LIME

THE ESSENTIAL CHEMICAL

". . . one of the essential building blocks of modern industry."

LIME: The Time-Tested Chemical

Lime is one of man's oldest and most vital chemicals. The ancient Romans used lime in building and road construction, uses which continue to the present day. From earliest times, lime has been made by heating limestone (calcium carbonate) to high temperatures. This process, known as calcining, results in quicklime, or calcium oxide. Hydrated lime (calcium hydroxide) is produced by reacting quicklime with sufficient water to form a dry, white powder.

While lime is one of the earliest industrial commodities known to man, its production and uses have grown with the times, and it continues to be one of the essential building blocks of modern industry.

"Recent annual U.S. lime production was approximately 21 million tons — and growing."

LIME: The Modern Chemical

Because lime for today's markets must meet exacting chemical and physical specifications, high purity limestone is required, and processing of limestone into lime is tightly controlled to ensure quality products. The four basic production steps are:

1. Quarrying or mining. Limestone is extracted in both underground and surface mines. Lime-quality limestone must be carefully identified and extracted to maintain its purity.
2. Stone preparation. This step includes crushing and screening, and in many cases, washing to remove impurities.
3. Calcining. Limestone, which is primarily composed of calcium carbonate, is heated to convert the calcium carbonate into calcium oxide. In the United States, this process is generally carried out in either large rotary kilns or vertical shaft kilns. Because of the high temperatures required (exceeding 1800 degrees F.), calcining is an energy-intensive process. The product of the calcining process is quicklime, which can be used as "pebble lime," or may be crushed or pulverized, depending on its intended use.
4. Hydrating. Hydrated (or "slaked") lime is produced by reacting quicklime with water in continuous hydrators. The end product is a fine dry powder, or, with additional water, pumpable "milk of lime."

In addition to high calcium lime types, dolomitic quicklime and hydrated lime, containing magnesium as well as calcium compounds, are also produced.

Recent annual U.S. lime production was approximately 21 million tons — and growing. Lime is produced in 33 states and Puerto Rico, by companies ranging from large multi-facility corporations to small, family-owned operations.

"Lime is truly THE versatile chemical for today's market."

LIME: The Versatile Chemical

Lime is employed by a wide range of industries for a myriad of uses. It is used in many of the products and materials all Americans use every day, including paper, steel, sugar, plastics, paint, and many more. Lime is truly THE versatile chemical for today's market.

LIME: The Metallurgical Chemical

The largest single use of lime is in steel manufacturing, where it serves as a flux for removing impurities (silica, phosphorus and sulfur) in refining steel. It is used both in traditional basic oxygen furnaces (BOF) and the newer electric arc furnaces, as well as in secondary refining. Lime for use in the steel industry — both high calcium and dolomitic — must meet exacting specifications as to its physical and chemical properties. Without this high-quality lime, U.S. steel production would be crippled.

Lime is also essential to producing metals other than steel. Thus, lime is used to beneficiate copper ore, to make alumina and magnesia for use in aluminum and magnesium manufacture, to extract uranium, and to recover gold and silver.

"A growing use of lime is in the treatment of stack gases from industrial facilities, power plants, medical waste incinerators and hazardous waste incinerators."

LIME: The Environmental Chemical

As a product derived from the Earth, it is fitting that many of lime's uses also benefit the Earth. Indeed, the second leading use of lime is for environmental applications, involving air, drinking water, wastewater, and solid wastes.

Industrial, utility and mining operations rely on lime to comply with a host of environmental regulations. Lime is used to treat industrial and mining wastewater, in which it adjusts the pH of acidic waste, removes phosphorus and nitrogen, and promotes clarification. A growing use of lime is in the treatment of stack gases from industrial facilities, power plants, medical waste incinerators and hazardous waste incinerators. Lime absorbs and neutralizes sulfur oxides from these gases, helping to prevent acid rain, and also reduces emissions of hazardous air pollutants, including mercury.

Lime is especially vital to municipalities in meeting their environmental and public health responsibilities at a reasonable cost. First, lime is widely used for potable water softening and to remove impurities (such as lead) from drinking water. Second, it is a highly cost-effective method to treat sewage sludge. Third, stack gases from municipal incinerators are treated with lime to remove sulfur dioxide, hydrogen chloride and other contaminants.

As America's pollution control regulations become increasingly stringent, these applications of lime are sure to become even more important to our efforts to maintain a clean environment.

LIME: The Construction Chemical

In construction, lime's traditional use is in mortar and plaster, because of its superior plasticity, workability and other qualities. Lime's dominant construction use today is in soil stabilization for roads, airfields, building foundations and earthen dams, where it upgrades low quality soils into usable base and subbase materials. It is also used as an additive in asphalt, in which it improves the cohesion of the asphalt, reduces "stripping" and retards the aging process. Dolomitic lime is also used in the production of masonry mortar and stucco, and high calcium lime is used in the production of aerated autoclaved concrete.

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LIME: The Industrial Chemical

In addition to the uses described above, lime is essential to many other industries. For example, the chemical industry uses lime to manufacture sodium alkalies, calcium carbide, calcium hypochlorite, citric acid, petrochemicals, phenolates, stearates, naphthenates, nitrates, caseinates, calcium phosphates, propylene glycol, glycerin, and many others. These chemicals, in turn, go into virtually every product made in America.

An important and growing use for lime is in the production of precipitated calcium carbonate (PCC), which is used in the production of paper, paint, ink, plastic, and rubber.

The paper industry uses lime as a causticizing agent and for bleaching and, increasingly, for producing PCC for use in the paper manufacturing process.

Other key uses of lime include refractories, sugar refining, agricultural liming, glass making, and leather tanning.

". . . lime is substantially less expensive than potential substitutes for virtually all of its applications."

LIME: The Affordable Chemical

Lime is the only material that can perform so many functions at so reasonable a cost. Indeed, lime is substantially less expensive than potential substitutes for virtually all of its applications. In most cases, lime could only be replaced — if at all — by highly expensive synthetic materials.

In addition, lime is convenient to use. Lime is available in bulk or in bags, and can be shipped by rail, truck or barge. The distribution of numerous lime producers across the United States means that most users can find a nearby source of lime, keeping transportation costs to a minimum.

LIME: The Essential Chemical

The lime industry, although small compared to some other industries, is essential to the U.S. economy. It provides jobs to workers in 33 states, and represents a significant investment in land and equipment. (The equipment required to produce lime is massive, heavy and complex, making the lime industry very capital-intensive.) Even more important, because lime is basic to the manufacture of steel and numerous other products, millions of jobs are dependent upon lime's continued availability. Furthermore, without lime, the cost of virtually all consumer goods would increase due to the use of more expensive alternatives to lime.

The lime producers of the United States and Canada, represented by the National Lime Association, are committed to providing a steady supply of this essential chemical to industry, and ultimately, to the public.