calcium | 36,200 | 1,400 |
| Magnesium | 6,190 | 19.1 |
| Potassium | 1,460 | 45.2 |
| Strontium | 1,070 | 9.2 |
| Manganese | 14 | 0.41 |
| Sulfate | 229 | 2,300 |

Natural brines contain a number of elements not found in mined salts or found in low concentration. The most important of these additional ions is calcium. Calcium must be added to rock salt to enhance its melting characteristics. It is found in oil-field brines from Ohio at about 25 percent of the chloride concentration. Other major ions such as magnesium and potassium are present in brines but have little effect in the de-icing characteristics of the fluid.

**35. Does oil-field brine contain metals?**

Trace elements, including heavy metals, have been measured at various concentrations in Ohio brines for many years. As analytical techniques have improved and detection limits have lowered, many older analyses have been found to be in error, usually exaggerating the concentrations. Table 4 is a list of ranges of trace element concentrations for Ohio production brines measured with state-of-the-art techniques (D.A. Stith and N. Knapp, p.11). Barium and zinc concentrations are expressed in milligrams per liter (mg/l). All other trace element concentrations are expressed in micrograms per liter (ug/l) which is roughly equivalent to parts per billion. To compare, there is a column showing the current U.S. EPA maximum contaminant concentrations for public drinking water. The lower end of the ranges is generally the detection limit of analytical instruments being used.

TABLE 4

| Trace Element | Range in Ohio Brines | Maximum Contaminant Level for Drinking Water |
|---|---|---|
| Barium | 0.1 to 255 mg/l | 2 mg/l |
| Zinc | 0.05 to 4.1 mg/l | ------ |
| Cadmium | 0.4 to 181 ug/l | 5 ug/l |
| Chromium | 0.6 to 644 ug/l | 100 ug/l |
| Cobalt | 0.4 to 155 ug/l | ------ |
| Copper | 0.3 to 220 ug/l | 1300 ug/l |
| Lead | 5 to 1300 ug/l | 50 ug/l |
| Mercury | 0.915 to 0.70 ug/l | 2 ug/l |
| Molybdenum | 4 to 51 ug/l | ------ |
| Nickel | 0.7 to 637 ug/l | 100 ug/l |
| Vanadium | 0.6 to 30 ug/l | ------ |

36. **What environmental or public health and safety risks are posed by trace metals in oil-field brines?**

Although some trace metals exceed standards for drinking water in the concentrated brine, dilution with snow and ice melt often reduce these concentrations to below the maximum contaminant concentrations before the brine leaves the roadway. In addition to dilution of major and trace ions, there are chemical reactions, which occur between the brine and soils once the fluid leaves the road surface. During these reactions trace metals are physically or chemically removed or added to the fluid moving through the rock materials. Brine road spreading studies have shown that, generally, under careful spreading practices, most trace metals are diluted or absorbed to clay particles and do not reach sources of fresh ground water. An important exception is barium. While brines from the Clinton, Trenton and Trempealeau typically have low concentrations of barium, (.2-52.4 milligrams per liter), barium is the second most abundant trace metal in soils. Cation exchange between soils and brine can release barium into solution. It should be noted that road salt would cause the same chemical reaction, releasing barium from soils. Dilution and reabsorption to soils are the only mechanisms to reduce barium concentrations in ground water. If this does not occur before the water reaches a water well, barium can present some health risks at concentrations exceeding U.S. EPA's maximum contaminant level of 2.0 milligrams per liter (E.S. Bair, p.60, 61).

37. **Does oil-field brine contain oil or dissolved hydrocarbons?**

Most oil-field brine is a waste product produced along with oil and gas. The brine is separated from the oil, settling to the bottom of a tank. As the brine is drawn off the bottom of the tank, small amounts of oil and dissolved hydrocarbons are also separated from the bulk of the oil. As the brine is spread on the road surface, some of the dissolved organic compounds are released to the air. Small quantities of dissolved hydrocarbons are placed on the road.

38. **What environmental or public health and safety risks are posed by hydrocarbons in oil-field brines?**

Benzene, toluene, ethyl benzene, and xylene (BTEX), four of the most mobile hydrocarbons found in oil-field brine, have been found at shallow depths of less than two feet in soil and water samples collected near road spreading sites. Only toluene and xylene have been observed at greater depths. Concentrations of these volatile organic compounds (VOC's) are reduced from hundreds of micrograms per liter (parts per billion) at the road surface to below detection in nearby ground water. After an initial dilution by precipitation, it's known that volatilization into the air, sorption onto organic matter in the soil and biological degradation (bacterial action) are the processes which cause reduction of VOC's. These processes are believed to make public health and safety risks from hydrocarbons contained in brines spread on road surfaces negligible (E.S. Bair, p.50-52).

39. **Have studies been conducted to measure the removal of dissolved hydrocarbons from production brine through natural processes?**

Yes. In 1991, the University of Akron completed a study to measure the volatilization (evaporation) of dissolved hydrocarbons from oil-field brine. Brines from six Ohio oil and gas wells, including five "Clinton sandstone" completions and one Trempealeau well were tested. For each well, samples of brine were collected at progressive stages in the production-to-disposal process including: wellhead, separator, storage tank, truck tank, spreader bar nozzle and road surface. The results of this study show a steady decrease in the concentrations of dissolved hydrocarbons from wellhead to road surface. Removal efficiency ranged from 79-93 percent and averaged 87.2 percent. An additional tenfold dilution of brine in the ground-water system would reduce benzene concentrations below the U.S. EPA Maximum Contaminant Level for public drinking water supplies, even if there was no additional reduction in concentration through volatilization in the soil zone, adsorption or biodegradation (R.G. Corbett, p.37-46).

20. **Has research been conducted in Ohio to simulate the impact of brine spreading on ground-water quality?**

Yes. In 1988, The Ohio State University completed a study that was designed to evaluate ground-water quality changes resulting from road spreading of brine at rates and frequencies allowable by Ohio law. A field site in Newark, Ohio was selected because its hydrogeologic setting offered a worst-case scenario for evaluating impacts caused by surface spreading. The local aquifer is a thin (6-8 feet) sand and gravel deposit, underlain by a dense clay confining layer. The gentle slope of the terrain minimized runoff and maximized infiltration of applied brine. The shallow water table, one to five feet below land surface, allowed rapid entry of applied brine into the local ground-water system while the small water storage capacity of the aquifer minimized the ability to dilute contaminants. Drought conditions that persisted through the summer of 1988 further reduced contaminant dilution capabilities of the aquifer, thus increasing the aquifers contamination potential.

Ground-water impacts were measured using a network of 11 monitoring wells. The monitoring network included one upgradient well to characterize natural water quality conditions and three parallel rows of downgradient wells located 5, 30 and 50 feet from the road bed, respectively. Brine spreading was conducted in two phases to simulate a winter de-icing season and a summer dust-control season.

Brine was spread at the maximum allowable rate (3,000 gallons per mile) for eight consecutive weeks from January 12 to March 8, 1988, regardless of need or road conditions. After eight weeks of spreading, only one monitor well, located five feet from the road bed, showed chloride concentrations exceeding U.S. EPA Secondary Maximum Contaminant Level (SMCL) for public water supplies (250 milligrams per liter). These secondary standards are related to taste, not potential health risk. Chloride concentrations in the other nine downgradient wells increased slightly (3-116 milligrams per liter). However, within 70 days after brine spreading ceased, water quality in the ten downgradient wells showed minimal residual impact.

Brine spreading resumed during an eleven week period from June 22 to August 31, 1988. Ground-water impacts measured during the dust control season were much more severe. After the eleventh spreading episode, monitor well No. 8, located 30 feet from the road bed, reached a maximum chloride concentration of 1,360 milligrams per liter (5.4 times the SMCL). Seven monitor wells exceed the SMCL for chloride and monitor well No. 9, 50 feet from the road bed, recorded a chloride concentration of 806 milligrams per liter. The relatively severe contamination was attributed to the drought conditions that persisted throughout the summer of 1988. Drought conditions reduced the ability of the aquifer to dilute contaminants. Salts precipitating from the brine accumulated on the road surface until a severe rain storm dissolved the salts, and rapidly flushed them into the aquifer.

During both winter and summer spreading seasons, the primary contaminants detected in the aquifer were sodium and chloride, the same elements that comprise road salt. No aromatic hydrocarbons were detected in any monitor well throughout the entire study. Primary Maximum Contaminant Levels were never exceeded for any trace metal.

Although brine spreading did cause temporary ground-water contamination, the contaminants detected were essentially the same as those induced by road salt application. Saline contamination of ground water was restricted to the area near the road surface and dissipated between spreading seasons (E.S. Bair, p.63-65).

41. **How do the environmental and public health and safety risks associated with spreading oil-field brine compare with conventional de-icing agents?**

De-icing agent application to roadways can potentially affect the environment in four ways:

1) degradation of surface water;
2) degradation of ground water;
3) contamination and textural degradation of soils; and
4) vegetation stress.

The degree of environmental impact is related to many variables including precipitation, soil permeability, depth to ground water, topography, temperature, vegetation type and cover, and application of de-icing agent.

Surface water can be immediately contaminated in roadside ditches, and contaminated runoff may impact streams or ponds. Studies in Vermont have shown that 90 percent of the salt applied to road surfaces reaches streams when the ground is frozen. Dilution is somewhat greater when oil-field brine is applied because there are no solids, which continue to dissolve. Except in environmentally sensitive situations with direct release of salt into small water courses, dilution will adequately reduce concentrations of ions, which damage stream organisms and fish.

Ground-water contamination by de-icing salts represents considerable environmental concern. A few case studies of water wells near roadways being contaminated by conventional de-icing agents used on roads and at storage facilities have been documented in Ohio. Although some have been reported in Michigan, there are no documented cases in Ohio where domestic water wells have been contaminated by oil-field brine used as a de-icing agent. This may represent the limited usage of brine in comparison to conventional salts. Scientific evidence certainly exists to show that excessive use of conventional salt or oil-field brine on roadways will increase ionic concentrations in shallow unconfined aquifers downgradient of the applications.

Specific site conditions dictate the impact of brine or conventional de-icing on ground-water resources. A study in Ohio shows that 99 percent dilution of chloride ions occurs between the road bed surface and the ground-water table. With dilution of all ions being equal, the trace ions are diluted below maximum contaminant concentrations. An exception are those ions such as magnesium and barium which are released from clay surfaces or minerals by saline fluids. Other than elevated chloride concentrations in ground-water aquifers near application surfaces, little is known about long-term effects of prolonged application of saline de-icers.

Runoff from roadways, where de-icers are used, can adversely affect vegetation and soils. During periods of ground thaw, saline fluid generated by de-icers can move through roadside soils. Depending on the physical properties of the soils, sodium ions may displace cations such as calcium, aluminum, potassium or magnesium that are important for soil structure and productivity. Excessive salt concentrations may impede plant growth by inhibiting absorption of water. Studies indicate that 1,000 milligrams per liter (parts per million) of chloride will induce vegetation damage.

The degree of vegetation damage is plant specific. In general, grasses are more salt tolerant than deciduous plants. In some cases, this can be desirable to control woody vegetation at roadside. Concentrations of chloride at less than 600 ppm (parts per million) have been shown to stimulate growth of vegetation. This improvement is contributed mostly to the maintenance of soil moisture by the hygroscopic salt. Brine has been found to be less damaging to vegetation than sodium chloride de-icers because of the higher concentrations of calcium and magnesium. Calcium restricts the plant uptake of toxic sodium and reduces the damage to soil structure and drainage characteristics. Cumulative effects on vegetation seem to be very dependent on the rate which salts leach from the soil during periods of non-application (Filliman, p.3-3).

## CONCLUSION

Research has shown that oil-field brine can be an effective ice control agent and dust suppressant. When application rates and volumes are properly controlled, brine can be spread in most areas with minimal risk of ground-water contamination.

If you are interested in obtaining oil-field brine, you should contact a local registered brine hauler. The Division of Mineral Resources Management maintains a current list of registered brine haulers, which can be obtained by calling (614) 265-1032. Oil-field brine can generally be obtained for free or for a small transportation fee.

# REFERENCES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in rules adopted by the chief, and provided further that the person complies with all rules and orders adopted or issued by the chief which apply to the activity.

**Cross-References to Related Sections**
Penalties-
Civil, RC § 1509.33.
Criminal, RC § 1509.99(B).

**Ohio Administrative Code**
Solution Mining of Minerals, OAC Chapter 1501:9-7.

## § 1509.222 Brine transporter registration; disposal plan; fee; disapproval.

(A) (1) Except as provided in section 1509.226 of the Revised Code, no person shall transport brine by vehicle in this state unless the business entity that employs the person first registers with and obtains a registration certificate and identification number from the chief of the division of oil and gas.

(2) No more than one registration certificate shall be required of any business entity. Registration certificates issued under this section are not transferrable. An applicant shall file an application with the chief, containing such information in such form as the chief prescribes, but including a plan for disposal that provides for compliance with the requirements of this chapter and rules of the chief pertaining to the transportation of brine by vehicle and the disposal of brine so transported and that lists all disposal sites that the applicant intends to use, the bond required by section 1509.225 of the Revised Code, and a certificate issued by an insurance company authorized to do business in this state certifying that the applicant has in force a liability insurance policy in an amount not less than three hundred thousand dollars bodily injury coverage and three hundred thousand dollars property damage coverage to pay damages for injury to persons or property caused by the collecting, handling, transportation, or disposal of brine. The policy shall be maintained in effect during the term of the registration certificate. The policy or policies providing such coverage shall require the insurance company to give notice to the chief if the policy or policies lapse for any reason. Upon such termination of the policy, the chief may suspend the registration certificate until proper insurance coverage is obtained. Each application for a registration certificate shall be accompanied by a nonrefundable fee of five hundred dollars.

(B) The chief shall issue an order denying an application for a registration certificate if the chief finds that:

(1) The applicant, at the time of applying for the registration certificate, has been found liable by a final nonappealable order of a court of competent jurisdiction for damage to streets, roads, highways, bridges, culverts, or drainways pursuant to section 4513.34 or 5577.12 of the Revised Code until the applicant provides the chief with evidence of compliance with the order;

(2) The applicant's plan for disposal does not provide for compliance with the requirements of this chapter and rules of the chief pertaining to the transportation of brine by vehicle and the disposal of brine so transported.

(C) No applicant shall attempt to circumvent division (B) of this section by applying for a registration certificate under a different name or business organization name, by transferring responsibility to another person or entity, or by any similar act.

(D) A Registered transporter shall apply to revise a disposal plan under procedures that the chief shall prescribe by rule. However, at a minimum, an application for a revision shall list all sources and disposal sites of brine currently transported. If the chief approves a revision of a plan under this division, the approval also constitutes approval of a revision of affected disposal plans required by division (I) of section 1509.06 of the Revised Code, except as the chief otherwise specifically provides in the order approving the revision. The chief shall deny any application for a revision of a plan under this division if the chief finds that the proposed revised plan does not provide for compliance with the requirements of this chapter and rules of the chief pertaining to the transportation of brine by vehicle and the disposal of brine so transported. Approvals and denials of revisions shall be by order

of the chief.

(E) The chief may adopt rules, issue orders, and attach terms and conditions to registration certificates as may be necessary to administer, implement, and enforce sections 1509.222 to 1509.226 of the Revised Code for protection of public health or safety or conservation of natural resources.

HISTORY: 140 v H 501. Eff 4-12-85.

**Cross-References to Related Sections**

Penalties-
Civil, RC § 1509.33.
Criminal, RC § 1509.99.

Application for certificate as transporter of brine to include bond or other security, RC § 1509.22.5.
Disposition of fines, RC § 1509.02.
Orders of chief of oil and gas division regulating transportation and disposal of brine by vehicle deemed adjudication orders when issued under RC § 1509.22.4(A) or (B), RC § 1509.03.
Political subdivision or governmental entity may transport brine without registration, bond, RC § 1509.22.6.
Procedures regarding order, final order, hearing, appeal in relation to denial of brine transporter's certification or disposal plan, RC § 1509.22.4.
Suspension, revocation of certificate for habitual violation of rules, RC § 1509.22.4.
Prohibition against violating rules and orders applicable to storage and disposal of brine, RC § 1509.22.

**Research Aids**

Disposal of brine:
O-Jur3d: Energy § 32

## § 1509.223 Engaging unregistered transporter prohibited; transportation reports; daily logs; vehicle identification.

(A) No permit holder or owner of a well shall enter into an agreement with or permit any person to transport brine produced from the well who is not registered pursuant to section 1509.222 of the Revised Code or exempt from registration under section 1509.226 of the Revised Code.

(B) Each registered transporter shall file with the chief of the division of oil and gas, on or before the fifteenth day of April, a statement concerning brine transported, including quantities transported and source and delivery points, during the last preceding calendar year, and such other information in such form as the chief may prescribe.

(C) Each registered transporter shall keep on each vehicle used to transport brine a daily log and have it available upon the request of the chief or an authorized representative of the chief or a peace officer. The log shall, at a minimum, include the following information:

(1) The name of the owner or owners of the well or wells producing the brine to be transported;

(2) The date and time the brine is loaded;

(3) The name of the driver;

(4) The amount of brine loaded at each collection point;

(5) The disposal location; and

(6) The date and time the brine is disposed of and the amount of brine disposed of at each location.

No registered transporter shall falsify or fail to keep or submit the log required by this division.

(D) Each registered transporter shall legibly identify with reflective paints all vehicles employed in transporting or disposing of brine. Letters shall be no less than four inches in height and shall indicate the identification number issued by the chief, the word "brine," and the name and telephone number of the transporter.

(E) The chief shall maintain and keep a current list of persons registered to transport brine under section 1509.222 of the Revised Code. The list shall be open to public inspection. It is an affirmative defense to a charge under division (A) of this section that at the time the permit holder or owner of a well entered into an agreement with or permitted a person to transport brine, the person was shown on the list as currently registered to transport brine.

HISTORY: 140 v H 501. Eff 4-12-85.

**Cross-References to Related Sections**

Penalties-
Civil, RC § 1509.33.
Criminal, RC § 1509.99.

Inspection of premises, documents in re control of transportation of brine, RC § 1509.03.
Orders of chief of oil and gas division regulating transportation

and disposal of brine by vehicle deemed adjudication orders when issued under RC § 1509.22.4(A) or (B), RC § 1509.03.
Political subdivision or governmental entity may transport brine without registration, bond, RC § 1509.22.6.
Procedures regarding order, final order, hearing, appeal in relation to denial of brine transporter's certification or disposal plan, RC § 1509.22.4.
Suspension, revocation of certificate for habitual violation of rules, RC § 1509.22.4.

Research Aids
Disposal of brine:
O-Jur3d: Energy § 32

## § 1509.224 Suspension or revocation of transporter certificate; preliminary and final orders.

(A) In addition to any other remedies provided in Chapter 1509. of the Revised Code, if the chief of the division of oil and gas has reason to believe that a pattern of the same or similar violations of any requirements of sections 1509.22, 1509.222, or 1509.223 of the Revised Code, or any rule adopted thereunder or term or condition of the registration certificate issued thereunder exists or has existed, and the violations are caused by the transporter's indifference, lack of diligence, or lack of reasonable care, or are willfully caused by the transporter, the chief shall immediately issue an order to the transporter to show cause why the certificate should not be suspended or revoked. After the issuance of the order, the chief shall provide the transporter an opportunity to be heard and to present evidence at an informal hearing conducted by the chief. If, at the conclusion of the hearing, the chief finds that such a pattern of violations exists or has existed, he shall issue an order suspending or revoking the transporter's registration certificate. An order suspending or revoking a certificate under this section may be appealed under sections 1509.36 and 1509.37 of the Revised Code, or notwithstanding any other provision of this chapter, may be appealed directly to the court of common pleas of Franklin county.

(B) Before issuing an order denying a registration certificate; approving or denying approval of an application for revision of a registered transporter's plan for disposal; or to implement, administer, or enforce section 1509.22, 1509.222, 1509.223, 1509.225, or 1509.226 of the Revised Code and rules and terms and conditions of registration certificates issued thereunder pertaining to the transportation of brine by vehicle and the disposal of brine so transported, the chief shall issue a preliminary order indicating the chief's intent to issue a final order. The preliminary order shall clearly state the nature of the chief's proposed action and the findings on which it is based and shall state that the preliminary order becomes a final order thirty days after its issuance unless the person to whom the preliminary order is directed submits to the chief a written request for an informal hearing before the chief within that thirty-day period. At the hearing the person may present evidence as to why the preliminary order should be revoked or modified. Based upon the findings from the informal hearing, the chief shall revoke, issue, or modify and issue the preliminary order as a final order. A final order may be appealed under sections 1509.36 and 1509.37 of the Revised Code.

HISTORY: 140 v H 501. Eff 4-12-85.

Cross-References to Related Sections
Orders of chief of oil and gas division regulating transportation and disposal of brine by vehicle deemed adjudication orders when issued under RC § 1509.22.4(A) or (B), RC § 1509.03.

Research Aids
Disposal of brine:
O-Jur3d: Energy § 32

## § 1509.225 Surety bond required for registered transporters; bond forfeiture.

(A) Before being issued a registration certificate under section 1509.222 of the Revised Code, and applicant shall execute and file with the division of oil and gas a surety bond for fifteen thousand dollars to provide compensation for damage and injury resulting from transporters' violations of sections 1509.22, 1509.222, and 1509.223 of the

Revised Code, all rules and orders of the Chief of the division of oil and gas relating thereto, and all terms and conditions of the registration certificate imposed thereunder. The applicant may deposit with the chief, in lieu of a surety bond, cash in an amount equal to the surety bond as prescribed in this section, or negotiable certificates of deposit issued by any bank organized or transacting business in this state, or certificates of deposit issued by any building and loan association as defined in section 1151.01 of the Revised Code, having a cash value equal to or greater than the amount of the surety bond as prescribed in this section. Cash or certificates of deposit shall be deposited upon the same terms as those upon which surety bonds may be deposited. If certificates of deposit are deposited with the chief in lieu of a surety bond, he shall require the bank or building and loan association that issued any such certificate to pledge securities of a cash value equal to the amount of the certificate that is in excess of the amount insured by any of the agencies and instrumentalities created by or under the following acts and amendments thereto:

(1) Federal Deposit Insurance Corporation, 64 Stat. 873, 12 U.S.C. 1811;

(2) Federal Savings and Loan Insurance Corporation, 48 Stat. 1256, 12 U.S.C. 1726;

(3) Deposit guaranty association, sections 1151.80 to 1151.92 of the Revised Code.

Such securities shall be security for the repayment of the certificate of deposit. Immediately upon a deposit of cash or certificates with the chief, he shall deliver it to the treasurer of the state who shall hold it in trust for the purposes for which it has been deposited.

(B) The surety bond provided for in this section shall be executed by a surety company authorized to do business in this state. The chief shall not approve any bond until it is personally signed and acknowledged by both principal and surety, or as to either by his attorney in fact, with a certified copy of the power of attorney attached thereto. The chief shall not approve such bond unless there is attached a certificate of the superintendent of insurance that the company is authorized to transact a fidelity and surety business in this state. All bonds shall be given in a form to be prescribed by the chief.

(C) If a registered transporter is found liable for a violation of section 1509.22, 1509.222, or 1509.223 of the Revised Code or a rule, order, term, or condition of a certificate involving, in any case, damage or injury to persons or property, or both, the court may order the forfeiture of any portion of the bond, cash, or other securities required by this section in full or partial payment of damages to the person to whom the damages are due. The treasurer of state and the chief shall deliver the bond or any cash or other securities deposited in lieu of bond, as specified in the court's order, to the person to whom the damages are due; however, execution against the bond, cash, or other securities, if necessary, is the responsibility of the person to whom the damages are due. The chief shall not release the bond, cash, or securities required by this section except by court order or until two years after the date on which a registration is terminated.

HISTORY: 140 v H 501. Eff 4-12-85.

**Cross-References to Related Sections**

Orders of chief of oil and gas division regulating transportation and disposal of brine by vehicle deemed adjudication orders when issued under RC § 1509.22.4(A) or (B), RC § 1509.03.

Registration of transporter of brine by vehicle, RC § 1509.22.2.

**Research Aids**

Disposal of brine:
O-Jur3d: Energy § 32

## § 1509.226 Surface application of brine; resolution; written plan; prohibitions.

(A) If a board of county commissioners, a board of township trustees, or the legislative authority of a municipal corporation wishes to permit the surface application of brine to roads, streets, highways, and other similar land surfaces it owns or has the right to control for control of dust or ice, it may adopt a resolution permitting such application as provided in this section. If a board or legislative authority does not adopt such a resolution, then no such surface application of brine is permitted on such roads, streets, highways, and other similar surfaces. If a board or legislative authority votes on a proposed resolution to permit such surface appli-

cation of brine, but the resolution fails to receive the affirmative vote of a majority of the board or legislative authority, the board or legislative authority shall not adopt such a resolution for one year following the date on which the vote was taken. A board or legislative authority shall hold at least one public hearing on any proposal to permit surface application of brine under this division and may hold additional hearings. The board or legislative authority shall publish notice of the time and place of each such public hearing in a newspaper of general circulation in the political subdivision at least five days before the day on which the hearing is to be held.

(B) If a board or legislative authority adopts a resolution permitting the surface application of brine to roads, streets, highways, and other similar land surfaces under division (A) of this section, the board or legislative authority shall, within thirty days after the adoption of the resolution, prepare and submit to the chief of the division of oil and gas a copy of the resolution. Any department, agency, or instrumentality at this state or the United States that wishes to permit the surface application of brine to roads, streets, highways, and other similar land surfaces it owns or has a right to control shall prepare and submit guidelines for such application, but need not adopt a resolution under division (A) of this section permitting such surface application.

All resolutions and guidelines shall be subject to the following standards:

(1) Brine shall not be applied:

(a) To a water-saturated surface;

(b) Directly to vegetation near or adjacent to surfaces being treated;

(c) Within twelve feet of structures crossing bodies of water or crossing drainage ditches;

(d) Between sundown and sunrise, except for ice control.

(2) The discharge of brine through the spreader bar shall stop when the application stops;

(3) The applicator vehicle shall be moving at least five miles per hour at all times while the brine is being applied;

(4) The maximum spreader bar nozzle opening shall be three-quarters of an inch in diameter;

(5) The maximum uniform application rate of brine shall be three thousand gallons per mile on a twelve-foot-wide road or three gallons per sixty square feet on unpaved lots;

(6) The applicator vehicle discharge valve shall be closed between the brine collection point and the specific surfaces that have been approved for brine application;

(7) Any valves that provide for tank draining other than through the spreader bar shall be closed during the brine application and transport;

(8) The angle of discharge from the applicator vehicle spreader bar shall not be greater than sixty degrees from the perpendicular to the unpaved surface;

(9) Only the last twenty-five per cent [sic] of an applicator vehicle's contents shall be allowed to have a pressure greater than atmospheric pressure; therefore, the first seventy-five per cent [sic] of the applicator vehicle's contents shall be discharged under atmospheric pressure.

If a resolution or guidelines contain only the standards listed in division (B) (1) to (9) of this section, without addition or qualification, the resolution or guidelines shall be deemed effective when submitted to the chief without further action by the chief. All other resolutions and guidelines shall comply with and be no less stringent than this chapter, rules concerning surface application that the chief shall adopt under division (C) of section 1509.22 of the Revised Code, and other rules of the chief. Within fifteen days after receiving such other resolutions and guidelines, the chief shall review them for compliance with the law and rules and disapprove them if they do not comply.

The board, legislative authority, or department, agency, or instrumentality may revise and resubmit any resolutions or guidelines that the chief disapproves after each disapproval, and the chief shall again review and approve or disapprove them within fifteen days after receiving them. The board, legislative authority, or department, agency, or instrumentality may amend any resolutions or guidelines previously approved by the chief and submit them, as amended, to the chief. The chief shall receive, review, and approve or disapprove the amended resolutions or guidelines on the same basis and in the same time as original resolutions or

guidelines. The board, legislative authority, or department, agency, or instrumentality may amend any resolutions or guidelines previously approved by the chief and submit them, as amended, to the chief. The chief shall receive, review, and approve or disapprove the amended resolutions or guidelines on the same basis and in the same time as original resolutions or guidelines. The board, legislative authority, or department, agency, or instrumentality shall not implement amended resolutions or guidelines until they are approved by the chief under this division.

(C) Any person, other than a political subdivision required to adopt a resolution under division (A) of this section or a department, agency, or instrumentality of this state or the United States, who owns or has a legal right or obligation to maintain a road, street, highway, or other similar land surface may file with the board of county commissioners a written plan for the application of brine to the road, street, highway, or other surface. The board need not approve any such plans, but if it approves a plan, the plan shall comply with this chapter, rules adopted thereunder, and the board's resolutions, if any. Disapproved plans may be revised and resubmitted for the board's approval. Approved plans may also be revised and submitted to the board. A plan or revised plan shall:

(1) Identify the sources of brine to be used under the plan;

(2) Identify by name, address, and registration certificate, if applicable, any transporters of the brine;

(3) Specifically identify the places to which the brine will be applied; and

(4) Specifically describe the method, rate, and frequency of application.

(D) The board may attach terms and conditions to approval of a plan, or revised plan, and may revoke approval for any violation of this chapter, rules adopted thereunder, resolutions adopted by the board, or terms or conditions attached by the board. The board shall conduct at least one public hearing before approving a plan or revised plan, publishing notice of the time and place of each such public hearing in a newspaper of general circulation in the county at least five days before the day on which the hearing is to be held. The board shall record the filings of all plans and revised plans in its journal. The board shall approve, disapprove, or revoke approval of a plan or revised plan by the adoption of a resolution. Upon approval of a plan or revised plan, the board shall send a copy of the plan to the chief. Upon revoking approval of a plan or revised plan, the board shall notify the chief of the revocation.

(E) No person shall:

(1) Apply brine to a water-saturated surface;

(2) Apply brine directly to vegetation adjacent to the surface of roads, streets, highways, and other surfaces to which brine may be applied.

(F) Each political subdivision that adopts a resolution under divisions (A) and (B) of this section, each department, agency, or instrumentality of this state or the United States that submits guidelines under division (B) of this section, and each person who files a plan under divisions (C) and (D) of this section shall, on or before the fifteenth day of April of each year, file a report with the chief concerning brine applied within his or its jurisdiction, including the quantities transported and the sources and application points during the last preceding calendar year and such other information in such form as the chief requires.

(G) Any political subdivision or department, agency, or instrumentality of this state or the United States that applies brine under this section may do so with its own personnel, vehicles, and equipment without registration under or compliance with section 1509.222 or 1509.223 of the Revised Code and without the necessity for filing the surety bond or other security required by section 1509.225 of the Revised Code. However, each such entity shall legibly identify vehicles used to apply brine with reflective paint in letters no less than four inches in height, indicating the word "brine" and that the vehicle is a vehicle of the political subdivision, department, agency, or instrumentality. Except as stated in this division, such entities shall transport brine in accordance with sections 1509.22 to 1509.-226 of the Revised Code.

(H) A surface application plan filed for approval under division (C) of this section shall be accompanied by a nonrefundable fee of fifty dollars, which

shall be credited to the general fund of the county. An approved plan is valid for one year from the date of its approval unless it is revoked before that time. An approved revised plan is valid for the remainder of the term of the plan it supersedes unless it is revoked before that time. Any person who has filed such a plan or revised plan and had it approved may renew it by refiling it in accordance with divisions (C) and (D) of this section within thirty days before any anniversary of the date on which the original plan was approved. The board shall notify the chief of renewals and nonrenewals of plans. Even if a renewed plan is approved under those divisions, the plan is not effective until notice is received by the chief, and until notice is received, the chief shall enforce this chapter and rules adopted thereunder with regard to the affected roads, streets, highways, and other similar land surfaces as if the plan had not been renewed.

(I) A resolution adopted under division (A) of this section by a board or legislative authority shall be effective for one year following the date of its adoption and from month to month thereafter until the board or legislative authority, by resolution, terminates the authority granted in the original resolution. The termination shall be effective not less than seven days after enactment of the resolution, and a copy of the resolution shall be sent to the chief.

(J) As used in this section, "board of county commissioners" includes any other county legislative authority established by law.

HISTORY: 140 v H 501. Eff 4-12-85.

**Cross-References to Related Sections**

Orders of chief of oil and gas division regulating transportation and disposal of brine by vehicle deemed adjudication orders when issued under RC § 1509.22.4(A) or (B), RC § 1509.03.

Procedures regarding order, final order, hearing, appeal in relation to denial of brine transporter's certification or disposal plan, RC § 1509.22.4.

Suspension, revocation of certificate for habitual violation of rules, RC § 1509.22.4.

Prohibition against agreement with unregistered or non-exempt transporter of brine;current list of registered transporters, RC § 1509.22.3.

Prohibition against violating rules and orders applicable to storage and disposal of brine, RC § 1509.22.

Registration of transporter of brine by vehicle, plan, RC § 1509.22.2.

**Research Aids**

Use of brine:
O-Jur3d: High § 184.5

## § 1509.23 Safety regulations.

Rules of the chief of the division of oil and gas may specify practices to be followed in the drilling of wells and production of oil and gas for protection of public health or safety or to prevent damage to natural resources, including specification of devices, minimum distances that wells and other excavations, structures, and equipment shall be located from water wells, streets, roads, highways, railroads tracks, and buildings, and other methods of operation.

HISTORY: 131 v 475 (Eff 10-15-65); 140 v H 501. Eff 4-12-85.

**Cross-References to Related Sections**

Penalty, RC § 1509.99.

When permit holder may commence drilling at a new location, RC § 1509.09.

**Ohio Administrative Code**

Pipeline Identification and Safety Measures, OAC Chapter 1501:9-10.

Safety Practices for Drilling and Producing Oil and Gas Wells, OAC Chapter 1501:9-9.

**Research Aids**

Rules of division:
O-Jur3d: Energy §§ 27, 39
Am-Jur2d: Gas & O § 159

**Text Discussion**

Purpose and types of regulation. **Kuntz** § 77.1

Spacing regulations. **Kuntz** § 77.2

**ALR**

Implied duty of oil and gas lessee to protect against drainage. 18 ALR4th 14.

Remedy for breach of implied duty of oil and gas lessee to protect against drainage. 18 ALR4th 147.

**Law Review**

Report of the oil and gas law committee. 39 OSBJ 1225 (1966).

CASE NOTES AND OAG

1. (1982) Ohio Admin. Code 1501:9-1-05 prohibits the drilling

**EXAMPLE OF RESOLUTION**
**FOR USE BY COUNTY COMMISSIONERS**

The _____County Board of Commissioners wishes to permit the surface application of brine by _____, to the roads, streets, highways, and other similar land surfaces situated in_____ County which, the Board of Commissioners has the right to administer for the control of dust and ice. Therefore the _____ County Board of Commissioners hereby adopts the following Resolution which grants _____ right to apply said brine to the road surfaces of _____ County.

Prior to the acceptance of this Resolution permitting surface application of brine, a public hearing was held at the _____ Court House, Commissioners Room, _____, Ohio. A Notice of time, place and content of the hearing was published by the Board of Commissioners of _____ County in "_____", a newspaper of general circulation in _____County, Ohio at least five days prior to the date of the public hearing.

The surface application of brine in _____ County shall be regulated as follows:

1) Brine shall not be applied:
   a) To a water saturated surface;
   b) Directly to vegetation near or adjacent to surface to be treated;
   c) Within twelve (12) feet of structures crossing bodies of water or crossing drainage ditches;
   d) Between sundown and sunrise except for ice control.
2) The discharge of brine through the spreader bar shall stop when the application stops;
3) The applicator vehicle shall be moving at least five (5) miles per hour while the brine is being applied;
4) The maximum spreader bar nozzle opening shall be three quarters (3/4") of an inch in diameter;
5) The maximum uniform application rate of brine shall be three thousand (3,000) gallons per mile on a twelve foot (12') wide road, or three (3) gallons per sixty square (60') feet on unpaved lots;
6) The applicator vehicle discharge valve shall be closed between the brine collection point and the specific surfaces that have been approved for brine application;
7) Any valves that provide for tank draining other than through the spreader bar shall be closed during the brine application and transport;
8) The angle of discharge from the applicator vehicle spreader bar shall not be greater than sixty (60°) degrees from the perpendicular to the unpaved surface;
9) Only the last twenty-five (25%) percent of an applicator vehicle's content shall be allowed to have a pressure greater than atmospheric pressure; therefore, the first seventy-five (75%) percent of the applicator vehicles contents shall be discharged under atmospheric pressure.

Furthermore, be it known that a copy of this resolution permitting the application of brine to roads, street, highways and other similar land surfaces in _____ County, shall within thirty (30) days

**EXAMPLE OF RESOLUTION**
**FOR USE BY COUNTY COMMISSIONERS**

after the adoption of the Resolution be submitted to the Chief of the Division of Mineral Resources Management of the State of Ohio.

This resolution is accepted this day, _____, 200__.

_____
Commissioner

_____
Commissioner

_____
Commissioner

**EXAMPLE OF RESOLUTION**
**FOR USE BY COUNTY COMMISSIONERS**

# Resolution
## County Commissioners

Date Adopted _____

Subject _____Approval of Brine Water Permit for_____

It was moved by _____ and seconded by _____ that the following resolution be adopted:

WHEREAS, _____ County desired to utilize the application of brine water for dust control, and

WHEREAS, the Board of County Commissioners on _____[date] passed Resolution No. _____ authorizing the approval of brine water application,

WHEREAS, _____ has submitted an application and plan for spreading brine water on private property, and

WHEREAS, the County Engineer has reviewed said application and plan, and recommends the Board's acceptance of such,

NOW, THEREFORE, BE IT RESOLVED that this plan having been reviewed and found to be compliant in all areas, that the aforementioned _____ be issued a permit for brine water application.

On roll call, the vote was as follows:

AYE AYE AYE

I, _____, Clerk of the Board of County Commissioners, _____ County, Ohio, hereby certify that the above is a true and correct copy of the resolution as adopted by said Board under said date.

_____
Clerk

**EXAMPLE OF APPLICATION**
**FOR BRINE PERMIT**

DATE: _____

1. PROPERTY OWNER NAME: _____
   ADDRESS: _____

2. PLACE WHERE BRINE IS TO BE APPLIED: Brine is to be applied on truck drive at both locations for dust control. _____

3. TRANSPORTER: _____ REGISTRATION NO. UIC: _____

4. SOURCE OF BRINE TO BE USED: (List well, number and location)
   Over 100 wells, this information would be available at the time of application. _____

5. DESCRIBE THE METHOD, RATE AND FREQUENCY OF APPLICATION: Gravity with spreader bar _____

The above mentioned property owner has adopted the following rules for spreading the salt water:

1. Brine shall not be applied:
   1.1. To a water saturated surface;
   1.2. Directly to vegetation near or adjacent to surface to be treated;
   1.3. Within twelve (12) feet of structures crossing bodies of water or crossing drainage ditches;
   1.4. Between sundown and sunrise except for ice control.
2. The discharge of brine through the spreader bar shall stop when the application stops;
3. The applicator vehicle shall be moving at least five (5) miles per hour while the brine is being applied;
4. The maximum spreader bar nozzle opening shall be three quarters (3/4") of an inch in diameter;
5. The maximum uniform application rate of brine shall be three thousand (3,000) gallons per mile on a twelve foot (12') wide road, or three (3) gallons per sixty square (60') feet on unpaved lots;
6. The applicator vehicle discharge valve shall be closed between the brine collection point and the specific surfaces that have been approved for brine application;
7. Any valves that provide for tank draining other than through the spreader bar shall be closed during the brine application and transport;
8. The angle of discharge from the applicator vehicle spreader bar shall not be greater than sixty (60°) degrees from the perpendicular to the unpaved surface;
9. Only the last twenty-five (25%) percent of an applicator vehicle's content shall be allowed to have a pressure greater than atmospheric pressure; therefore, the first seventy-five (75%) percent of the applicator vehicles contents shall be discharged under atmospheric pressure.

_____ _____

PROPERTY OWNER'S SIGNATURE DATE

**EXAMPLE OF RESOLUTION**
**TO DISCONTINUE THE USE OF BRINE ON ROADS**

The Board of Trustees of _____ County, Ohio met on _____[date] and _____ moved the adoption of the following Resolution:

BE IT RESOLVED, by the Board of Trustees of _____ County, Ohio

In view of the fact that the surface application of brine for dust control and ice control on Township roads has been discontinued for the past several years, therefore,

BE IT RESOLVED, by the Board of Trustees of _____ County, Ohio

do Hereby Rescind A Resolution passed on _____[date] permitting the surface application of brine on Township roads for ice and dust control, under certain conditions.

Mr./Ms. _____ seconded the Resolution and the roll being called upon its adoption resulted as follows:

_____ YEA

_____ YEA

_____ YEA

Adopted _____[date]

_____, Clerk

Township Trustees, _____County, Ohio

CIVIL AND CRIMINAL PENALTIES

| CODE | DESCRIPTION | CIVIL PENALTY | CRIMINAL PENALTY | |
|---|---|---|---|---|
| | | | First Offense | Subsequent Offense |
| ORC 1509.03 | No person shall violate a term or condition of a permit or registration certificate issued under this chapter. | $4,000 (Maximum for each offense) | $100 - $1,000 | $200 - $2,000 |
| ORC 1509.22(A)(1) | No person shall place or cause to be placed brine in surface or ground water or in or on the land in such quantities or in such a manner as actually causes or could reasonably be anticipated to cause water used for consumption by humans or domestic animals to exceed the standards of the "Safe Drinking Water Act" | $2,500 - $10,000 (For each violation) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violation) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |
| ORC 1509.22(A)(2) | No person shall place or cause to be placed brine in surface or ground water or in or on the land in such quantities or in such a manner as actually causes or could reasonably be anticipated to cause damage or injury to public health or safety or the environment. | $2,500 - $10,000 (For each violation) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violation) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |
| ORC 1509.22(B) | No person shall store or dispose brine in violation of a plan approved under Section 1509.06 or Section 1509.222 of the ORC or in violation of a resolution submitted under 1509.226 of the ORC or rules or orders applicable to such plans or resolution. | $4,000 (Maximum for each offense plus liability for any damage or injury and cost of rectifying) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violation) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |
| ORC 1509.22(C)(1) | Brine shall be disposed ...by surface application in accordance with Section 1509.226 of the ORC. | $4,000 (Maximum for each offense) | | |
| ORC 1509.222(A)(1) | No person shall transport brine by vehicle unless the business entity that employs the person first registers and obtains registration number and identification number. | $2,500-$20,000 (for each violation plus liability for any damage or injury and cost of rectifying) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violations) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |

| CODE | DESCRIPTION | CIVIL PENALTY | CRIMINAL PENALTY | |
|---|---|---|---|---|
| | | | First Offense | Subsequent Offense |
| 1509.222(C) | No applicant shall attempt to circumvent the application process by applying for a registration certificate under a different name or business organization name, by transferring responsibility to another person or entity, or by any similar act. | $4,000 (Maximum for each offense) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violation) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |
| 1509.223(A) | No permit holder or owner of a well shall enter into an agreement with or permit any person to transport brine who is not registered or exempt from registration. | $10,000 (Maximum for each violation plus liable for any damage or injury and cost of rectifying when knowing violation.) | $10,000 6 mos. prison (knowing violation) Up to $5,000 (negligent violation) | $20,000 2 yrs. prison (knowing violation) Up to $5,000 (negligent violation) |
| ORC 1509.223(C) | Each registered transporter shall keep on each vehicle used to transport brine a daily log and have it available upon request of the Chief or an authorized representative of the Chief or a peace officer. | $4,000 (Maximum for each offense) | $500 Maximum | $1,000 Maximum |
| ORC 1509.223(D) | Each registered transporter shall legibly identify with reflective paints all vehicles employed in transportation or disposing brine with letters at least 4 inches high and indicating identification number, the word "Brine" and the name and telephone number of the transporter. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |
| ORC 1509.224(A) | Suspension of revocation of transporter certificate if pattern of same or similar violations of any requirements of Sections 1509.22, 1509.222 or 1509.223 of Revised Code, rules, or terms and conditions. | N/A | N/A | |

| CODE | DESCRIPTION | CIVIL PENALTY | CRIMINAL PENALTY | |
|---|---|---|---|---|
| | | | First Offense | Subsequent Offense |
| ORC 1509.225(C) | Forfeiture of surety bond of registered transporter found liable for violation of Section 1509.22, 1509.222 or 1509.223 or a rule, order, term or condition of certificate involving damage or injury to persons, property or both. | N/A | $100-$1,000 | $200-$2,000 |
| ORC 1509.226(E)(1) | No person shall apply brine to a water-saturated surface. | $4,000 (Maximum for each offense) | $10,000 6 mos. prison | $20,000 2 yrs. prison |
| ORC 1509.226(E)(2) | No person shall apply brine directly to vegetation adjacent to surfaces to which brine may be applied. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |
| ORC 1509.226(F) | Each political subdivision, governmental agency or person who files a plan for the surface application of brine shall file a report by April 15th of each month regarding the amount transported, the sources and application points for the previous year. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |
| ORC 1509.226(G) | Each political subdivision or governmental agency that applies brine must legibly identify the vehicles used with at least 4 inch high letters stating "Brine" and ownership of the vehicle using reflective paint. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |
| OAC 1501-9-3-04(A) | All persons engaged in any phase of saltwater disposal operations shall conduct such operations in a manner which will not contaminate or pollute the surface of the land, or water on the surface or in the subsurface. Saltwater shall be stored, transported, and disposed of by a method decribed by OAC Chapter 1501:9-3. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |

| CODE | DESCRIPTION | CIVIL PENALTY | CRIMINAL PENALTY | |
|---|---|---|---|---|
| | | | First Offense | Subsequent Offense |
| OAC 1501:9-3-04(B) | All persons acting in the capacity of a contractor in any phase of transportation and disposal of saltwater operations shall supply an annual report by the first day of March of each year of the quantity of saltwater hauled and/or disposed and the location and quantity disposed at each site for the preceding year. | $4,000 (Maximum for each offense) | $100-$1,000 | $200-$2,000 |

# USING THE QUANTAB

The Quantab chloride titrator can be used to measure salt (chloride) concentration in water. When the Quantab is placed upright in water, fluid will rise in the brown column of the Quantab. If chloride is present in the water, it will cause a chemical reaction that turns the brown column, white. When the reaction is complete, the yellow strip at the top of the column turns dark blue. The height of the white color change in the column indicates the chloride concentration.

Directions:

1. Obtain a sample of your water prior to any filters or water conditioning equipment. The valve at the bottom of your pressure tank is a good place to obtain a sample if you have conditioning equipment.

2. Fill a cup or jar with water to a depth of one inch after you have run the water five minutes.

3. Stand the plastic strip upright in the cup or jar with the word Quantab at the top. Do not immerse the entire strip.

4. Within several minutes, the yellow strip will turn blue indicating completion of the test.

5. Within five minutes after this change, read the scale on the plastic strip.

6. Holding the top of the Quantab, run your thumbnail along the numbered strip toward the bottom. This procedure will make the test result permanent.

7. Return the Quantab with your questionnaire.

Following is a table to provide you with an estimated chloride concentration of your water based on the test you have completed.

## CALIBRATION TABLE

| Quantab Reading | Approximate Milligrams Per Liter Chloride |
|---|---|
| 1.0 | Less than 30 |
| 2.0 | 50 |
| 3.0 | 100 |
| 4.0 | 150 |
| 5.0 | 200 |
| 6.0 | 300 |
| 7.0 | 450 |
| 8.0 | Greater than 600 |

If the reading is over 5.5, the concentration of chloride in your water probably exceeds the U.S. Environmental Protection Agency Secondary Drinking Water Standard of 250 milligrams per liter. This is only an aesthetic standard and does not indicate a health hazard for most individuals. For questions or concerns about using your water for drinking, bathing or cooking, you should contact your County Health District Sanitarian or personal physician.

# Division of Mineral Resources Management

## Regional Offices

| WEST REGIONAL OFFICES | SOUTH REGIONAL OFFICES | NORTH REGIONAL OFFICES |
|---|---|---|
| 117 East High Street, Suite 144<br>**Mt. Vernon, OH 43050**<br>(740) 392-4499<br>(740) 392-4499 (fax) | 2050 E. Wheeling Avenue<br>**Cambridge, OH 43725**<br>(740) 439-9079 or<br>(740) 439-9213<br>(740) 432-7711 (fax) | 2207 Reiser Avenue SE<br>**New Philadelphia, OH 44663**<br>(330) 339-2207<br>(330) 339-4688 (fax) |
| 104 East Washington, Suite 105<br>**Napoleon, OH 43545**<br>(419) 599-0058<br>(419) 599-0058 (fax) | 34 Portsmouth Street<br>**Jackson, OH 45640**<br>(740) 286-6411<br>(740) 286-1868 (fax) | 3601 Newgarden Road<br>**Salem, OH 44460**<br>(330) 222-1527<br>(330) 222-2137 (fax) |
| 505 South State Route 741<br>**Lebanon, OH 45036**<br>(513) 933-6717 or<br>(513) 933-6718<br>(513) 933-9245 (fax) | Cambridge Environmental Lab<br>325 North 7th Street<br>**Cambridge, OH 43725**<br>(740) 439-5591<br>(740) 439-3075 (fax) | 3575 Forest Lake Drive, Suite 150<br>**Uniontown, OH 44685**<br>(330) 896-0616<br>(330) 896-1849 (fax) |
| 2045 Morse Road, Bldg. H-2<br>**Columbus, OH 43229**<br>(614) 265-6633<br>(614) 265-7999 (fax) | | |

# Division of Mineral Resources Management
# Regional Offices

## ***North Region***

Rick Simmers, Manager
Jay Cheslock, Assistant Manager
Wayne Schalk, Assistant Manager

| | | |
|---|---|---|
| Division of Mineral Resources Management<br>3601 Newgarden Road<br>Salem, OH 44460 | Office:<br>Fax: | (330) 222-1527<br>(330) 222-2137 |
| Division of Mineral Resources Management<br>2207 Reiser Avenue SE<br>New Philadelphia, OH 44663 | Office:<br>Fax: | (330) 339-2207<br>(330) 339-4688 |
| Division of Mineral Resources Management<br>3575 Forest Lake Drive, Suite 150<br>Uniontown, OH 44685 | Office:<br>Fax: | (330) 896-0616<br>(330) 896-1849 |

## ***South Region***

Dave Clark, Manager
Joe Hoerst, Assistant Manager
Greg Mills, Assistant Manager

| | | |
|---|---|---|
| Division of Mineral Resources Management<br>2050 East Wheeling Avenue<br>Cambridge, OH 43725 | Office:<br><br>Fax: | (740) 439-9079<br>(740) 439-9213<br>(740) 432-7711 |
| Cambridge Environmental Laboratory<br>325 North 7th Street<br>Cambridge, OH 43725 | Office:<br>Fax: | (740) 439-5591<br>(740) 439-3075 |
| Division of Mineral Resources Management<br>34 Portsmouth Street<br>Jackson, OH 45640 | Office:<br>Fax: | (740) 286-6411<br>(740) 286-1868 |

## ***West Region***

Jeff Fry, Assistant Manager

| | | |
|---|---|---|
| Division of Mineral Resources Management<br>117 East High Street, Suite 144<br>Mt. Vernon, OH 43050 | Office:<br>Fax: | (740) 599-0058<br>(740) 392-4499 |
| Division of Mineral Resources Management<br>104 East Washington, Suite 105<br>Napoleon, OH 43545 | Office:<br>Fax: | (419) 599-0058<br>(419) 599-0058 |
| Division of Mineral Resources Management<br>505 South State Street, Route 741<br>Lebanon, Oh 45036 | Office:<br><br>Fax: | (513) 933-6717<br>(513) 933-6785<br>(513) 933-9245 |
| Division of Mineral Resources Management<br>2045 Morse Road, Bldg. H-2<br>Columbus, Ohio 43229 | Office:<br>Fax: | (614) 265-6633<br>(614) 265-7999 |