CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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Arizona Department of Mines and Mineral Resources Mining Collection

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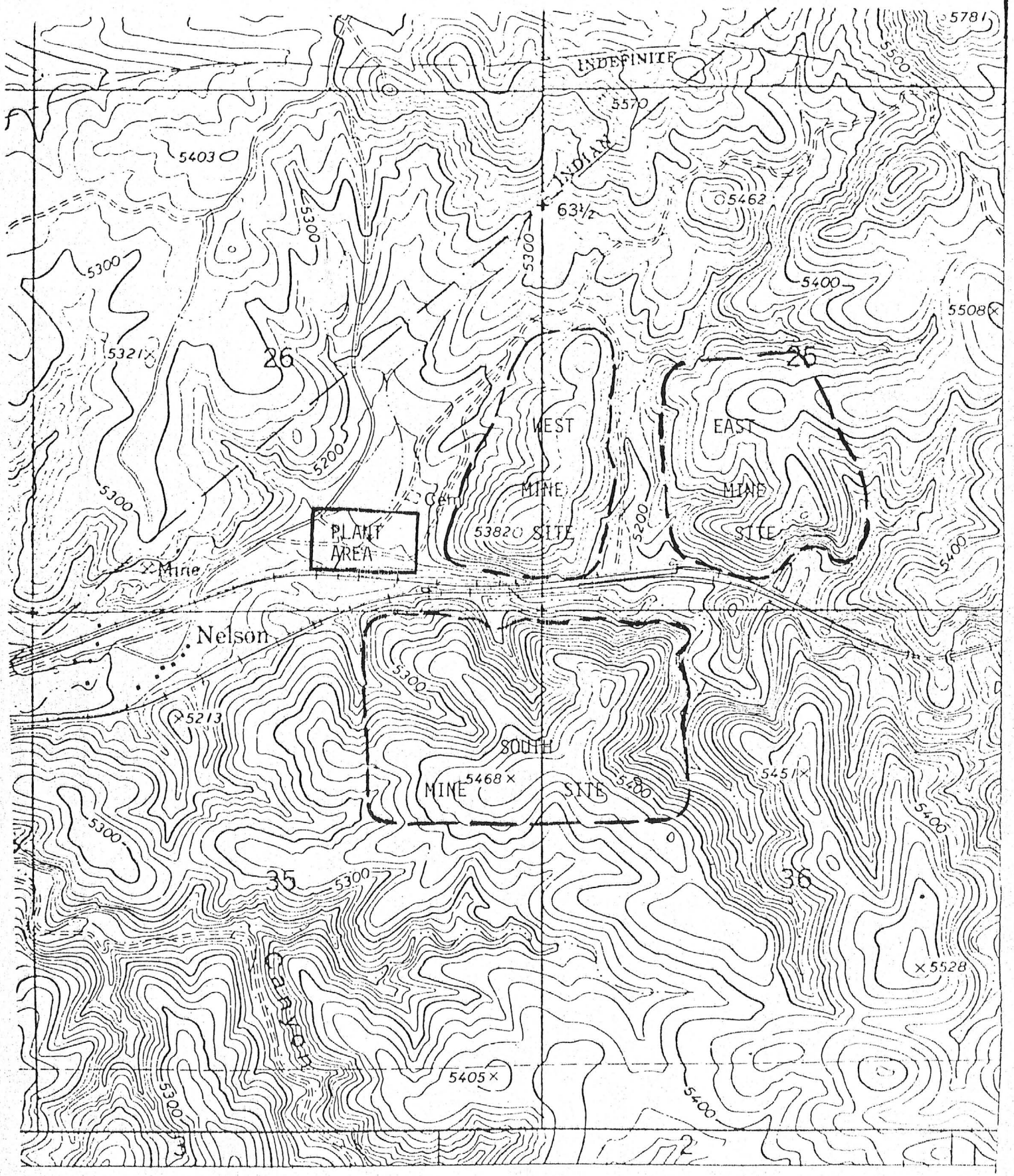
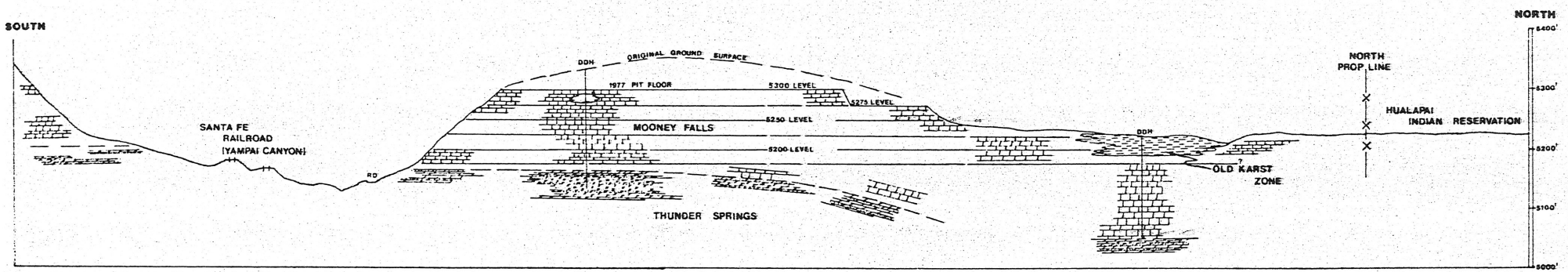


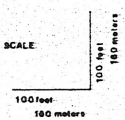
FIGURE 5: Map of Mine Sites at Nelson, Arizona
Showing Areas of Proven Reserves

FIGURE 6



TYPICAL MINE SECTION

WEST MINE SITE



MEMORANDUM

TO: John H. Jett, Director
FROM: Gerry Irvin, Mining Engineer
SUBJECT: Mine Visit - Nelson Plant (The Flintkote Company)
Date: October 19, 1977

Friday, October 14 at 3 p.m., stopped at Nelson Plant to check on operations. The new manager, Mr. Tom Roberts, gave the field engineer a tour of the plant and explained the operations.

A recent coal dust explosion in the lime pre-heater had resulted in considerable damage with no injuries. As a result, by patching and rerouting and with a special permit to discharge lime dust, the plant was returned to operation.

The tour started in the manager taking his car and driving to the pit, then to the primary crusher (see brochure), then to the grinding and burning section. The Control Room and the storage where two grades are kept. Coarse kiln lime and ground lime.

The storeage is arranged so that rail cars on the Sante Fe Siding can be direct loaded. Incoming coal is dumped and stored. As it is used it is pulverized and then fed into the firing end. (See accompanying brochure for details). The present kiln 15' diameter is rated at 800 t.p.d. A new 1,000 t.p.d. - 17' diameter kiln is being assembled along with pertinent accessories, for production and storage.

Thought is being given to a further increase in capacity possibly by using some other method than rotary kiln.

Left the plant for Tucson at 4 p.m.

c.c.-G.W. Irvin

MEMO

GRAND CANYON QUARRY AND PLANT
(U.S. LIME PRODUCTS CORP.)

Sept. 22, 1961
TRAVIS P. LANE

Visited the quarry and plant on Sept. 22, 1961. The plant was operating at 80 TPD which is a near-normal rate. The principal product is pebble quick lime most of which is shipped to steel plants in Calif. Kaiser is the largest buyer, with substantial amounts going to Bethlehem at Vernon and Columbia at Torrance. Johns-Manville takes some powdered quick for blast furnace flux at Watson, Calif. In Arizona Bagdad take pebble quick, and Iron King and Cypress take hydrated lime.

Jim Curless is Supt., 14 men are employed in the plant and one in the office. The quarrying and crushing to plant feed (-1 5/8") is done by contractor working and stockpiling at intervals (usually about 2 months work provides plant feed for 1½ to 2 years.

MEMO

June 23, 1960

GRAND CANYON LIME CO.

Travis P. Lane

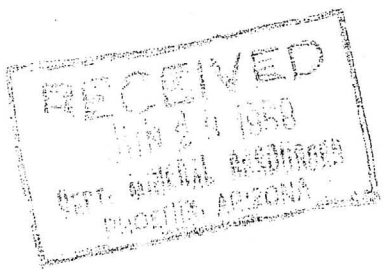
Visited the Nelson Lime plant of the U.S. Lime Products Division of the Flintkote Company. This was formerly the Grand Canyon Lime & Cement Co.

James Curless is Supt., P.O. Box 197, Peach Springs, Arizona. The plant makes 3 products; ground lime, lime hydrate and ground sized limestone and was operating normally at an average output of about 80 TPD. The average crew numbers 12 men. Quarrying is contracted and is intermittent, and aims at maintaining always a large stockpile of quarried material on hand.

SWIFT, SURE FREIGHT AND PASSENGER SERVICE IS A SANTA FE TRADITION

There was no intention of being late.
I had to get data from records in
Henderson, Nevada and Los, Angeles, Calif.

J. P.



STATE OF ARIZONA
DEPARTMENT OF MINERAL RESOURCES
MINERAL BUILDING, FAIRGROUNDS
PHOENIX, ARIZONA

May 1, 1958

Mr. Jim Curless, Supt.
Grand Canyon Lime & Cement Company
Box 197
Peach Springs, Arizona

Dear Mr. Curless:

I stopped by your office on April 21, but you were out. I was seeking basic information on your operation for our files. We try to keep informed on all phases of mining and milling in the state so that we may effectively serve the mining industry in the state.

The enclosed Mine Owner's Report form is for your convenience. Just omit any questions that do not apply to your operation. We would also like to know the number of people employed and the major items of equipment in your quarry and plant.

I hope it doesn't inconvenience you to answer this request. If we can be of service to you in any way, please don't hesitate to call on us.

Very truly yours,

LEE HAMMONS
Field Engineer

LH/H

Encl.

COPY

DEPARTMENT OF MINERAL RESOURCES
State of Arizona
MINE OWNER'S REPORT

Date May 3, 1958

1. Mine or Quarry Quarry

2. Location: Sec. ..... Twp. 24-25N Range 10W Nearest Town Peach Sprs. Distance 7 mi
Direction West Nearest R.R. AT & SF Distance On Main Line
Road Conditions Fair dirt road ½ mi to pavement west 3 mi east

3. Mining District and County: Nelson District Yavapai County

4. Former Name of Mine: Grand Canyon Lime & Cement Co.

5. Owner: United States Lime P roducts Corp.
Address: 2244 Beverly Blvd Los Angeles, Calif.

6. Operator: United States Lime Products Corp
Address: Same as above

7. Principal Minerals: Limestone

8. Number of Claims: Lode None Patented ..... Unpatented .....
Placer 20 Patented 20 Unpatented None

9. Type of Surrounding Terrain: Mostly bare rock hills with canyons and some low cliffs. Considerable scrub pine and juniper trees where soil is present.

10. Geology and Mineralization: Upper Mississippian-Lower Pennsylvanian sediments. Some minor volcanic intrusions. Some small manganese depositions in fractured zones which make the limestone worthless in the immediate vicinity. The only material of economic value is the limestone which is of very high purity having almost no silica or magnesium. The average $CACO_3$ content is above 99%.

11. Dimension and Value of Ore Body: The deposit extends for several miles north east and south. The thickness is about 1,000 ft. Due to remoteness of large markets the actual value in dollars is low. Were the deposit in southern Calif the value would be in billions of dollars.

Please give as complete information as possible and attach copies of engineer's reports, shipment returns, maps, etc. if you wish to have them available in this Department's files for inspection by prospective leasors or buyers.

(over)

12. Ore "Blocked Out" or "In Sight": On the one claim listed as producing there is about 2,000,000 tons available in the present quarry.

Ore Probable: No estimate has ever been made. It would run into billions of tons.

13. Mine Workings—Amount and Condition: One open quarry, good ground.

	No.	Feet	Condition
Shafts	None		
Raises	"		
Tunnels	"		
Crosscuts	"		
Stopes	"		

14. Water Supply: One well about 1,000' deep. Water is badly contaminated with oil probably natural in origin. Used for industrial purposes only. Capacity of well is approx. 20,000 gals per day. Domestic water is imported by rail.

15. Brief History: Actual start of operations is uncertain. It is sometime between 1885 and 1890. This is the second oldest continously operated industry in Arizona. One Phelps-Dodge operation outdates it. A great deal of lime from Nelson was used in the bonanza camps of Arizona and Nevada during the early years of the century. Nelson also furnished most of the lime used in the re-building of San Francisco after the earthquake and fire of 1906.

16. Remarks: The remoteness of markets is the only reason Nelson is not a major lime and limestone producer. This deposit has the highest average purity of any deposit in the U.S. We ship lime as far as Oregon and Washington, the product passing many closer lime plants en-route. Patented claims were patented in 1906. Most of the dwellings were built in 1904.

17. If Property for Sale, List Approximate Price and Terms: Not for sale

18. Signature: James Curless Supt.

GENSTAR

Cement & Lime Co.

215 Market Street, San Francisco, CA 94105
415 362-4224

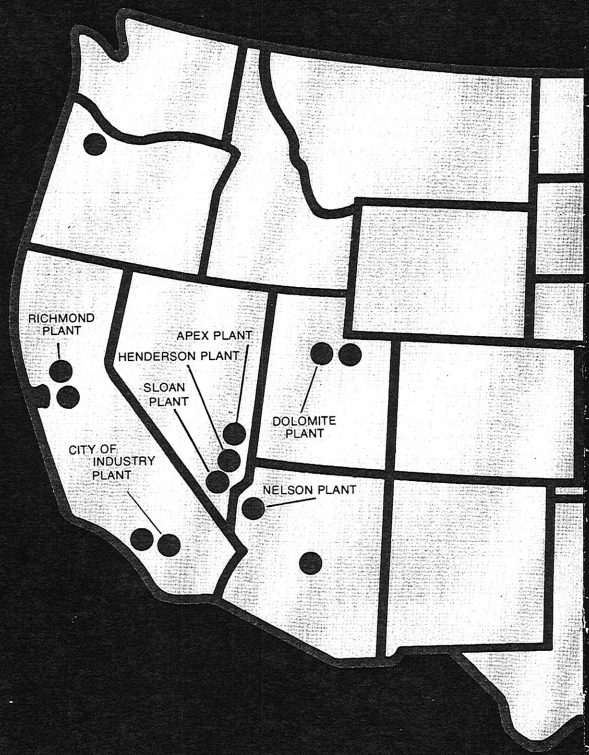
Other Offices:
Monterey Park, CA 91754
4700 Ramona Blvd., 213 265-5300

Portland, OR 97266
8304 S.E. Monterey, Suite 204, 503 659-4124

Salt Lake City, UT 84102
150 S. 600 E., 801 364-1886

Phoenix, AZ 85015
1777 W. Camelback Rd., Suite D-107, 602-263-9562

ANTS ● SALES OFFICES



Lime Plants and Products

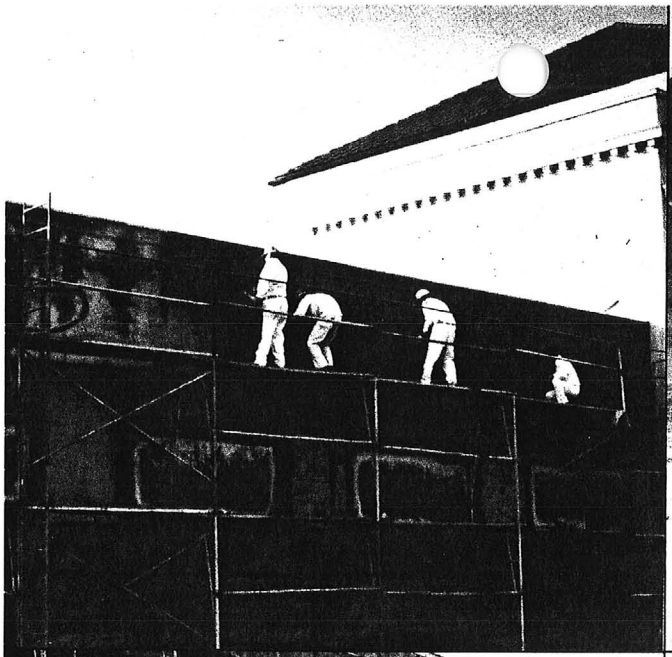
GENSTAR

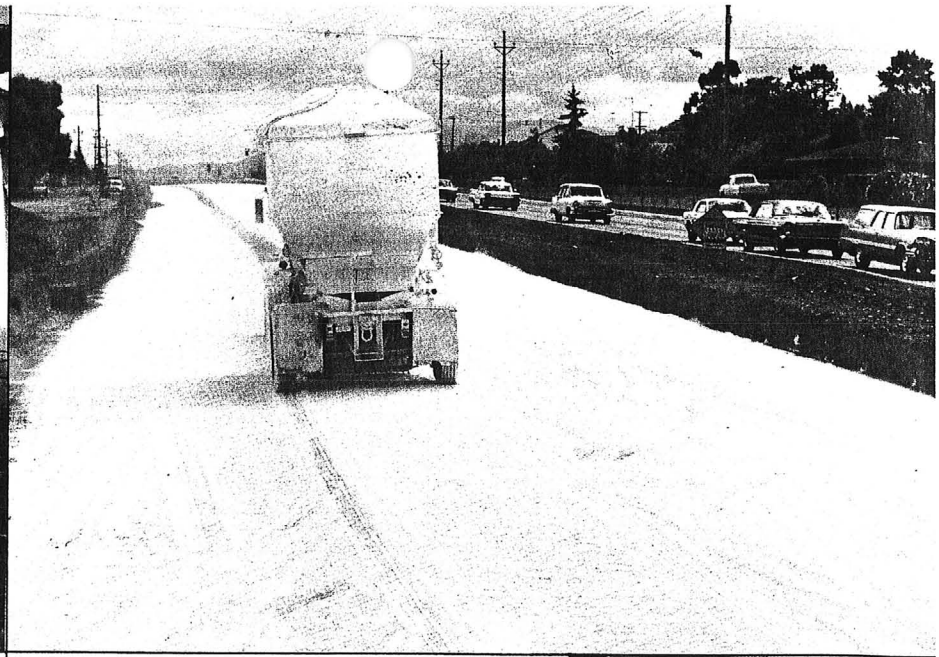
Cement and Lime Co.

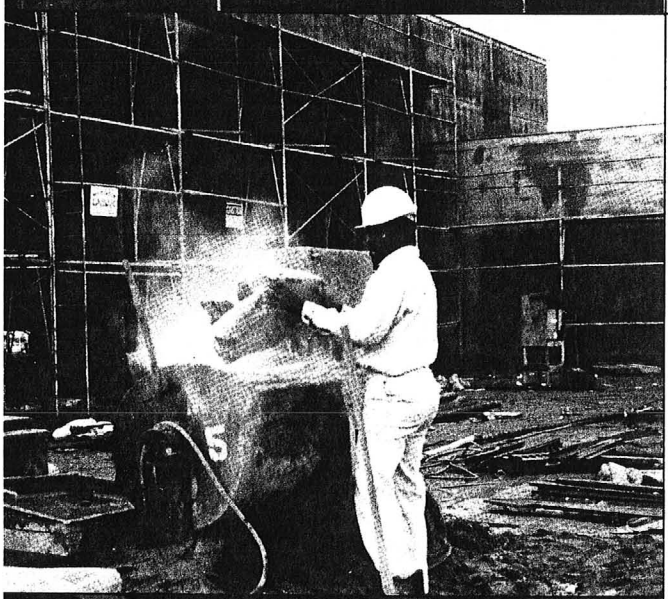
Clare Benson
District Sales Manager

GENSTAR
Building Materials

Genstar
Cement and Lime Company
Lime Products
1777 W. Camelback Rd.
Suite D-107
Phoenix, AZ 85015
602-263-9562







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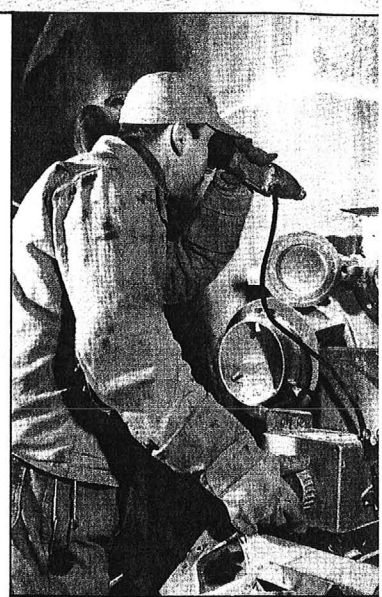
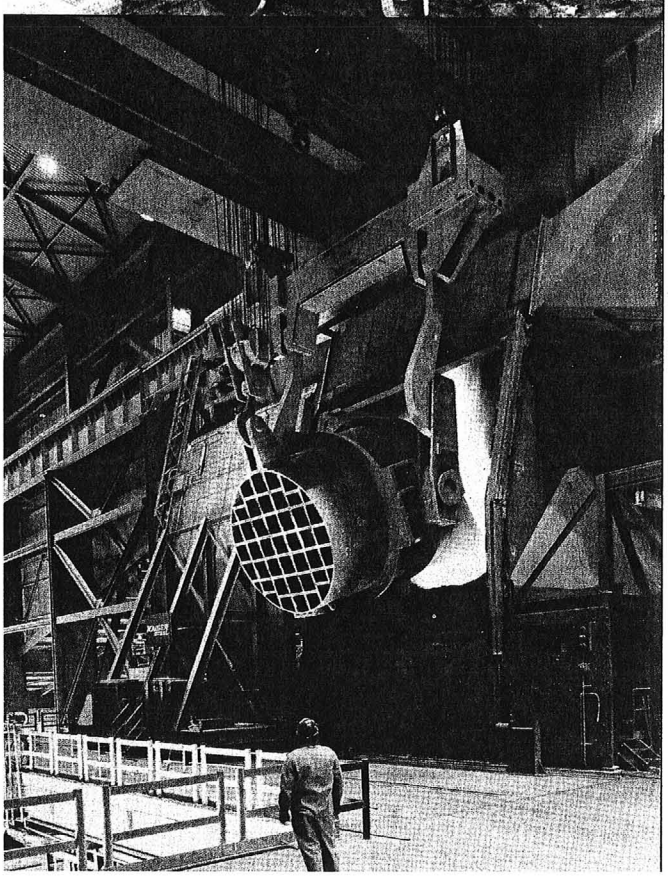
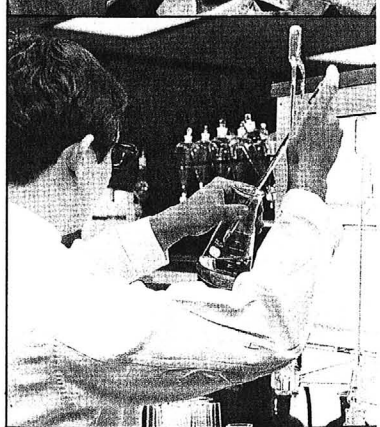
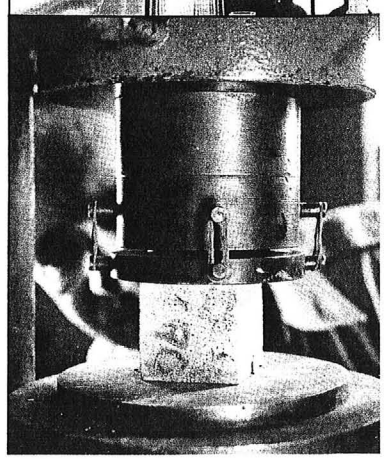








Lime Specifications and Reference Works

Designations of the American Society for Testing Materials (A.S.T.M.)

C5-79 —Quicklime for Structural Purposes

C206-79 —Special Finishing Hydrated Lime

C207-79 —Hydrated Lime for Masonry Purposes

C270-80 —Mortar for Unit Masonry

C593-69 —Fly Ash and other Pozzolans for use with Lime

C911-79 —Quicklime, Hydrated Lime and Limestone for Chemical Use

C50-78 —Sampling, Inspection, Packing and Marking of Lime and Limestone Products

C25-81 —Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

C110-76 —Physical Testing of Quicklime and Hydrated Lime

C400-81 —Testing Quicklime and Hydrated Lime of Neutralization of Waste Acid

C51-81 —Terms Relating to Lime

B202-77 —American Water Works Association Standard Spec.

FEDERAL SPECIFICATIONS

SS-L-351b —Lime; Hydrated for Structural Purposes

Water Chemical codes, 1982

PORTLAND CEMENT-LIME PLASTER[1] (Based on UBC Table #47F)

COAT	VOLUME[2] CEMENT	MAXIMUM VOLUME LIME PER VOLUME CEMENT	MAXIMUM VOLUME SAND PER COMBINED VOLUMES CEMENT AND LIME	APPROXIMATE MINIMUM THICKNESS	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	1	1	4	3/8"[3]	48 Hours[4]	48 Hours[5]
Second	1	1	4½	1st and 2nd Coats total ¾"	48 Hours	7 Days[6]
Finish	1	1[7]	3	1st, 2nd and Finished Coats 7/8"	—	[6]

[1] No plasticizing or air entraining agents shall be added.
[2] Type I, II or III Standard portland cement.
[3] Measured from face of support or backing to crest of scored plaster.
[4] Twenty-four hours minimum for moist curing of interior portland cement plaster.
[5] Twenty-four hours minimum interval between coats of interior portland cement plaster.
[6] Finished coat plaster may be applied to interior portland cement base coat after 48 hours.
[7] For finish coat plaster, up to an equal weight of dry hydrated lime (or lime putty) may be added to Types I, II or III Standard portland cement.

REFERENCE WORKS

"Lime—Handling, Application, and Storage"
Published by National Lime Association
Washington, D.C.

"Chemical Lime Facts"
Published by National Lime Association
Washington, D.C.

"Lime and Limestone"—Kribbs, N.V.S., and Gee, B. J.
Published by H. L. Hall Corp., Ltd.
Toronto, Canada

"Chemistry of Lime and Limestone"—Robert Boynton
Published by Interscience, New York, N.Y.

"The Lime Industries"
Published by U.S. Department of the Interior
Washington, D.C.

"Encyclopedia of Chemical Technology"
Published by Interscience Encyclopedia, Inc.
New York, New York

"The Making, Shaping and Treating of Steel"
Edited by Harold E. McGannon, United States Steel

"Lime Stabilization Construction Manual"
Published by National Lime Association
Washington, D.C.

"Wall Plaster: Its Ingredients, Preparation and Properties"
Bureau of Standards Circular No. 151

"Water Supply and Treatment — Hoover"
Published by National Lime Association
Washington, D.C.

"Exterior Masonry Construction"
Walter C. Voss
Published by the National Lime Association
Washington, D.C.

"Principles of Sewage Treatment"
Published by National Lime Association
Washington, D.C.

"The Use of Lime vs. Caustic Soda and Soda Ash as Acid Neutralization Agents"
Published by National Lime Association
Washington, D.C.

"Advanced Wastewater Treatment"
Russell L. Culp/Gordon L. Culp
Published by Van Nostrand Reinhold Company, New York, New York

All about Lime and GENSTAR *Lime Products*

This booklet is about lime and limestone — their chemical and physical forms. Their uses. Also, this is the story of Genstar Cement & Lime Company of San Francisco.

Genstar markets lime and limestone products throughout the western United States, western Canada, Alaska and Hawaii, and maintains sales offices in San Francisco and Monterey Park, California, Phoenix, Arizona, Salt Lake City, Utah and Portland, Oregon. Genstar lime products are also available for export.

Keeping pace with the ever-increasing demands for lime in pollution control, manufacturing, metallurgy and construction, Genstar has continued to broaden its complex of lime deposits and manufacturing plants throughout the western states. Existing plants have been modernized to provide superior quality control and shipping service.

Knowledgeable, experienced sales, production and chemical personnel are on hand in your area to give you immediate assistance in any problem or question regarding the handling and application of lime.

Air Pollution Control

One of the most serious atmospheric pollutants in today's world is sulfur dioxide (SO_2), produced at coal-fired power plants. Lime is an economical and effective way of removing these sulfur oxide pollutants.

Milk of lime slurries can and are being used either in flue gas wet scrubbers or in flash drier scrubbers. Either method has met with commercial acceptance, and in recent years the addition of dolomitic lime has improved desulfurization efficiencies further.

Genstar can provide a full line of industrial lime and technical assistance to meet the rapidly growing flue gas desulfurization market.

Pulp and Paper Manufacture

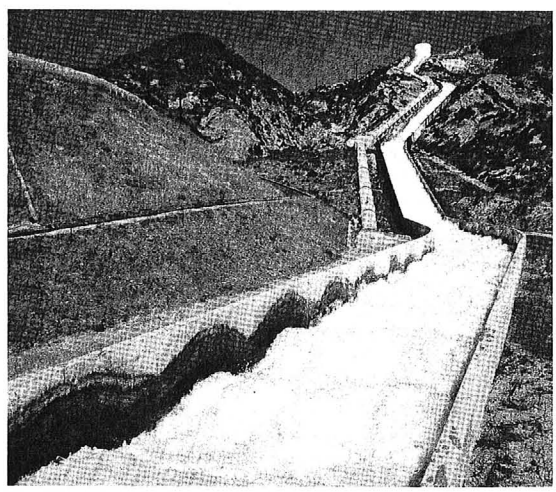
Sulfate Process — A major application of lime in pulp manufacture is as a causticizing agent in sulfate plants. Here the waste sodium carbonate solution is recovered and reacted with high-calcium lime to generate caustic soda for re-use in the process.

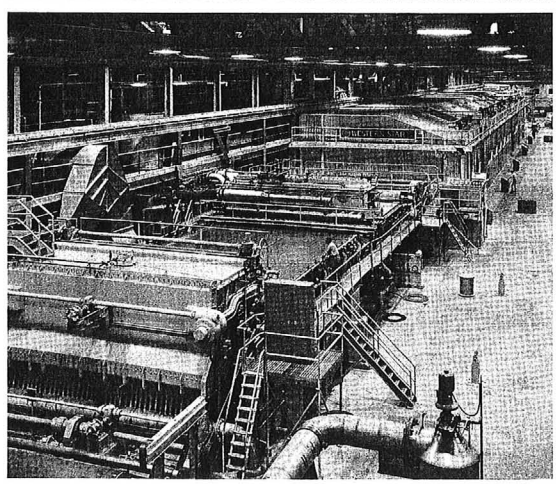
Other — Bleaching pulp (calcium hypochlorite • Strawboard manufacture • Treatment of pulp and paper mill wastes (coagulant and filtration conditioner).

Food and Food By-Products

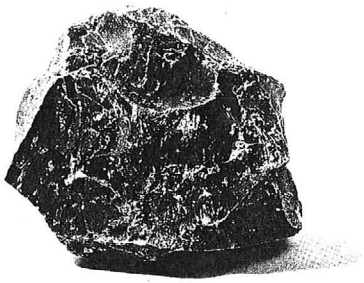
Sugar — In the production of sugar from both cane and beets, the crude sugar juice is reacted with lime. The result is an insoluble calcium sucrate which is filtered to remove phosphatic materials and undesirable plant acids. Subsequent reaction of the calcium sucrate with carbon dioxide produces insoluble calcium carbonate and purified soluble sucrose. The process can be repeated several times to assure greater purity of the sugar solution, which is then crystallized and packaged.

Other — Manufacture of dairy products (calcium lactate) • Manufacture of glue and gelatin • Manufacture of baking powder • Production of fruit juices • Treatment of food wastes (flocculation and coagulation) • Manufacture of animal feeds.

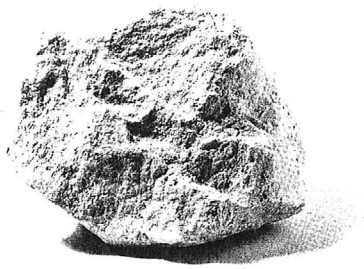




Origin of High Calcium and Dolomitic Limestone



GENSTAR HIGH CALCIUM LIMESTONE
Contains not less than 95% calcium carbonate ($CaCO_3$).



GENSTAR DOLOMITIC LIMESTONE
Contains approximately 55% calcium carbonate and 45% magnesium carbonate.

Classifying Limestones

Both high calcium and dolomitic limestones contain varying amounts of impurities such as silica and oxides of iron and aluminum. High grade commercial deposits usually contain not more than 3% total impurities. Except in certain exacting chemical uses, magnesium is not considered an impurity.

Although limestone is geologically common, high grade deposits low in impurities are rare. This is particularly true in western North America.

Genstar owns a number of deposits of both high calcium and dolomitic limestones, and operates producing facilities in Arizona, Nevada and Utah. All are ideally situated to serve the demands of growing western industry. The Company's patented and proved reserves are adequate for all foreseeable demands for hundreds of years.

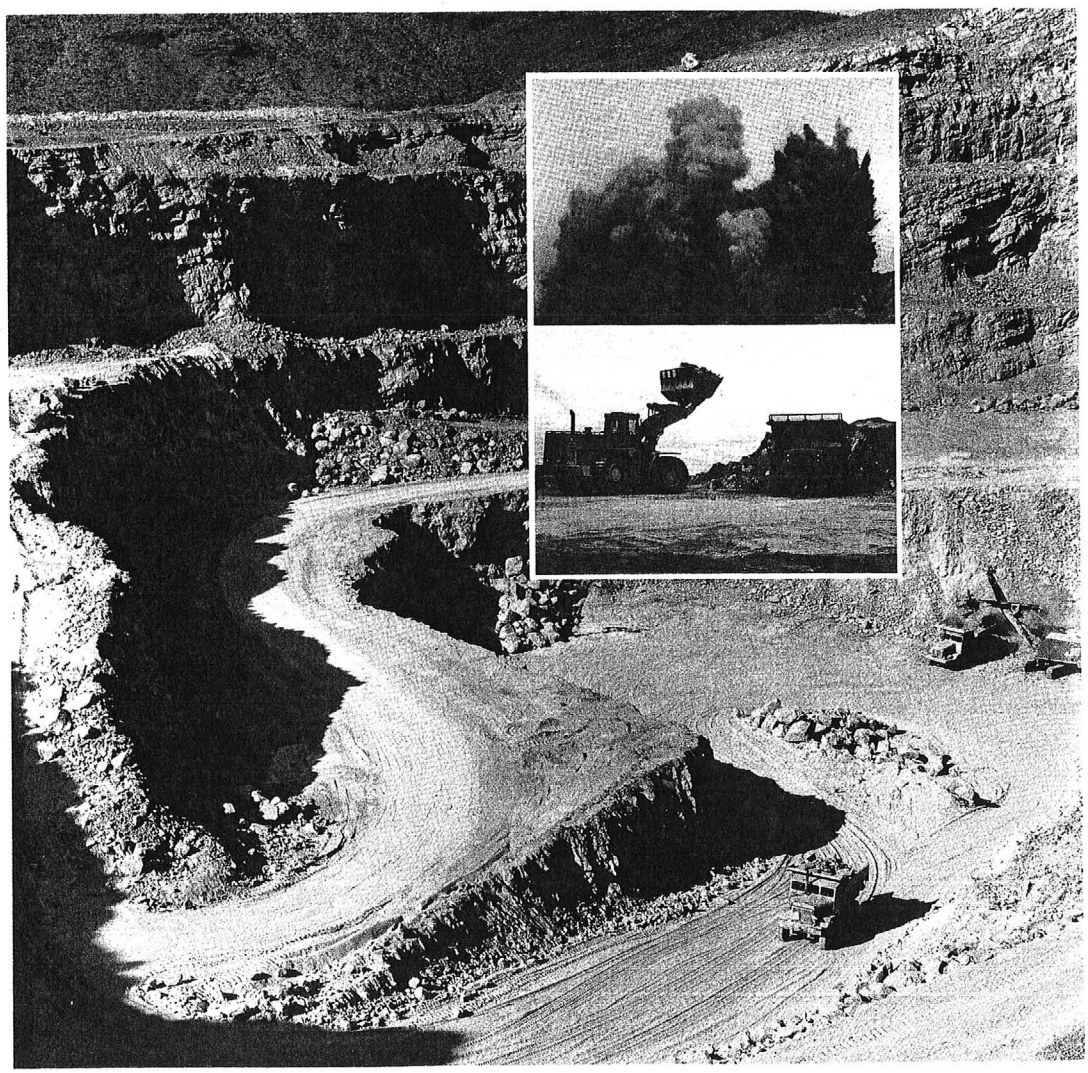
Lime is manufactured from either of two raw materials: high calcium or dolomitic limestone. The first is a relatively pure calcium carbonate; the second a combination of calcium and magnesium carbonates. Although limestone deposits are scattered widely over the earth's crust, stone of commercially suitable purity is found in comparatively few areas.

Millions of years ago, water high in carbonic acid dissolved the lime from igneous rocks and carried it to ancient lakes and inland seas. There it was deposited on the bottom, either by chemical reaction through evaporation and temperature change, or as shells of marine organisms. This process is still going on today and in several localities beds of oyster or clam shells are being dredged for their lime content.

Like high calcium limestone, dolomitic limestone can be formed by direct deposition; but geologists agree that its formation is usually the result of dolomization — the replacement of part of the limestone after consolidation, by infiltration of water rich in magnesium carbonate.

Consolidation of marine and lake deposits into thick beds, followed by elevation above water level during periods of land uplift, accounts for the present deposits of high calcium and dolomitic limestone being so widely distributed.

Movements of the earth's crust have in many cases tilted the deposits from their original horizontal bedding; in some cases intense folding and faulting have resulted in the original beds' standing on edge. When folding was particularly severe, the accompanying heat and pressure often completely metamorphosed limestone into marble.



Wastewater Treatment

The quality of our nation's water is an ever-growing concern. With the Environmental Protection Agency and others recommending increasingly stringent controls, Genstar is readying plants and lime products to meet the inevitable mandatory regulations.

Lime is necessary to, or at least amenable with, every sewage process. High-calcium lime is usually efficient in sewage treatment; however, dolomitic lime can be the economic choice for some applications.

Lime, used in a physical-chemical process, provides a treatment method that is uniformly manageable and dependable. Biological systems can be negated by weather or overwhelmed by pollutants too strong for the bacteria to cope with, but lime can be made to counteract contaminants regardless of concentration or weather. And, unlike lime substitutes such as alum and ferric chloride, lime does not add salts to the effluent, nor otherwise create contamination of its own.

Because of this benefit, accidental over-dosage becomes relatively unimportant. Excess lime simply reacts with the ever-present carbon dioxide in the air to revert to its original carbonate form.

Although, in some sewage-treatment processes, the quantity of lime needed may be higher than that of its substitutes, the over-all operating advantages of lime use can result in the least expensive process of all.

Lime is easy to handle, transport, store and utilize. The user can buy it as quicklime, and add water at any point to form a hydrated lime slurry. Or Genstar can furnish it as hydrated lime — a dry powder — which can similarly be converted into a slurry.

After doing its work, any remaining hydrated lime simply reacts with the CO_2 of the air, and reverts to the chemical composition of the original limestone rock, which can be used all over again. Such modern sewage-treatment plants as the one at South Tahoe, California, have lime-recovery as a vital part of their operation.

No biological process, no other chemical process, provides such an ideal — and consummately efficient — method of wastewater treatment as lime.

Water Treatment

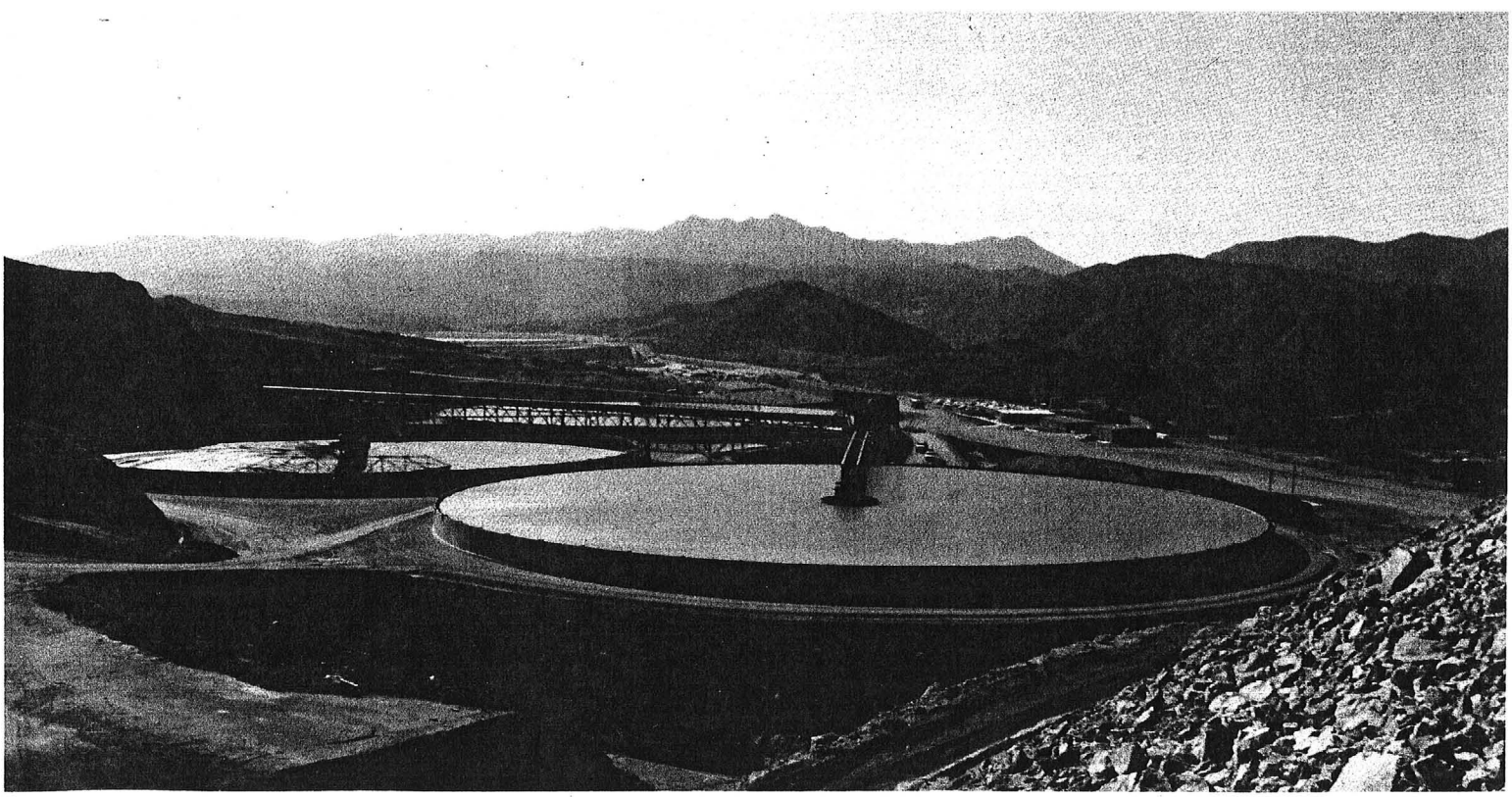
Purification — By adding an excess of lime to water and retaining the water in contact with lime for 24-48 hours, it is possible to purify the water against bacteria. This application of lime is employed where "phenolic water" exists since chlorine treatment tends to produce an unpalatable water due to the phenol present. This process is called "excess alkalinity treatment."

Neutralization — Lime is used to neutralize acid water and thus impede corrosion of pipes and lines. Further, it is used to correct corrosive waters containing excessive amounts of carbon dioxide. The lime absorbs the CO_2 and forms calcium carbonate which provides a protective coating on the inside of water mains.

Softening — In water softening, the function of lime is to remove the temporary (bicarbonate) hardness from the water. Where only temporary hardness exists, it is used by itself. Where there is both temporary and permanent (sulphate) hardness, it is generally used with soda ash (lime-soda softening process).

Silica Removal — One of the most common methods of removing silica from water is through the use of dolomitic lime. The magnesium component of this lime is the active constituent in the silica removal.

Other — Municipal sewage pH control
• Neutralization of industrial trade wastes.



BASICITY FACTORS OF COMMON ALKALINE REAGENTS*

ALKALI	DESCRIPTIVE FORMULA	BASICITY FACTOR (CaO = 1.000)
Dolomitic quicklime	$CaO \cdot MgO$	1.110
High-calcium quicklime	CaO	0.941
Dolomitic normal hydrate	$Ca(OH)_2 - MgO$	0.912
Dolomitic pressure hydrate	$Ca(OH)_2 - Mg(OH)_2$	0.820
High-calcium hydrate	$Ca(OH)_2$	0.710
Sodium hydroxide (caustic soda)	$NaOH$	0.687
Dolomitic limestone	$CaCO_3 \cdot - MgCO_3$	0.564
Sodium Carbonate (soda ash)	Na_2CO_3	0.507
High-calcium limestone	$CaCO_3$	0.489

**A relative comparison of the alkaline availability for neutralization of acids. For example, dolomitic quicklime will neutralize 1.11 times as much acid as pure CaO, whereas soda ash will only neutralize .507 (or about ½) as much acid as pure CaO.*

NOTE: Magnesium limes such as dolomitic quicklime or dolomitic hydrated lime are considerably less soluble than calcium limes above pH 6.5.

Safety Information

DANGER – INJURIOUS TO EYES CAUSES SKIN IRRITATION

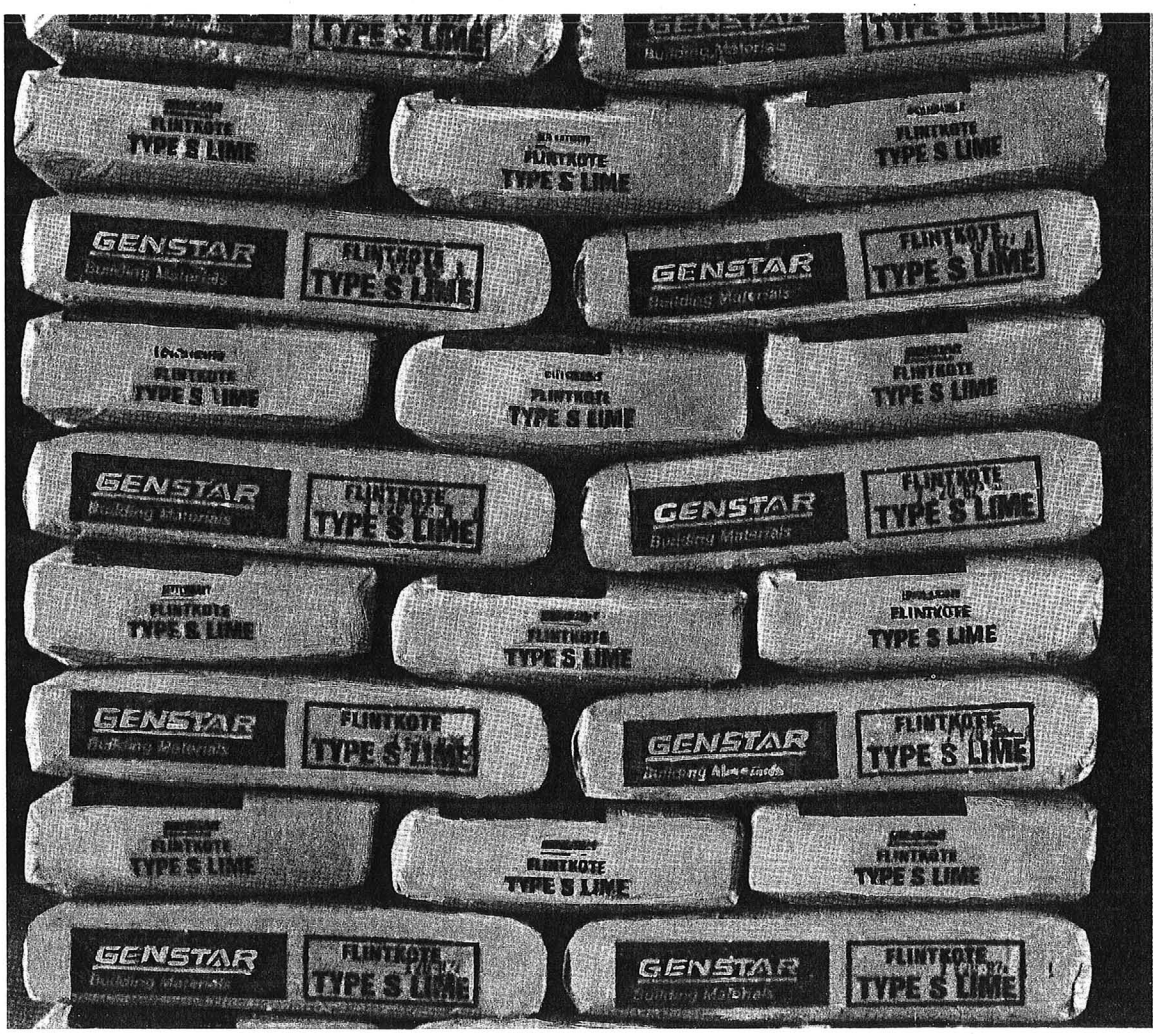
QUICKLIME AND HYDRATED LIME CAN BURN THE EYES RESULTING IN BLINDNESS. Wear dust proof goggles or other appropriate eye protection while using this product. If any lime gets into the eye, flush immediately with plenty of water for fifteen (15) minutes and see a doctor promptly.

QUICKLIME AND HYDRATED LIME CAN IRRITATE THE SKIN. Protect exposed skin with gloves, long sleeved clothing and other covering to avoid contact. In addition apply protective cream to the face, hand, neck, waist and ankles. In case of contact with skin wash immediately with water and get prompt medical treatment for burned areas.

QUICKLIME AND HYDRATED LIME CAN IRRITATE AND INJURE INTERNAL TISSUES IF INHALED OR INGESTED. Wear a NIOSH approved respirator while using this product.

For additional safety information read LIME DATA SHEET No. 241 published by the National Safety Council, 444 No. Michigan Avenue, Chicago, Illinois 60611. Material Safety Data Sheets are available upon request.

KEEP OUT OF THE REACH OF CHILDREN



GENSTAR
LIME PRODUCTS

CALIFORNIA PLANTS
High-Calcium Hydrated Lime, bags or bulk
High-Calcium Quicklime

NEVADA PLANTS
High-Calcium Limestone
Dolomitic Limestone
High-Calcium Quicklime
Dolomitic Quicklime
Type S Hydrated Lime

ARIZONA PLANTS
High-Calcium Limestone
High-Calcium Quicklime

UTAH PLANTS
Dolomitic Limestone
Dolomitic Quicklime
Type S Hydrated Lime

Uses of Lime

Directly or indirectly, limestone and its derivatives, quicklime and hydrated lime, are probably employed in more industries than any other substance. Quicklime and hydrated lime can be easily and safely handled, and they are the cheapest strong bases known.

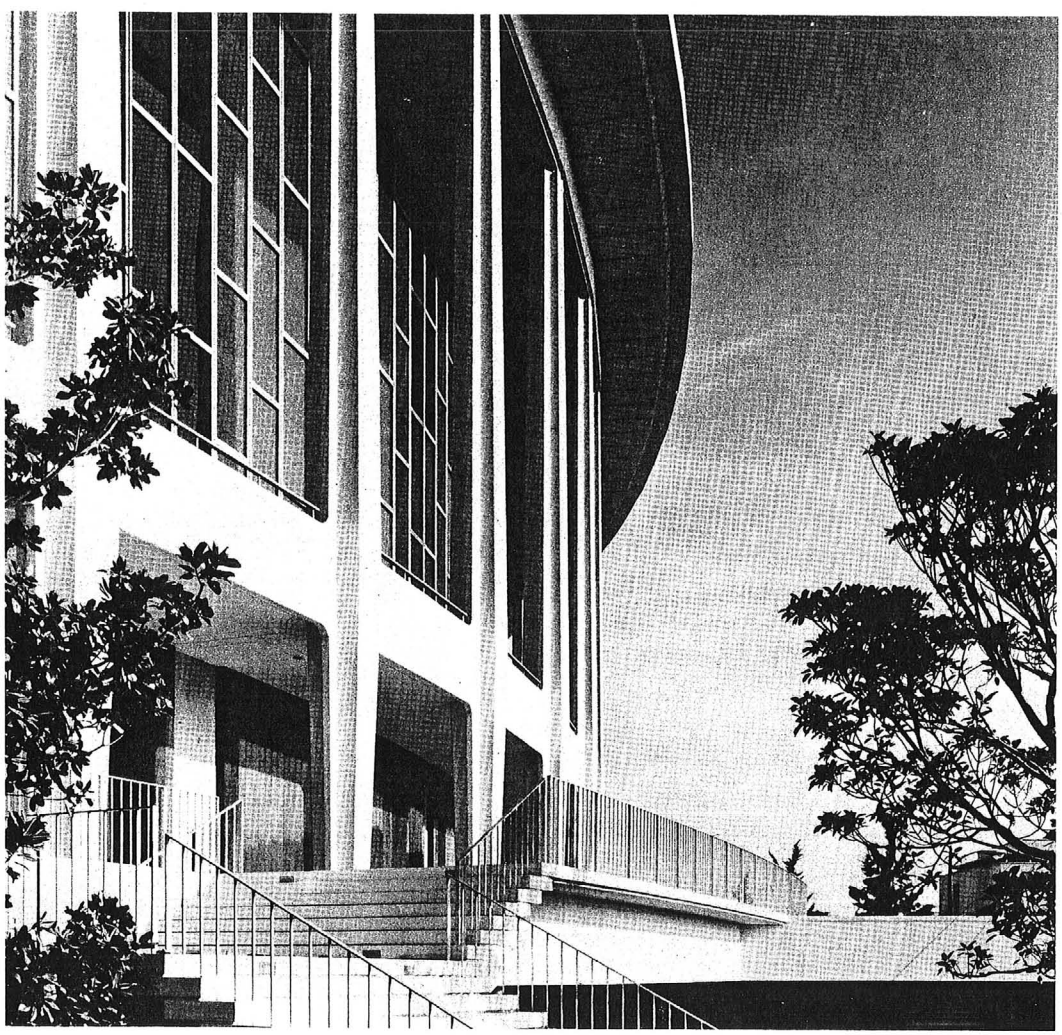
Lime is a very strong base: 30 pounds of it is stronger than 40 pounds of sodium hydroxide. It is not a readily soluble material but it has high available alkalinity.

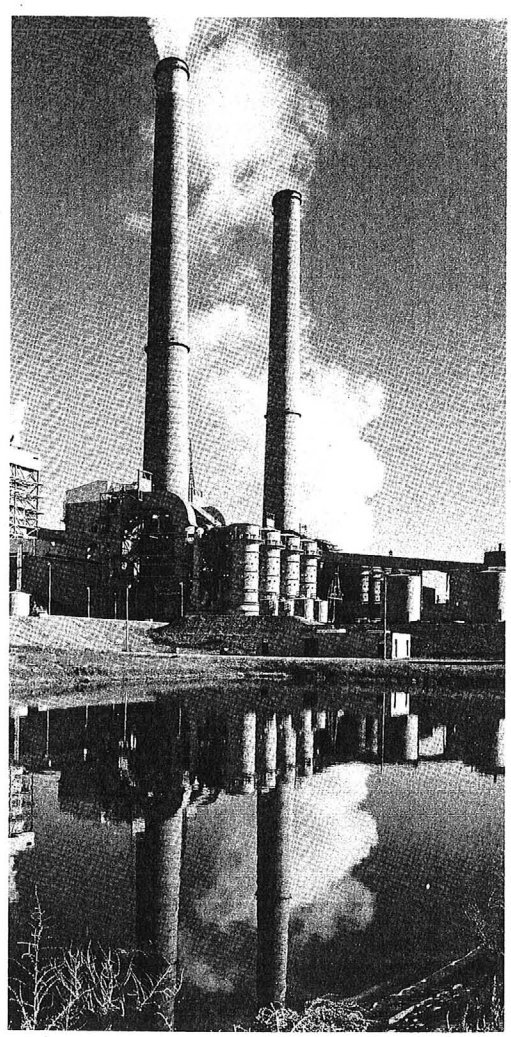
Milk of lime is a mixture of lime-saturated water and lime in suspension. As the lime in solution enters into any reaction, solution pressure immediately brings the water to saturation from the lime in suspension, and thus the overall effect is the same as if the lime were all dissolved originally. Practically all chemical processors make use of lime that has been slaked to the hydroxide and made into milk of lime. It is recommended whenever possible that quicklime be pre-slaked with the optimum amount of water to avoid "drowning" or "burning" in order to develop the highest slaking efficiency before thinning out to a milk of lime.

Quicklime is in a sense a perishable product, absorbing moisture and carbon dioxide from the air. Consequently the user should take all possible precautions to provide proper storage in order to minimize air contact, particularly in humid climates.

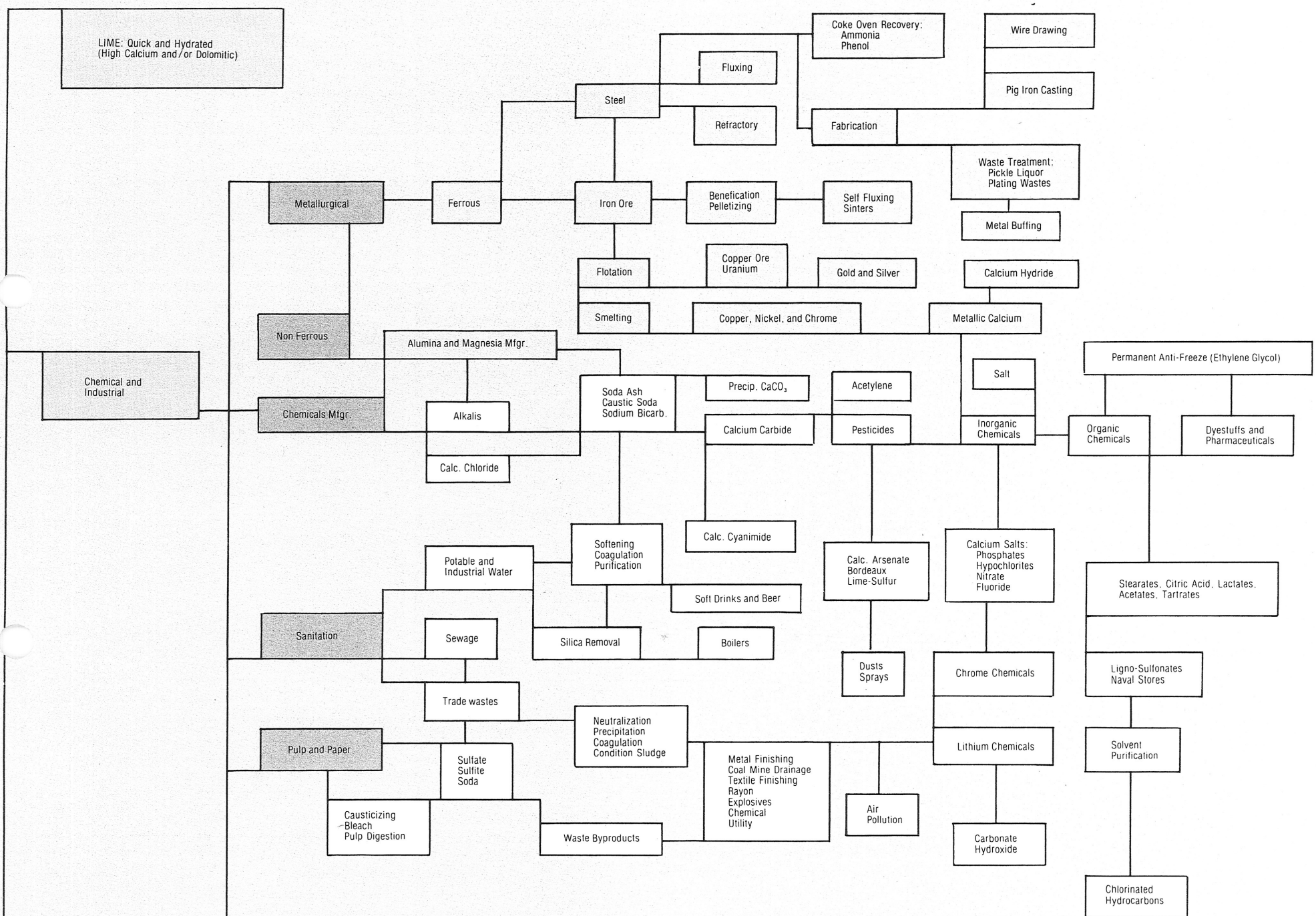
Hydrated lime is preferred by many industries because it is already properly slaked, is conveniently packaged and will not readily deteriorate when properly stored.

On the succeeding pages the many uses of lime in industry are described.





LIME—THE UNIVERSAL ADDITIVE | Users of quicklime and hydrated lime form a cross-section of industry.



GENSTAR LIME PRODUCTS

UTAH PRODUCTS

chemical analysis

PRODUCT	Acid Insol.	Iron Oxide Fe_2O_3	Aluminum Oxide Al_2O_3	Magnesium Carbonate $MgCO_3$	Calcium Carbonate $CaCO_3$	Calcium Oxide CaO	Magnesium Oxide MgO	Magnesium Hydroxide $Mg(OH)_2$	Calcium Hydroxide $Ca(OH)_2$	Moisture H_2O	ASTM Avail. Lime %
Dolomitic Limestone	1.0	.10	.3	44.0	55.0						
Dolomitic Quicklime	.8	.20	.7		1.5	56.0	40.0		1.5		
Type S Hydrated Lime	.5	.20	1.0		2.0		1.0	40.0	56.0	.5	

physical analysis

PRODUCT	Plasticity Index ASTM C-110	Yield Cu. Ft. Putty Per Ton	Yield Cu. Ft. Putty Per Cu. Ft. Lime	Yield Cu. Ft. Putty Per 50 Lb. Bag	Setting Rate to ½ Vol. in Min. ASTM C-110	Density Lbs./Cu. Ft. (Loose)	Specific Gravity
TYPE S Hydrated Lime	450 (immediate)	56	1.20	1.25	420	25	2.22

sieve analysis
(Percent Passing)

PRODUCT	6M	10M	16M	20M	30M	48M	65M	100M	150M	200M	325M
TYPE S Hydrated Lime				100	99.6	99	98	96	90	86	79

REPRESENTATIVE ANALYSES shown above are typical analyses at the time of shipment, based on averages. Genstar Lime products meet all existing U.S. Government specifications and ASTM standards. Test results determined by ASTM procedures.

CHARACTERISTICS OF QUICKLIME AND HYDRATED LIME

	Quicklime	*Hydrated Lime*
Formula	CaO	$Ca(OH)_2$
Molecular Weight	56.1	74.1
Physical State	White solid	White powder
Particulate Size	Pulverized to lump	Powder, 100 to 200 mesh
Bulk Density, lb./cu. ft.	55 to 65	25 to 50
Specific Gravity	3.2 to 3.4	2.3 to 2.4
Affinity for Water	Reacts quickly to form $Ca(OH)_2$ with heat of formation, 490 Btu/lb.	Absorbs H_2O and CO_2 from air to form $CaCO_3$
Solubility	Slightly, varies inversely with temperature	Slightly, varies inversely with temperature
Stability in Storage	In multi-walled bags, max. 60 days	Up to three months, in dry storage.
pH of Saturated Solution	12.4	12.4

PRODUCT SIZES

	ARIZONA	CALIFORNIA	NEVADA	UTAH
High-Calcium Limestone	2" x ⅜" —⅜"		6" x 3" 1¾" x ⅜" — ⅜"	1¾" x ⅜" — ⅜"
Dolomitic Limestone			1¾" x 7/16" 7/16" x 3/16" —3/16"	1¾" x ⅜" — ⅜"
High-Calcium Quicklime	—2" —½" —⅜" —⅛"	— ⅜" ⅜" x ⅛" — ⅛"	— 1¾" — ⅞" —⅜" —⅛"	
Dolomitic Quicklime			— 1¾" — ⅜" — 8 Mesh	— 1¾" — ⅜"

Inquiries are invited should material be required to meet size specifications not shown.

Deposits and Manufacturing Facilities

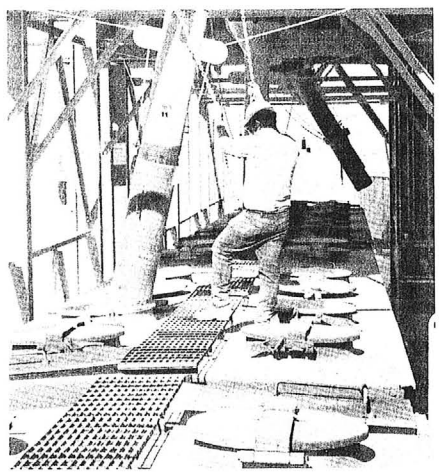
Two factors are of vital importance in determining the different chemical and physical characteristics important to industry in the selection of a lime product. One is the nature of the raw materials available; the other is the method used and the quality control standards exercised in converting this raw material into the final product.

Genstar obtains limestone from four extensive high grade deposits — two in Nevada, one in Utah and one in Arizona. Modern processing plants are operated at or near these raw material sources.

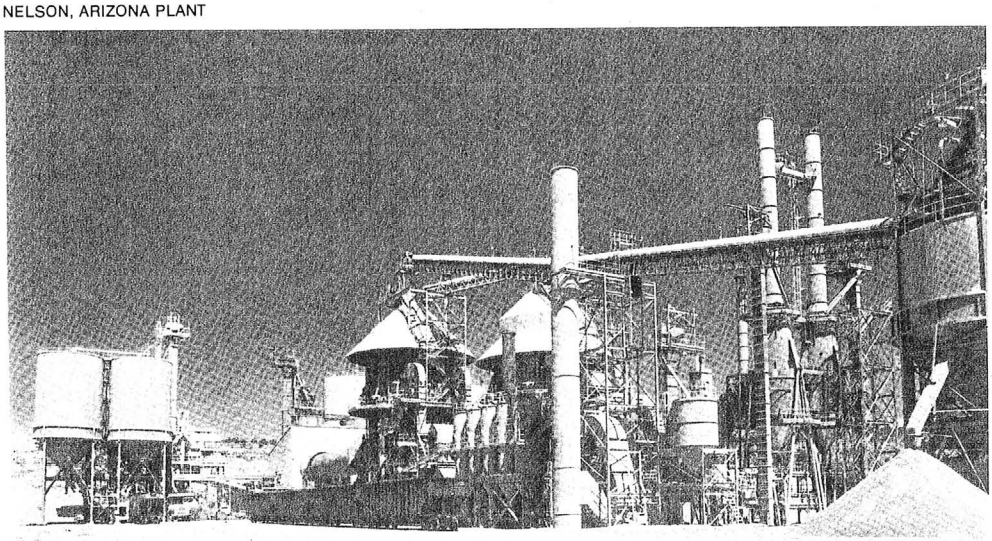
Additional processing plants have been established at City of Industry in Los Angeles County and at Richmond in the San Francisco Bay Area. These plants facilitate service in two of the nation's largest building and manufacturing centers.

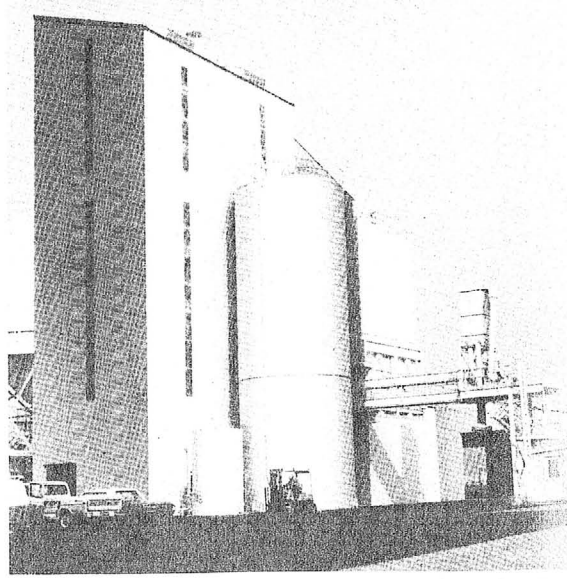
The Company has grown with the industries it serves. As new markets are created (such as soil stabilization and air, water and sewage pollution control), Genstar Lime continues, through research and development, to expand its facilities to provide quality lime products for industry.

CARLOADING OPERATION



NELSON, ARIZONA PLANT





PROCESSING PLANT, CITY OF INDUSTRY

EARLY LOS ANGELES PLANT
AND SALES OFFICE, CIRCA 1928

Soil Stabilization

Lime for base, subbase and subgrade treatment of expansive clay soils — Engineers can reduce structural sections by lime treating in-place clay soils. Contractors can minimize costly excavation and replacement of submarginal clays by using small percentages (2½-4%) of quicklime or hydrated lime. Generally quicklime is used for ease of handling and economic advantages. Developers can save time and money. By lime-treating the soil, they can turn rain-sodden earth into a firm base and construction can continue. Costly maintenance problems can be reduced.

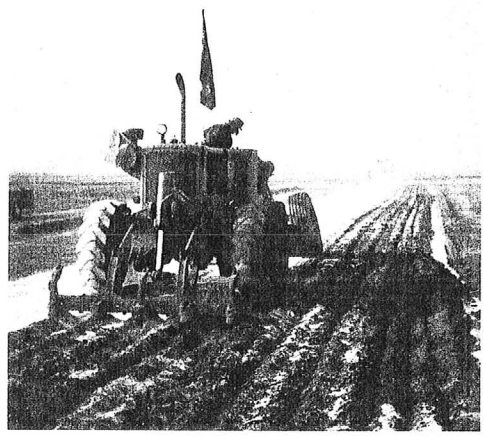
Benefits of lime — Reduces the plasticity index (P.I.) • Increases compressive and bearing values • Forms firm working table • Allows use of in-place soils • Makes clay soils friable and workable • Protects treated sections from moisture • Eliminates costly job delays • Saves time and money by rapid project completion.

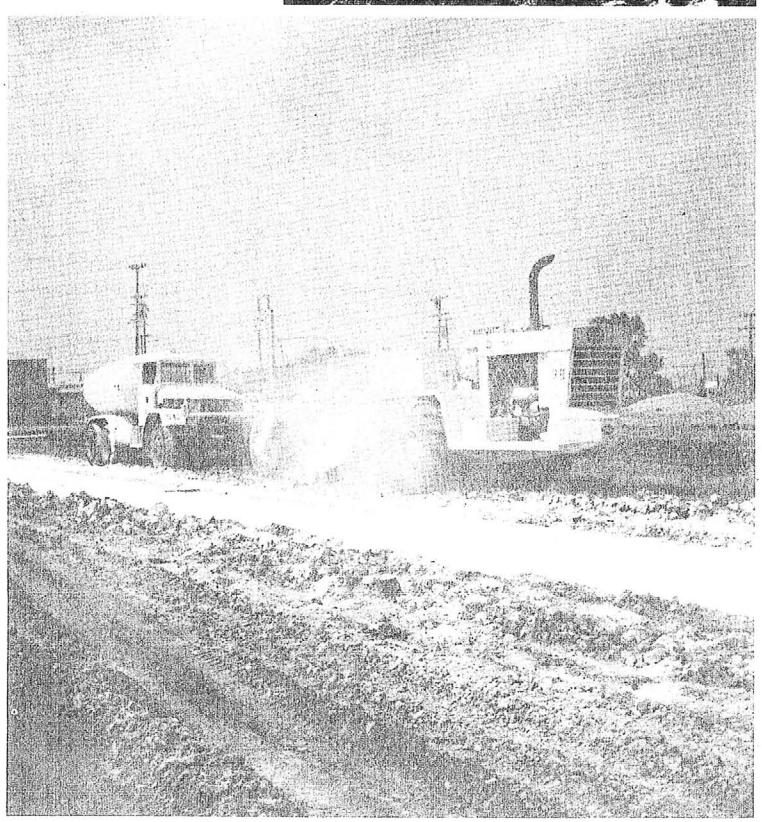
Roads and streets — In many cases the structural design can be reduced by the addition of a small percentage of lime. The ability of lime to upgrade expansive clay soils by changing its physical and chemical characteristics can save up to 20-40% of original costs. From freeways to roadways, lime can offer a low maintenance transportation medium. With the use of lime, jobs will progress more rapidly to completion and help hold costs down. Expensive and time-consuming excavation can be reduced by treating fine-grained clay soils with lime. Lime will make reaching optimum density easier with less compactive effort. Strength gains will increase many-fold and expansion will be reduced dramatically.

Soils that react with lime — Lime stabilization is primarily used with clay soils. Those soils with 35% or more passing a 200-mesh screen are generally amenable to lime treatment. Heavy expansive clays exhibit the most favorable results when lime stabilized. Usually the heavier the clay, the better the lime reaction. A soils engineer's pH test can tell how beneficial lime additions will be.

Lime upgrades aggregates for base and asphaltic concrete surfaces — Only a ½ to 1% addition of lime is needed to improve Sand Equivalent (S.E.) and upgrade aggregates for base courses. Quarries with fines problems now incorporate up to 1% lime at plantsite so that marginal aggregates can be used as a quality road base material. Many aggregates previously rejected because of clay content can be made readily acceptable without costly washing with chemicals or water.

Hydrated lime is used extensively throughout the Western United States in asphaltic concrete for longer life, improved stability and as an anti-stripping agent. Many states such as California, Utah, Colorado, New Mexico and Arizona use lime in upgrading of "hydrophillic" aggregates for use in asphaltic concrete surfaces. The lime-coated aggregate offers a positive bond with the asphalt; gives a longer lasting, flexible wearing course. By its nature the mixture then resists moisture, thus acting as an anti-stripping agent as well.

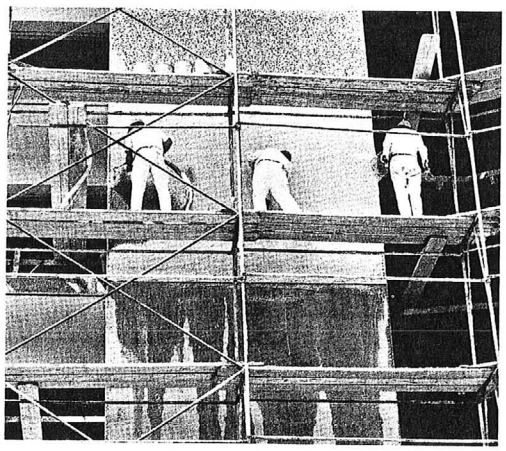




Genstar Type S Lime in Construction

Plaster — Genstar Type S Lime is a dolomitic hydrate made from dolomitic quicklime. Because dolomitic hydrate molecules are smaller than normal high calcium hydrate molecules and contain more surface area, the result is increased water retention, superior workability, pumpability, bonding, and less cracking in plaster walls.

Stucco — Similarly, for exteriors, stucco has been unsurpassed through the centuries. Now architects can blend improved stucco with modern design to provide colorful, functional buildings. Stucco provides an effective, low-cost method of facing homes and buildings. It is also used as a good economical method of modernizing old residences. A good stucco should contain an adequate amount of lime in order to add more elasticity, reduce shrinkage and cracking, improve workability, and yet give sufficient strength. Lime eliminates the need for asbestos in gun cement plaster and in stucco.

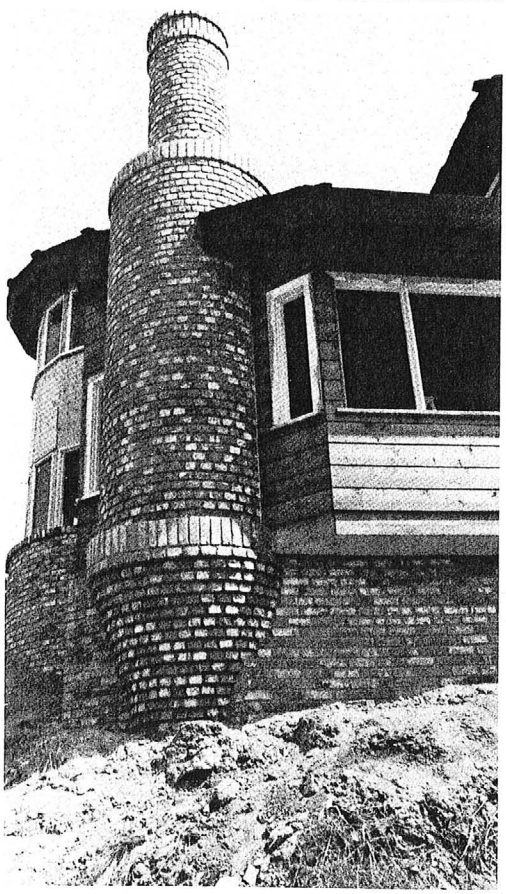


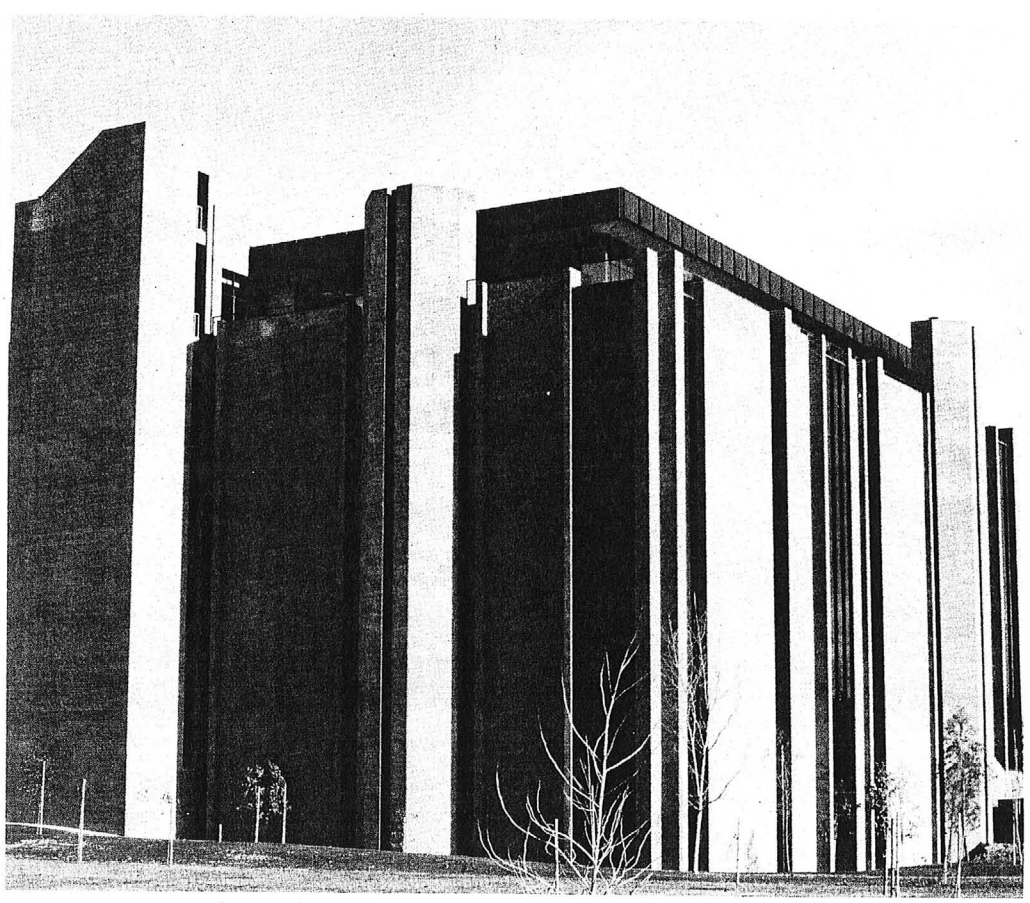
Marblecrete is in great favor with architects who are on the lookout for new media that permit a wide latitude on artistic effects. The proper amount of lime in the marblecrete bedding coat provides workability while controlling shrinkage to assure a true bond with the exposed aggregate.

Masonry & tile setting — Lime has been universally used for masonry since virtually the beginning of civilization. In fact, clay brick, stone and lime are the oldest permanent building materials. No combination of materials fulfills all requirements placed upon masonry mortar as well as, or as completely as, the proper proportions of portland cement and Type S hydrated lime. Type S Lime improves water retention, increases workability, increases shear value, bonding value, improves water tightness, reduces efflorescence, and minimizes volume change. The lifeline of any masonry structure is truly dependent on the quality of its mortar.

In the case of ceramic tile — which as often as not is working against gravity — proper lime mix in the bedding coat cannot be over stressed. Often the setting bed alone must hold the tile while the tile setter levels and grouts. Of equal importance is the result: a solid, waterproof monolith.

Other — Manufacture of sand-lime brick. Additive for the manufacture of concrete products. Manufacture of insulation materials.





Chemistry of Lime

The chemistry of lime is not complex. Lime is calcium oxide or a combination of calcium and magnesium oxides, in varying degree, formed by calcining (burning) limestone at a temperature high enough to drive off the carbon dioxide (CO_2) content.

The figure below shows the cycle about which the chemistry of lime revolves, as limestone is converted to quicklime, to hydrated lime, and back to limestone.

Dolomitic limestone follows the same cycle, substituting the symbol $CaCO_3$-$MgCO_3$ which represents the dolomitic stone. There is an important difference in one respect. When hydrating dolomitic lime to the usual dry powder at atmospheric pressure, only a small percentage of the magnesium oxide is hydrated and converted to the hydroxide form. To hydrate the remainder would require prolonged contact with water and is not commercially feasible.

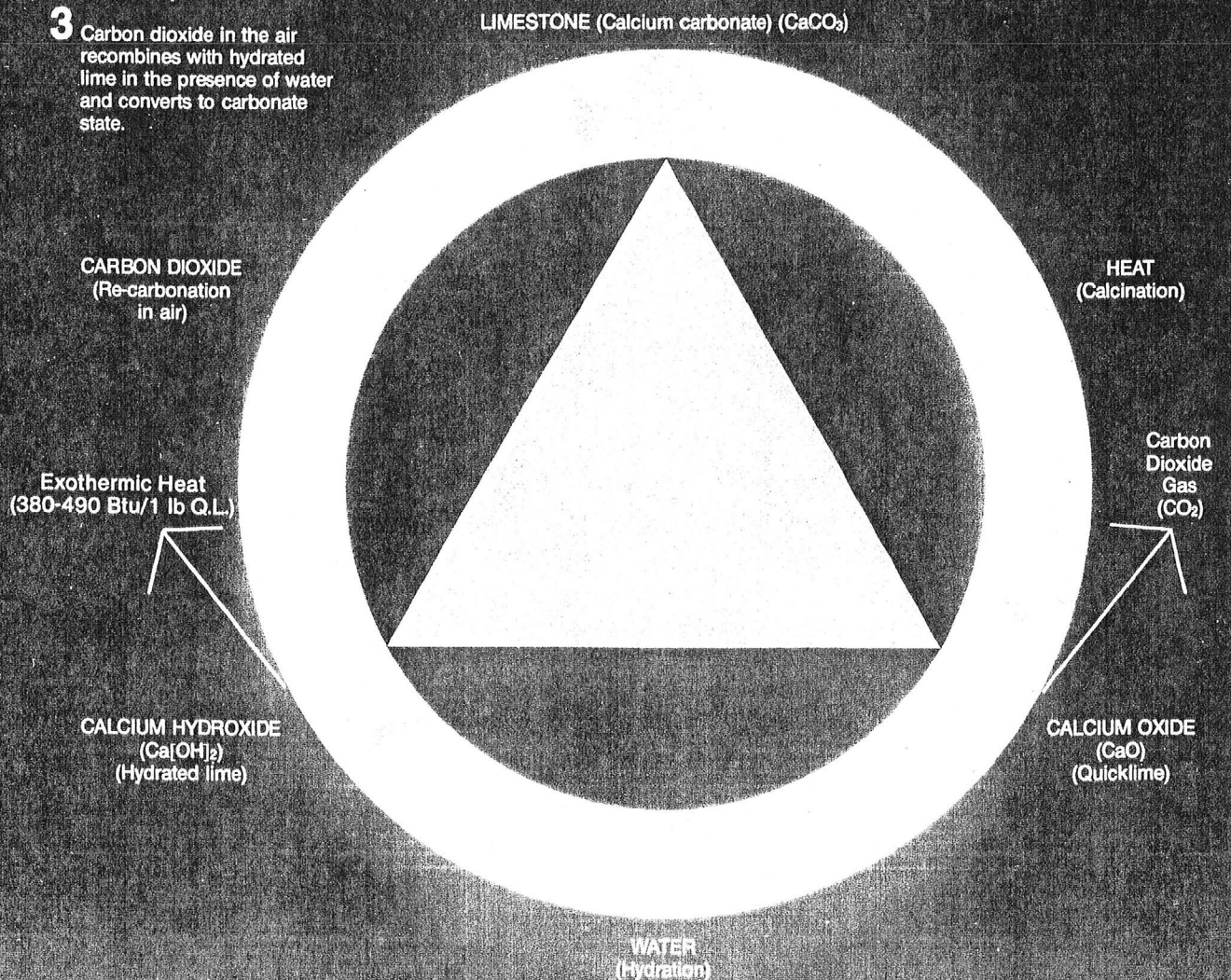
Complete hydration of magnesium oxides is accomplished by Genstar, however, under a continuous high-pressure system, and the resultant hydrated lime is marketed under the familiar TYPE S Lime designation. This product has achieved widespread popularity in the construction field because of its unique characteristic of attaining immediate plasticity in finish coat plaster, stucco and masonry mortar. This benefit eliminates the lengthy and costly process of soaking and aging necessary with normal dolomitic hydrated lime.

Limestone, quicklime and hydrated lime have many physical and chemical properties important to industry, including rate of slaking, suspension in water and settling rate in suspension.

THE LIME CYCLE

The use of heat, water and carbon dioxide transforms limestone into three distinct forms — all of which have many uses throughout industry.

1. Limestone is calcined (burned) to produce quicklime.
2. Quicklime and water react to produce hydrated lime.
3. Carbon dioxide in the air recombines with hydrated lime in the presence of water and converts to carbonate state.



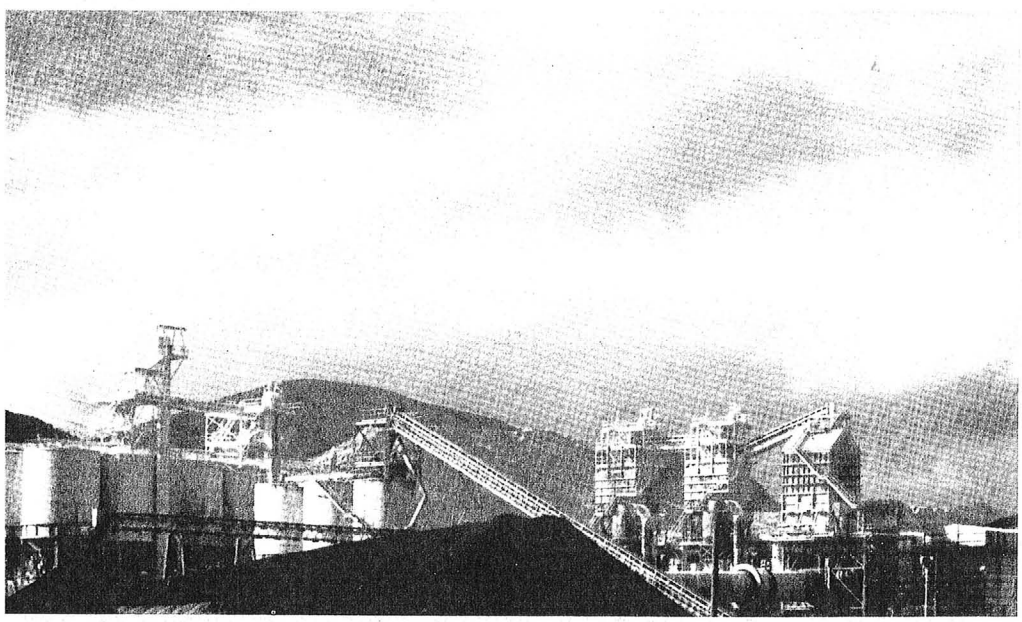
Arizona

Operations are at Nelson, Arizona — 65 miles east of Kingman on the A.T. & S.F. main line, just off U.S. 66. This newest Genstar plant, one of the largest ever constructed, can produce 1,800 tons per day of quality high-calcium quicklime. Engineers have estimated that this plant can provide a dependable supply of lime for more than 100 years.

Genstar is now shipping large quantities of lime and limestone throughout the Western U.S. from the Nelson facility. Storage silos with a capacity of 15,000 tons are utilized, and lime products are shipped by both rail and truck.

This new plant features two advanced style polygon shaped pre-heaters which make the kilns highly efficient.

These 1,000 and 800 tons-per-day rotary kilns are designed to use coal for fuel. Coal is not only a highly efficient fuel but the U.S. has abundant reserves to provide the plant with long term supply reliability.



APEX, NEVADA PLANT

California

In the Golden State are two almost identical hydrating and processing plants. The Richmond Plant in the San Francisco Bay Area serves Northern California, and the City of Industry Plant near Los Angeles serves the Southland.

Raw materials for both facilities come in rail cars from the Apex, Nevada and Nelson, Arizona plants. The high-calcium quicklime is delivered spurside for crushing, screening, hydration, finish milling and packaging — or to storage for bulk truck loading.

High-calcium products are produced at both plants. Quicklime and hydrate are sized according to customer specifications. Also, Stabil-Lime in either the quicklime or hydrate form is produced to meet the stringent California State Highway Dept. specifications for lime used in the stabilization of expansive clay soils.

All products are shipped by truck either in bulk, in palletized multiwall 50 lb. paper sacks or in sling bins.

Nevada

Three Genstar plants surround Las Vegas: Apex, 19 miles to the northeast; Sloan, 19 miles to the southwest; and Henderson, 13 miles southeast of the city. Rail or truck shipments can be made easily from any of the three. Apex and Sloan are on Interstate 15; Henderson is on the main Highway to Boulder City and points east; all are on the Union Pacific Railroad line.

A large deposit of uniform quality micro-crystalline high-calcium limestone is quarried at Apex. The crushing, sizing, calcining and storage facilities here are among the largest and most modern in the industry. Raw limestone is sized for sale or is calcined in 3 large rotary kilns. The resultant quicklime is shipped direct to customers by rail or truck. Live storage capacity for 5,000 tons of quicklime assures the industry of adequate quantities available for immediate delivery.

Dolomitic limestone for the Nevada operations comes from the Sloan quarry which has been described by the U.S. Bureau of Mines as the most extensive deposit of high grade dolomitic limestone in the western United States. A complete crushing and sizing plant at Sloan produces sized stone which is shipped either direct to customers or to the Henderson plant for further processing.

Henderson, the site of a large calcining, pulverizing and pressure-hydrating plant, has four rotary kilns with large bulk lime storage capacity. It is here that dolomitic limestone from Sloan is calcined and pressure-hydrated into the famous TYPE S Lime.

An automatic palletizer and new warehouse were recently added to facilitate the handling and shipping of TYPE S Lime. Additional quality control devices were also installed.

Utah

Genstar also operates a plant at Dolomite, Utah, 45 miles west of Salt Lake City. Dolomite contains a very large high grade dolomitic limestone deposit which is quarried by efficient, modern methods. The crushed, sized material is sold raw or is calcined in a rotary kiln and then pressure-hydrated to become TYPE S Lime for the construction industry.

* * *

Constant surveillance with state-of-the-art testing instruments assures strict quality control of all operations. Well-equipped laboratories provide means for constant checking of chemical and physical properties of the various products. On-site material handling facilities assure fast loading of rail and truck shipments.

STEEL
COPPER
SILVER
TRONA
MOLYBDENUM
URANIUM
PHOSPHATES
and OTHER METALS

Metallurgy

In the whole metallurgical field, lime—either as limestone or as quicklime in pebble form—finds its most extensive use as a flux in purifying steel. Whether used in a blast furnace, open hearth, basic oxygen, or electric furnace, lime is highly effective in removing such impurities as phosphorus, silicon, and sulfur, and, to a lesser extent, carbon and manganese. Generally, as the phosphorus content of the iron ore increases, the consumption of the lime correspondingly increases to tie up the phosphorus, as calcium phospate.

Both quicklime and hydrated lime are widely used in the flotation recovery and concentration of copper from copper bearing ores. Because of its low cost, lime is used as an alkalinity regulator and depressant (settling aid).

Quicklime is also purchased for use in the cyanide process at gold mines, for the recovery of trona at soda ash plants, and for neutralization and effluent treatment in silver, molybdenum and phosphate mining operations.

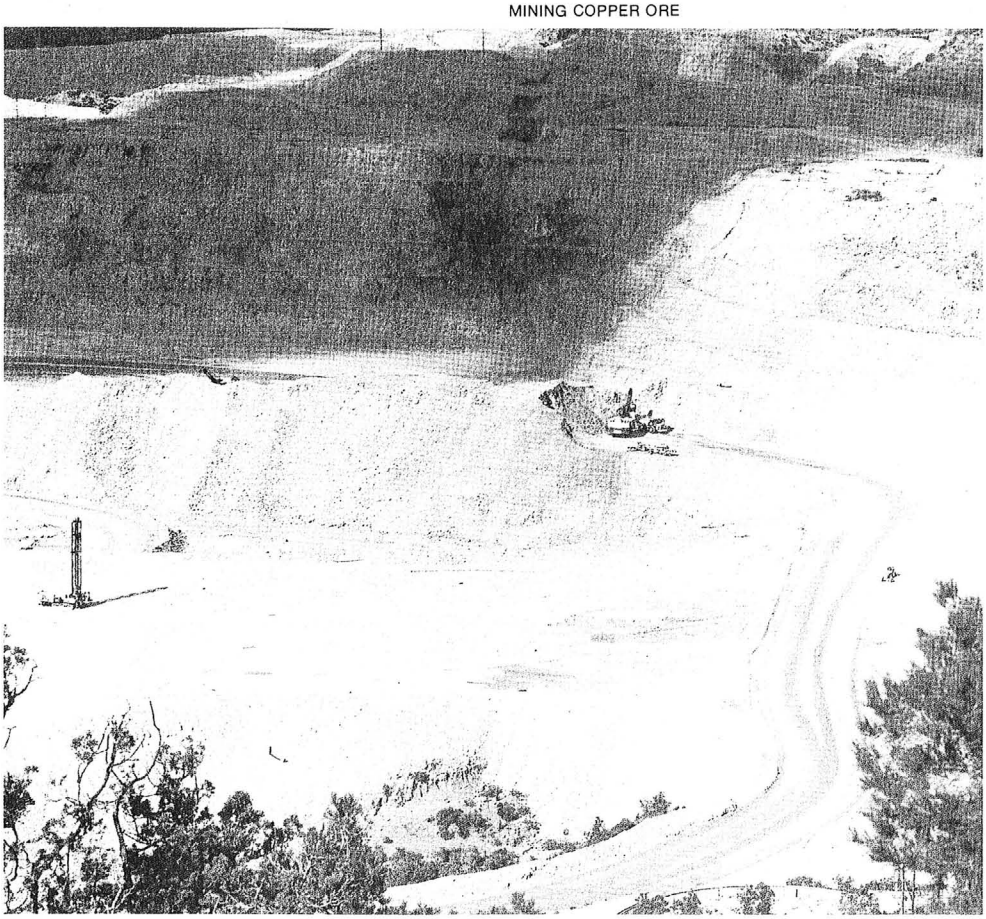
The United States is the world's leading copper producing country. Arizona consistently produces more copper than all other states combined. The Genstar plant at Nelson, Arizona is a convenient and reliable source for all of the lime needs of this industry in the Western States.

Noxious gas fumes of H_2S and SO_2 are present in smelting and refining of copper, zinc, lead and other non-ferrous ores. These gasses may be neutralized or removed by passing them through Milk of Lime to prevent atmospheric pollution and equipment corrosion. Milk of Lime is also one of the principle reagents for water treating. This provides a positive means of water reuse and conservation.

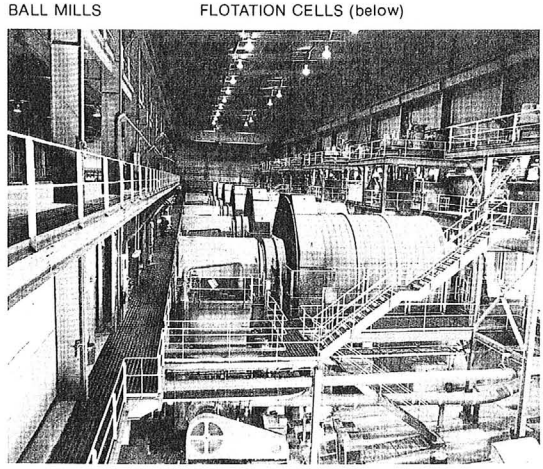
The uranium industry uses Milk of Lime for ore beneficiations and for neutralizing the acidic tailings effluent for safe disposal or reuse.

Lime is also used in the manufacture of magnesium, calcium carbide and alumina; manufacture of wire; coagulation and settling of slimes; refining vanadium ore.

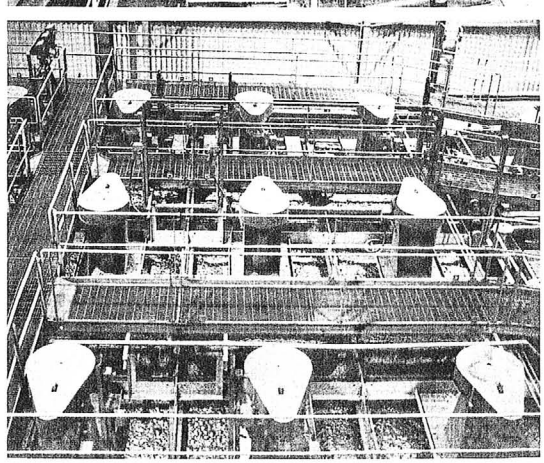
MINING COPPER ORE

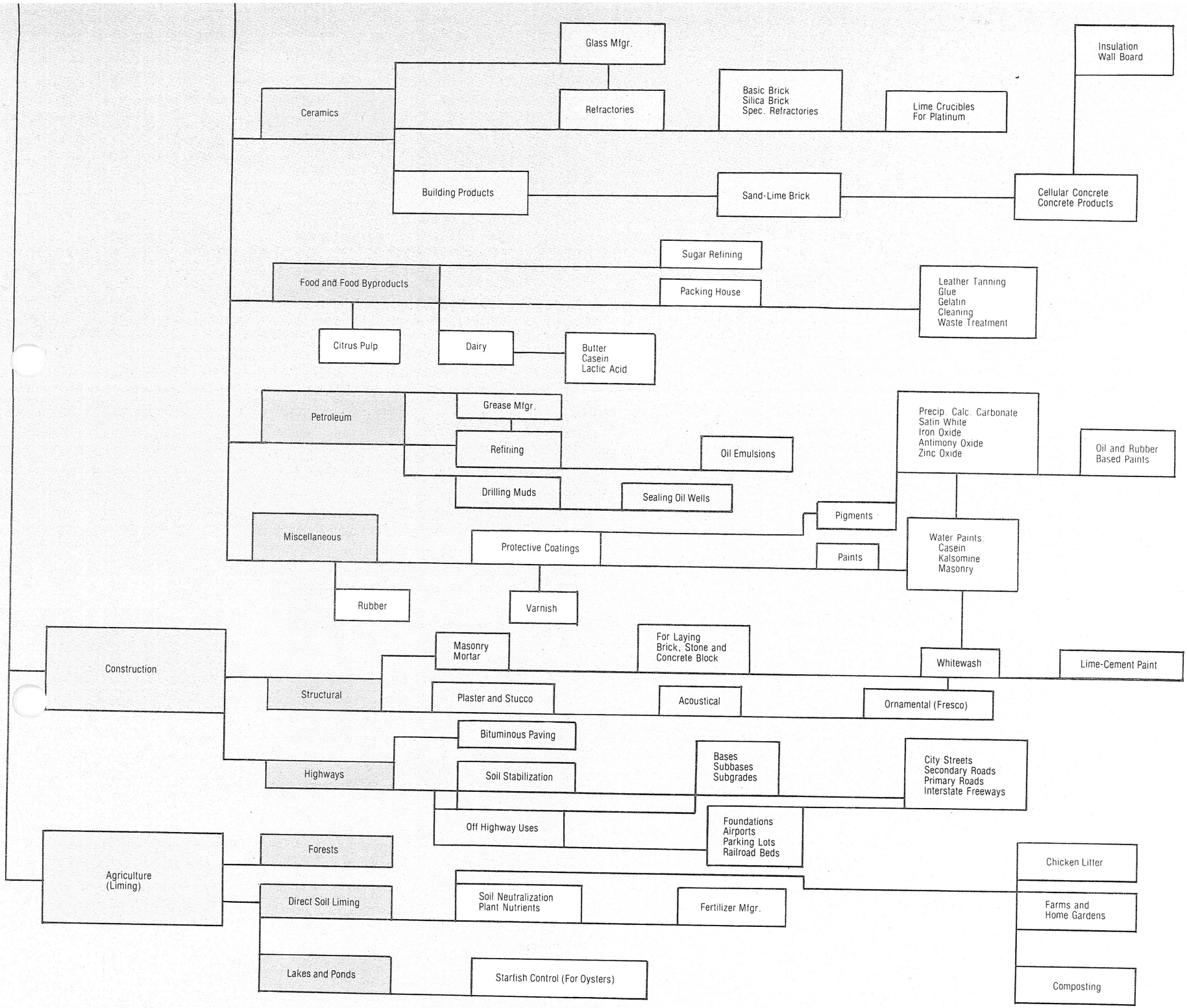


BALL MILLS



FLOTATION CELLS (below)




Glass Mfgr.
Insulation Wall Board
Ceramics
Refractories
Basic Brick
Silica Brick
Spec. Refractories
Lime Crucibles For Platinum
Building Products
Sand-Lime Brick
Cellular Concrete Concrete Products
Sugar Refining
Food and Food Byproducts
Packing House
Leather Tanning
Glue
Gelatin
Cleaning
Waste Treatment
Citrus Pulp
Dairy
Butter
Casein
Lactic Acid
Petroleum
Grease Mfgr.
Refining
Oil Emulsions
Drilling Muds
Sealing Oil Wells
Precip. Calc. Carbonate
Satin White
Iron Oxide
Antimony Oxide
Zinc Oxide
Oil and Rubber Based Paints
Pigments
Miscellaneous
Protective Coatings
Paints
Water Paints:
Casein
Kalsomine
Masonry
Rubber
Varnish
Construction
Masonry Mortar
For Laying Brick, Stone and Concrete Block
Whitewash
Lime-Cement Paint
Structural
Plaster and Stucco
Acoustical
Ornamental (Fresco)
Bituminous Paving
Highways
Soil Stabilization
Bases
Subbases
Subgrades
City Streets
Secondary Roads
Primary Roads
Interstate Freeways
Off Highway Uses
Foundations
Airports
Parking Lots
Railroad Beds
Forests
Chicken Litter
Agriculture (Liming)
Direct Soil Liming
Soil Neutralization
Plant Nutrients
Fertilizer Mfgr.
Farms and Home Gardens
Lakes and Ponds
Starfish Control (For Oysters)
Composting

GENSTAR LIME PRODUCTS

ARIZONA PRODUCTS

chemical analysis

PRODUCT	Acid Insol.	Iron Oxide Fe_2O_3	Aluminum Oxide Al_2O_3	Magnesium Carbonate $MgCO_3$	Calcium Carbonate $CaCO_3$	Calcium Oxide CaO	Magnesium Oxide MgO	Calcium Hydroxide $Ca(OH)_2$	Moisture H_2O	ASTM Avail. Lime %
High Calcium Limestone	1.0	.05	.2	.5	97.0					
High Calcium Quicklime	1.5	.07	.2		3.0	93.0	.5	2.0		(CaO) 92.0

physical analysis

PRODUCT	Yield Cu. Ft. Putty Per Ton	Yield Cu. Ft. Putty Per Cu. Ft. Lime	Setting Rate to ½ Vol. in Min. ASTM C-110	Density Lbs. Cu. Ft. (Loose)	Specific Gravity
High Calcium Limestone				86	2.63
High Calcium Quicklime	100	2.6	135	45-60	3.06

NEVADA PRODUCTS

chemical analysis

PRODUCT	Acid Insol.	Iron Oxide Fe_2O_3	Aluminum Oxide Al_2O_3	Magnesium Carbonate $MgCO_3$	Calcium Carbonate $CaCO_3$	Calcium Oxide CaO	Magnesium Oxide MgO	Magnesium Hydroxide $Mg(OH)_2$	Calcium Hydroxide $Ca(OH)_2$	Moisture H_2O	ASTM Avail. Lime %
High Calcium Limestone	1.5	.10	.3	1.7	96.5						
Dolomitic Limestone	0.7	.06	.3	42.0	57.0						
High Calcium Quicklime	2.0	.20	.7		1.5	92.0	2.0		1.0	nil	(CaO) 91.0
Dolomitic Quicklime	1.0	.08	.5		1.8	57.0	39.0				
TYPE S Hydrated Lime	.4	.10	.5		1.5		.6	40.0	55.0	.4	

physical analysis

PRODUCT	Plasticity Index ASTM C-110	Yield Cu. Ft. Putty Per Ton	Yield Cu. Ft. Putty Per Cu. Ft. Lime	Yield Cu. Ft. Putty Per 50 Lb. Bag	Setting Rate to ½ Vol. in Min. ASTM C-110	Density Lbs/Cu. Ft. (Loose)	Specific Gravity
High Calcium Limestone						93	2.71
Dolomitic Limestone						97	2.85
Dolomitic Limestone Fines						104	2.85
High Calcium Quicklime Minus 1¾"		85	2.56		350	60	3.15
Dolomitic Quicklime Minus 1¾"					37	53	3.19
TYPE S Hydrated Lime	500 (immediate)	56	1.20	1.25	225	25	2.24

sieve analysis (Percent Passing)

PRODUCT	6M	10M	16M	20M	30M	48M	65M	100M	150M	200M	325M
Dolomitic Limestone Fines	99	90	51	75	65.0	50	30	25	18	8-13	5-9
TYPE S Hydrated Lime				100	99.7	99	98	96	90	86	79

CALIFORNIA PRODUCTS

chemical analysis

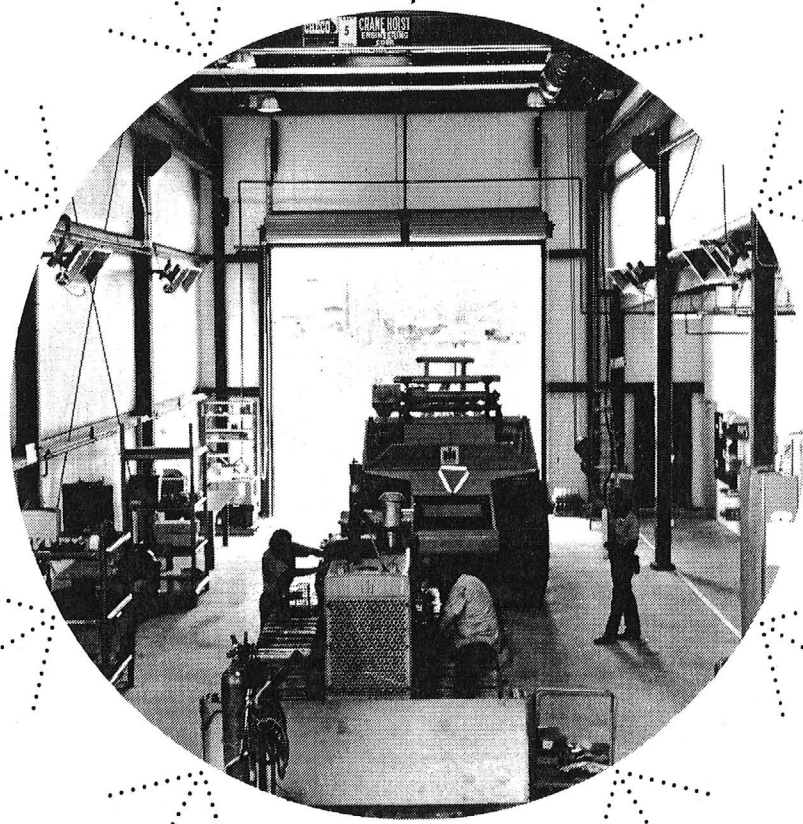
PRODUCT	Acid Insol.	Iron Oxide Fe_2O_3	Aluminum Oxide Al_2O_3	Calcium Carbonate $CaCO_3$	Calcium Oxide CaO	Magnesium Oxide MgO	Calcium Hydroxide $Ca(OH)_2$	Moisture H_2O	ASTM Avail. Lime %
High Calcium Quicklime	1.5	.20	1.0	1.5	92.0	1.5	2.0	nil	(CaO) 90.0
High Calcium Hydrated Lime	1.5	.10	.5	1.5	nil	1.0	93.0	.5	$(CA[OH]_2)$ 91.5
High Calcium Stabil-Lime	2.0	.20	.7	2.0	nil	1.0	93.0	.5	$(CA[OH]_2)$ 91.0

physical analysis

PRODUCT	Bag Capacity Cu. Ft.	Yield Cu. Ft. Putty Per Ton	Yield Cu. Ft. Putty Per Cu. Ft. Lime	Yield Cu. Ft. Putty Per 50 Lb. Bag	Settling Rate to ½ Vol. in Min. ASTM C-110	Density Lbs./Cu. Ft. (Loose)	Density Lbs./Cu. Ft. (Compact)	Specific Gravity
High Calcium Quicklime	.7	85	2.6	2.1	350	60		3.20
High Calcium Hydrated Lime	1.3	51	1.1	1.3	150	28	42	2.23

sieve analysis (Percent Passing)

PRODUCT	6M	10M	20M	35M	48M	65M	100M	150M	200M	325M
High Calcium Hydrated Lime			100	100	100	100	Trace On	99	97	88
High Calcium Stabil-Lime				99.6					86	



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The Tanner job is on a previously graded and drained section of the new alignment. The firm's bid of $8,150,276 was low of five submitted and covers work in Yavapai County, beginning about five miles east of the Mohave County line and extending easterly toward Seligman for 11.7 miles. In addition to lime treatment, the project includes aggregate base course and the asphaltic concrete surface.

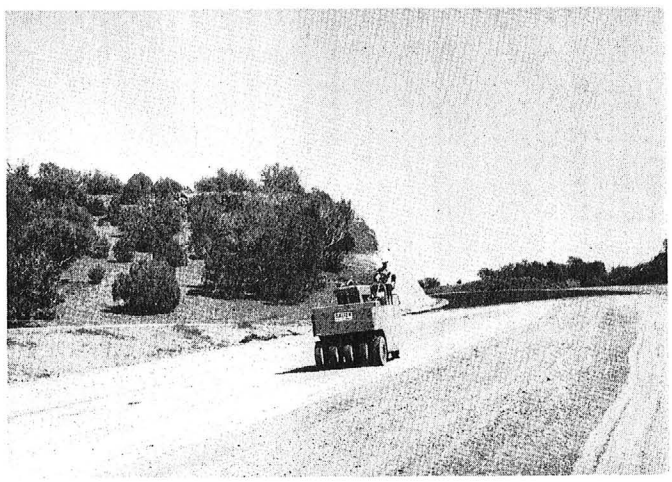
National Applicators, Inc., Phoenix, had the subcontract for the lime phase, which included de-rocking and scarification. This work, now finished, covered about 90 percent of the roadway distance, and involved some 7,400 tons of quicklime placed at the rate of 25 lbs. per sq. yd. The lime, hauled from the Nelson plant in end dump trucks, was minus 3/8-inch granular.

The subbase was first ripped to a depth of eight inches, then watered and smoothed with a grader. The lime was then distributed directly from the trucks and the roadway ripped again, followed by watering and mixing with two Bros. LSPRM-8 Models. The lime mix was then smoothed with a grader and rolled with a rubber tire roller. Then, following a 17 to 72 hour interval — depending on the condition of the roadway — the ripping and mixing were repeated. This was followed by grid rolling, finish grading, and sealing with a penetration oil of 50 percent water and 50 percent bitumuls.

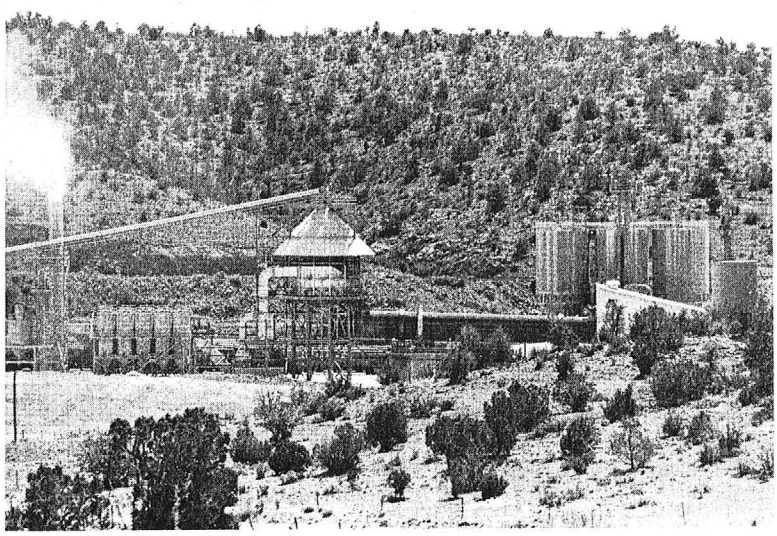
This is the present status of the highway, probably through the winter. Tanner has been producing and stockpiling the 428,000 tons of aggregate required, using three crushers in sequence — a new Cedarpaids 36" x 48" jaw, a 21" x 48" Pioneer, and a 40" x 30" Pioneer triple roll.

Tanner will begin the paving the spring. DOT specifications call for 351,325 tons of asphaltic concrete placed at a depth of 11 inches (probably in three lifts) over six inches of the aggregate base.

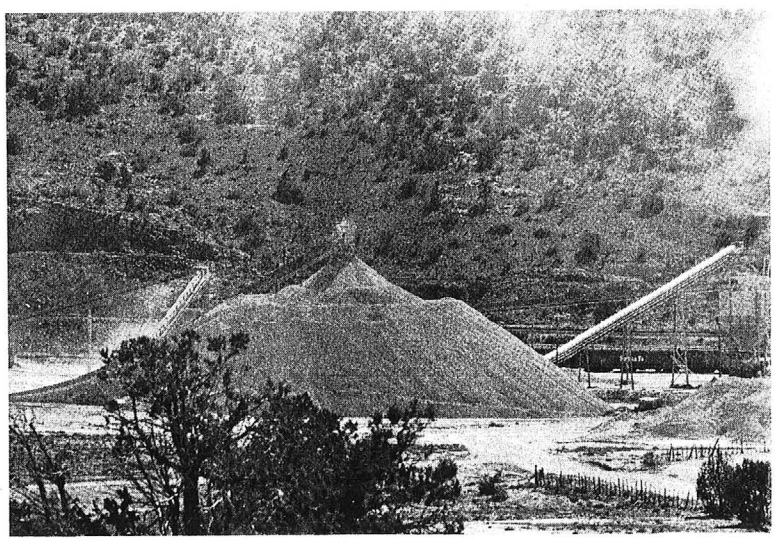
The hydrated lime road was smoothed with grader and compacted with Grid roller.



Rubber tire roller did the final compaction.



U.S. Lime plant at Nelson. (Ariz. DOT photo).



Stockpile of high-grade limestone at the Nelson plant. (Ariz. DOT photo).

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