Description

Contains lithium nitrate (LiNO₃) in solution.

Typical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density @ 25°C (77°F)</td>
<td>1.20 g/cm³ (10.0 lb./gal)</td>
</tr>
<tr>
<td>pH (1:6 dilution) at 25°C</td>
<td>7-10</td>
</tr>
<tr>
<td>Freezing point (inception crystallization)</td>
<td>-8°C (18°F)</td>
</tr>
<tr>
<td>Boiling point</td>
<td>110°C (230°F)</td>
</tr>
</tbody>
</table>

What is ASR?

Alkali-silica reactivity (ASR) is a chemical reaction that occurs between the reactive silica in aggregates used to make concrete and the alkalis (sodium or potassium) present in the concrete mix. The reaction causes the formation of a gel that absorbs water and swells, exerting stresses that can lead to cracking and premature deterioration of the concrete. The deterioration weakens the matrix so the concrete can be further damaged by traffic loading, vibrations and environmental stresses such as freeze-thaw cycles or steel corrosion.

Product Description

ASR Mitigator admixture is a lithium-based, specially formulated admixture, designed to control alkali-silica reactivity (ASR) in concrete. The product is derived from research conducted under the Strategic Highway Research Project (SHRP) which demonstrated that ASR could be controlled by the use of lithium salts in fresh concrete (see SHRP C-343). These tests showed control of ASR expansion was obtained when a sufficient amount of lithium ion was supplied in the mix. See figure 1 for an example of ASR cracking.

Lithium hydroxide was chosen as the preferred salt in this study because all salts tested converted to lithium hydroxide in the pore solution. Lithium hydroxide is caustic and corrosive, however, and requires special handling precautions and equipment.

GRT developed ASR Mitigator as an enhancement of the work conducted under the Strategic Highway Research Project. ASR Mitigator, based on lithium nitrate rather than hydroxide, is easy to handle, does not require special equipment, and has only minimal effect on the plastic and hardened properties of concrete. The effects seen to date are minor set acceleration and a small amount of water reduction.
ASR Mitigator
Lithium

Product Description (cont.)
Pore solution testing of the concrete matrix manufactured with ASR Mitigator demonstrates that unlike the lithium salts tested in SHRP, ASR Mitigator does significantly increase hydroxide in the pore solution, thus significantly reducing the potential pessimum effect from increased alkali loading. This makes ASR Mitigator more effective at reducing ASR expansion than other lithium compounds.

The dosage of ASR Mitigator can generally be significantly reduced when the material is used in conjunction with certain pozzolans such as Class F fly ash.

ASR Mitigator has now been approved by a number of State Departments of Transportation for use in mitigation of ASR in fresh concrete, and is recommended over other lithium salts in the American Association of State and Highway Transportation Officials (AASHTO) guide specifications in the United States. It has also been approved by the US Federal Aviation Administration and the US Department of Defense for use at military airports. ASR Mitigator is NSF-registered and can be used safely in concrete that is in contact with potable water.

Usage
The “standard” (or “100%” or “normal”) dose is 0.55 gallon of ASR Mitigator per cubic yard for every pound of sodium equivalent supplied by the cement. To maintain the same water-to-cement ratio, subtract 0.85 gallon of mix water for each gallon of ASR Mitigator added. For example, for a mix containing 600 pounds of cement with a sodium equivalent of 0.82%, the standard dose is 2.7 gallons of ASR Mitigator per yard of concrete (4.9 pounds of sodium equivalent x 0.55 gallon of ASR Mitigator per pound of sodium equivalent). For the same cement loading of 600 pounds, if the sodium equivalent is 0.6%, the standard dose is 2.0 gallons of ASR Mitigator per yard of cement. The actual amount of ASR Mitigator admixture necessary to suppress deleterious expansions from ASR in concrete is determined by performance testing. ASR Mitigator dosages can be lowered when used in conjunction with suitable pozzolans. For example, with Class F fly ashes that make up 15% to 25% of the cementitious matrix, the ASR Mitigator dosage might be reduced 25% to 50%. Since the reduction in ASR Mitigator dosage is dependent on the composition of the pozzolan, reactivity of the aggregate, and overall mix design, testing is conducted to determine minimum dosage for the particular mix. GRT’s recommended test methodology is similar to ASTM C1567, and takes 30 days to perform. Contact GRT for a copy of its recommended test methodology or for assistance in specifications. Testing conducted to date indicates that ASR Mitigator has no general or significant adverse effects on concrete properties. However, due to the wide variety of admixtures and mix designs, GRT recommends that mix designs be tested prior to production.
Dosage Rates

The amount of ASR Mitigator needed to mitigate ASR in fresh concrete is a function of the sodium equivalent (Na2Oe)* of the cement and the amount of cement used per cubic yard of concrete.

For every pound of Na2Oe present in a cubic yard of concrete, the standard dose is 0.55 gallon of ASR Mitigator. This number is then multiplied by the % of the standard dose found to be effective in performance testing. For every gallon of ASR Mitigator needed in the mix, subtract 0.85 gallon of water from the original mix design.

To calculate the gallons of ASR Mitigator needed, first calculate the total pounds of cement per cubic yard. (If the mix design is based on sacks of cement, note that each sack contains 94 pounds of cement.)

Next determine the total pounds of Na2Oe in the cement by changing the Na2Oe percentage to a decimal and multiplying by the total pounds.

To determine the gallons of ASR Mitigator, multiply this resulting number by 0.55, the number of gallons of ASR Mitigator per pound of Na2Oe, and multiply this number by the % of the standard dose indicated by the results of the performance testing. Remember to reduce the amount of batch water by 0.85 gallon for every gallon of ASR Mitigator added.

A shorter method is to multiply the number of cement sacks by the percentage of Na2Oe, then multiply that result by the ASR Mitigator factor of 0.516 gal/sack.

Example: For a 6.5-sack mix (611 lbs cement) with a 0.6% Na2Oe using the standard dose:

6.5 sacks x 0.6% Na2Oe x 0.516 gal/sack = 2.01 gallons of ASR Mitigator

or

611 lbs X 0.006 Na2Oe X 0.55 gal/lb of sodium = 2.01 gallons of ASR Mitigator

The amount of water in the mix should be reduced by 2.01 x 0.85, or 1.71 gallons.

ASR Mitigator dosages will generally be lower than the standard dose when used in combination with suitable pozzolans. For example, with low lime Class F fly ashes that make up 15% to 20% of the cementitious matrix, the ASR Mitigator dosage might be reduced 25% to 50%. Since the reduction in ASR Mitigator dosage is dependent on composition of the pozzolan, reactivity of aggregate and overall mix design, testing should be conducted with the particular mix to determine minimum dosage for the use.

For example, in the Example above, with a low lime Class F fly ash cement substitution of 20%, the effective ASR Mitigator dosage may be:

611 lbs cement – (20 % fly ash X 611) = 489 lbs cement

Amount of ASR Mitigator, assuming that performance testing indicated a 50% dose:

489 lbs cement X 0.006 sodium X (0.55 gal/lb of sodium X 0.5) = 0.81 gals

Note that this is only 40% of the admixture dose in the mix without the fly ash (0.81/2.01).

*Sodium equivalent (Na2Oe) = %Na2O + 0.658 x %K2O
ASR Mitigator
Lithium

Toxicity & Safety Data
Strong oxidizer if the solution is allowed to evaporate. Clear, odorless, water white to yellow solution. May be irritating to the eyes, skin and mucous membranes.

COMPLETE INFORMATION ON TOXICITY AND SAFETY IS CONTAINED IN THE GRT MATERIAL SAFETY DATA SHEET (MSDS) AVAILABLE FOR THIS PRODUCT.

Handling & Storage
Do not get in eyes, on skin or clothing. Avoid breathing vapors. Wash thoroughly after handling. Store away from readily oxidizable materials, strong acids and flammable materials. Keep container closed.

Shipping
ASR Mitigator is packaged and shipped in 55-gallon drums, 275-gallon totes or in a bulk.

Shipments of ASR Mitigator are not classified as hazardous in transport. Shipments by post, parcel (e.g. UPS), air, water, rail, or road are acceptable within each carrier’s weight limits and packaging requirements.

Responsible Care initiative dictates that all shipments of lithium chemicals must be transported in a DOT-approved vehicle in a responsible manner (i.e., no flat bed trucks).

Note: Recommendations, cited specifications and admixture interactions are based on actual testing performed with this product. Care should be taken when applying this data to other grades of lithium nitrate and products from other manufacturers. GRT recommends that testing be conducted with alternative materials prior to use.