

## Tephra® WP



CR Minerals offers Tephra® WP, a bright white, high-performance SCM - one of several grades of amorphous aluminum silicate - to serve the architectural, decorative, shotcrete and construction concrete markets, as a natural pozzolan.

### Naturally Pure and Environmentally Sound

Tephra® WP gets its brilliant white color and light density naturally through Mother Nature. Calcination happens rapidly as the volcano violently erupts the molten aluminum silicate from deep within the Earth's felsic lava region. Tephra® WP does not contain the heavy metals present in fly ash or carry the carbon footprint of calcined pozzolans such as Metakaolin, Expanded Shale or Clay. Molten lava, flash frozen upon explosive ejection from the volcanic vent, became what the Romans called 'pulvis puteolanus' or pozzolana – in other words natural pozzolan. This material was the key ingredient in Roman concrete which is proven to last thousands of years



### Sustainability and Responsible Mining

Tephra® WP originates from our world class pumice mine in New Mexico. Operating in a sustainable and responsible way is central to CR Minerals vision of being a world leader in high quality pumice products. At CR Minerals, we're committed to being good stewards of our resources, therefore in our operations and activities, we strive to leave a positive legacy. Reclaiming the land is a top priority in our mining process as we are committed to leaving a light footprint with all of our operations. We minimize the impact on local environments thorough research, planning, and management of each deposit which allows our team to extract our reserves efficiently and reclaim the landscape to its prior natural beauty.

### Proven Durability and Reliance

While much of our modern concrete infrastructure crumbles, ancient concrete relics of the Roman Empire stand as somber witnesses to the engineering prowess of the Empire's engineers. Their secret—and the origin of the term "pozzolan"—was fine-grained volcanic material they first sourced from Pozzuoli, in Italy. When mixed with lime (still the key component of Portland cement today) and aggregate, the magma based pozzolanic concrete hardened into the most enduring man-made construction material ever designed. The Pantheon, the Coliseum, the Aqueducts and other Roman engineered concrete structures have withstood over two millennia of earthquakes, elements, wars, as well as the relentless passage of time.



Much of our modern concrete is deteriorating before our eyes. Efflorescence discolors the surface of many concrete structures and internal self-destruction is advanced through deleterious chemical forces inherit to modern cement and concrete. Natural pozzolans not only mitigate such chemical forces, but improve the strength and abrasion resistance of concrete, creating an ageless and durable construction material.

Modern engineers "rediscovered" the benefits of pozzolanic concrete early in the 20th century with the use of fly ash. While fly ash works as a replacement pozzolan, the original pozzolan, natural Tephra based material, remains the superior choice. CR Minerals' pozzolans are the same as the natural, sustainable pozzolans used by the Romans, carefully refined, resulting in a pozzolan that greatly enhances concrete chemistry and that performs consistently, pour after pour. CR Minerals' pozzolans should be part of the toolbox of any engineer interested in designing strong, durable concrete, and resistant to the passage of time.

### Pozzolan Benefits:

CR Minerals' Tephra® WP has been tested, proven and certified as a natural pozzolan in accordance with ASTM C618N. This certification means that Tephra® WP is among the most effective products available to protect concrete from the deleterious effects of chemical attack, and to significantly enhance compressive strengths.

#### Enhances Compressive Strength

The pozzolanic reaction between Tephra® WP and calcium hydroxide begins only after the C3S and C2S in the cement begins to hydrate, thereby releasing calcium hydroxide as a by-product. At the early stage of curing, due to slower (but more effective) reactions created by the pozzolan, compressive strengths will be lower than reference OPC initially. Over time, however, the natural pozzolan continues to react with the calcium hydroxide produced by cement hydration and increases the compressive strength by producing additional, densifying C-S-H. Sometime between 28 - 40 curing days, the CR Minerals' pozzolan/OPC mixture begins to exceed reference OPC in compressive strength. After 56 days, strengths may exceed reference OPC by 20% or more. The pozzolanic reaction continues until there is no free calcium hydroxide available in the concrete mass. As a result, long term compressive strengths may exceed the reference OPC by up to 30% or more, depending on mix design.

#### Mitigates Alkali Silica Reaction (ASR)

CR Minerals' Tephra® WP is crushed to a fine particle size resulting in dramatically increased reactive surface area. Thus, Tephra® WP will readily react with calcium hydroxide as it becomes available and trap the liquid phase alkali inside the densified cement paste. The consumption of deleterious calcium hydroxide, the densified paste and the resultant alleviation of capillary action virtually eliminates both alkali-silica reactions and efflorescence.



#### Resists Sulfate Attack

CRM Tephra® WP will react with the calcium hydroxide to form additional C-S-H, thereby removing or mitigating the opportunity for the naturally occurring sulfates in certain soils to react and damage the concrete. Additionally, the WP will decrease the concrete's permeability, thus restricting the ingress of sulfate infused moisture.

#### Reduces Permeability and Efflorescence

The leaching of calcium hydroxide produced by the hydration of Portland cement can be a significant contributor to the formation of efflorescence and internal porosity in all Portland cement-based concrete. Tephra® WP can effectively mitigate this by reacting with the calcium hydroxide to form stabilizing and strength enhancing C-S-H before it migrates to the surface of the concrete.

#### Protects Steel Reinforcement / Resists Chloride Attack

Concrete made with Tephra® WP in the mix design can protect steel reinforcement by creating a more densely packed concrete matrix which then resists the ingress of chloride containing liquids and other chemicals into the concrete. When 20-30% Tephra® WP is added to cement, it will react with the free calcium hydroxide and form a denser, less permeable paste, providing greater resistance to the ingress of harmful chemicals into the concrete matrix.

#### Reduces Heat of Hydration

Experiments show that replacing 15-30% Portland cement (OPC) with Tephra® WP pozzolan can reduce the expansion and heat of hydration by as much as 20~40%. Less heat is produced when pozzolan reacts with the available calcium hydroxide. Tephra® WP not only decreases the overall heat generated by cement hydration, it also delays the time of peak temperature. The 'heat of hydration' of a Tephra® WP-OPC cement mixture is extended longer and lower to form a much more moderate curve than the 'heat of hydration' curve for OPC itself.

#### Shipping and Availability

CR Minerals' Tephra® WP is mined and distributed out of our state-of-the-art facility located in New Mexico. Tephra® WP is a high performance white natural pozzolan for any applications using white cement. WP is available for purchase in 50lb sacks and 2000lb super sacks.

## Physical Properties of Tephra® WP

Grade	Description	Bulk Density (lbs/ft <sup>3</sup> )	Specific Gravity
Tephra® NP	Amorphous Aluminum Silicate (Gray)	48	2.39-2.45
Tephra® WP	Amorphous Aluminum Silicate (White)	48	2.33-2.34

## Quality Control and Consistency

Tephra® WP is manufactured to stringent tolerances and thoroughly tested not only for the performance data discussed here, but to ensure the product has superior properties when compared to any other ASTM C618 Type N pozzolans. We rigorously ensure consistency of particle size, shape, and chemistry thereby minimizing variability in the product.

## Applications for CR Minerals' Tephra® WP

CR Minerals' Tephra® WP has the same pozzolanic properties as Tephra® NP (see NP TDS), but due to its white color, has additional uses in applications where the color of the concrete is important, such as:

- Architectural Precast Concrete
- Decorative Glass Fiber Reinforced Concrete Panels (GFRC)
- Light or white colored Stone Veneer
- Architectural & Decorative Concrete construction
- Colored Ready-Mix Concrete (especially with white cement)
- Decorative Concrete for statuary, pools, facades
- Any concrete that needs to be strong and durable will benefit from the addition of natural pozzolan to the mix design

#### Additional Information at [www.CRMinerals.com](http://www.CRMinerals.com)

To place an order or obtain additional information, please contact CR Minerals at 505-428-2940, or contact your local distributor.



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