Food Grade Calcium Hydroxide –
Origins, Use and Best Practices for Transportation, Handing and Safety

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MLC™
AN HBM COMPANY

TORTILLA INDUSTRY ASSOCIATION TIA

Disclaimer

Mississippi Lime Company d.b.a. MLC cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used.

It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use.

The information in this presentation is believed to be accurate, to the best of the Company's knowledge, as of the date issued.

INTRODUCING THE NEW MLC

MLC has launched a new global brand platform and has begun operating under the name MLC.

The transformation of the company's brand reflects MLC's vision, mission, and values and our identity as an international lime solutions partner with an unwavering commitment to safety, sustainability and service.

MISSISSIPPI® LIME

Discovering what's possible with calcium

is now

MLC™

AN HBM COMPANY

Mississippi Lime - VitaCal® H - MLC

MISSISSIPPI LIME

The Standard of Excellence

VITACAL® H

FOOD GRADE CALCIUM HYDROXIDE
(HYDRATED LIME)

CERTIFIED KOSHER - PAREVE

MANUFACTURED BY
MISSISSIPPI LIME COMPANY

MLC™

VITACAL® H

FCC food-grade calcium hydroxide

CERTIFIED KOSHER - PAREVE

Manufactured by MLC

Agenda

- What is Lime?
- How is lime made?
- Lime in nixtamalization
- Using Lime
  - Safety
  - Material Handling

MLC™

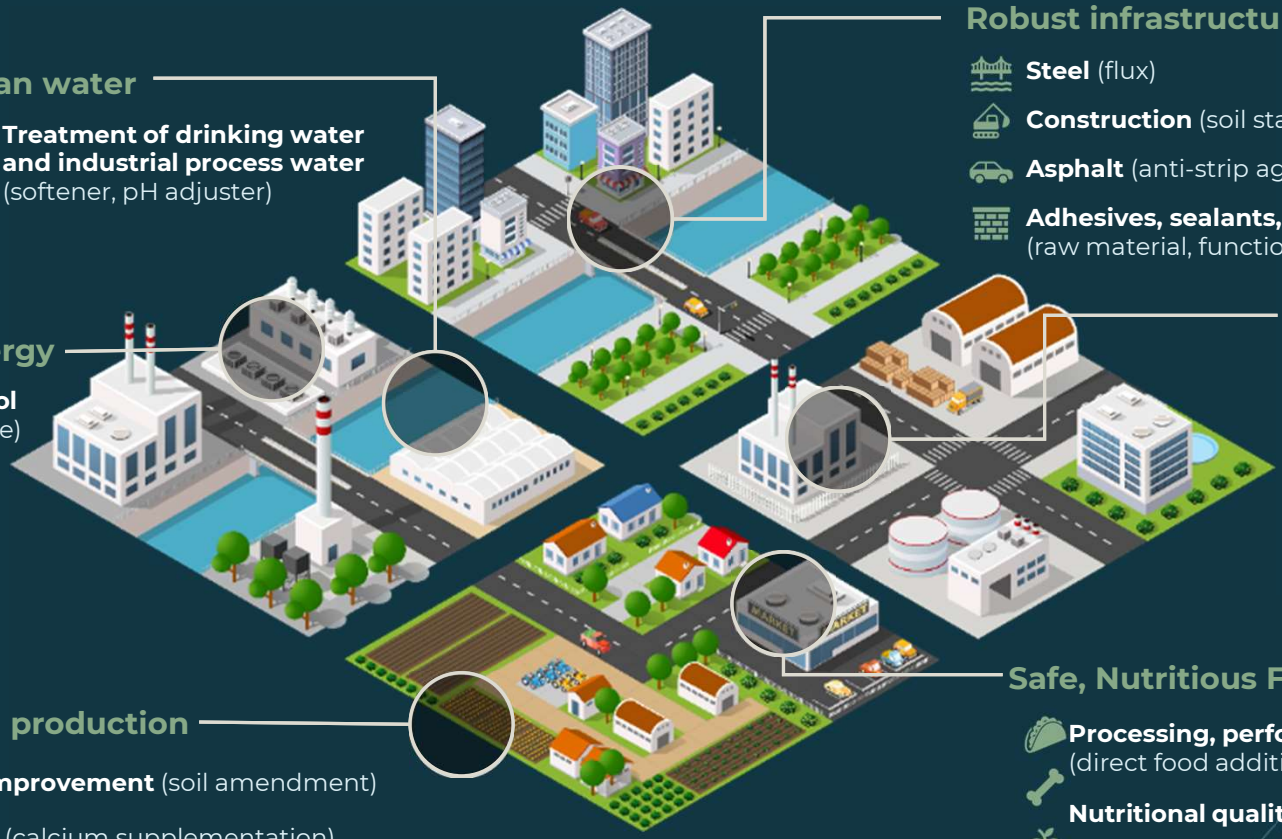
VITACAL® H

FCC food-grade calcium hydroxide

CERTIFIED KOSHER - PAREVE

Manufactured by MLC

Lime Applications: an Essential Mineral



Clean water

Treatment of drinking water and industrial process water (softener, pH adjuster)

Robust infrastructure

- **Steel** (flux)
- **Construction** (soil stabilizer)
- **Asphalt** (anti-strip agent, functional filler)
- **Adhesives, sealants, mortars, and plasters** (raw material, functional filler)

Sustainable energy

- **Pollution control** (acid gas capture)
- **Wind turbines** (fiberglass raw material)

Reliable manufacturing

- **Metals** (flux)
- **Rubber and plastics** (desiccant, accelerant, filler)
- **Glass** (flux, fusion aid)
- **Paper** (functional filler)
- **Adhesives** (raw material, filler)

Efficient food production

- **Crop yield improvement** (soil amendment)
- **Animal feed** (calcium supplementation)

Safe, Nutritious Foods and Beverages

- **Processing, performance, Flavor and texture** (direct food additive)
- **Nutritional quality** (calcium supplementation)
- **Preservation** (capture of ripening gases, synthesis ingredient)

What is “Lime”?

Calcium Carbonate

Chemical grade limestone is mined, crushed, and processed.

Calcium Oxide

Limestone is heated until conversion to quicklime and further processed and refined.

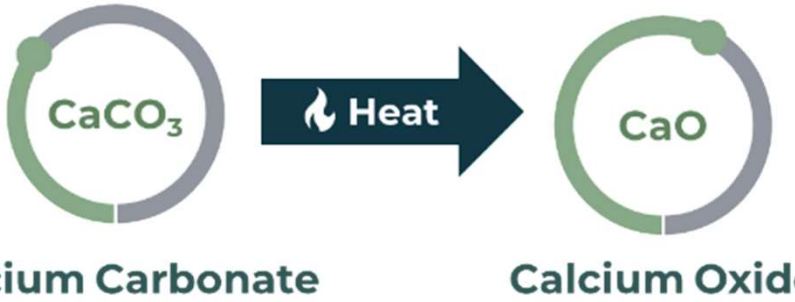
Calcium Hydroxide

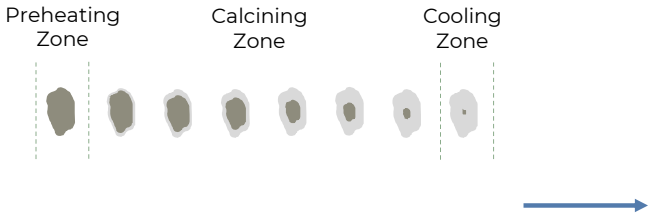
Quicklime is reacted with water and converted into hydrated lime, then processed and refined.

Lime is a catch-all term for the versatile industrial mineral.

Quicklime Production (Calcium Oxide)

Drilling & Blasting Limestone (Calcium Carbonate)

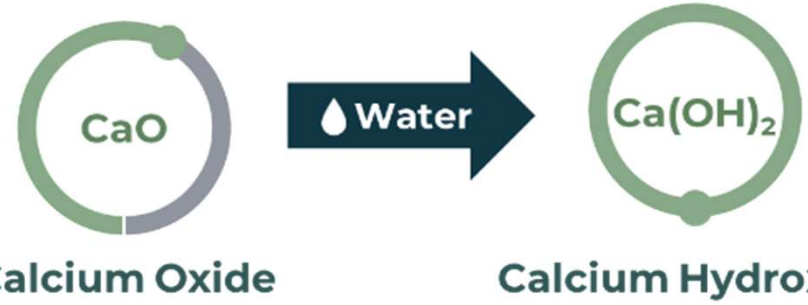




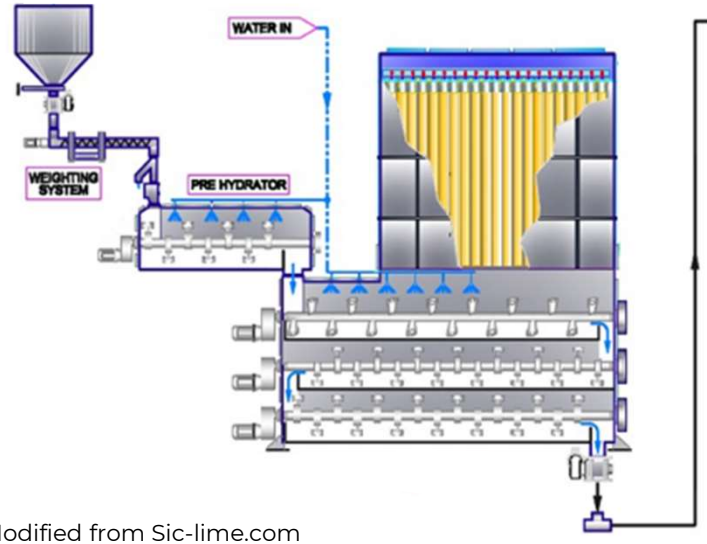
Kiln

Quicklime (Calcium Oxide)

Calcium Hydroxide Production



Quicklime (Calcium Oxide)



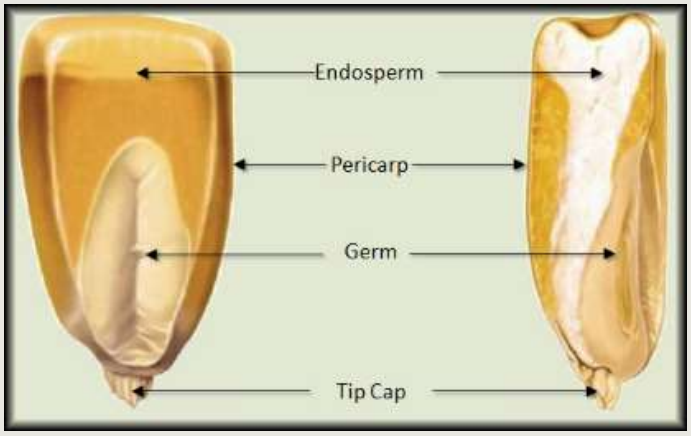
Modified from Sic-lime.com

Hydrate Refinement

Finished Hydrate

Hydrated Lime (Calcium Hydroxide)

Nixtamalization and the Role of Lime



A traditional Mesoamerican technique that involves cooking corn in an alkaline solution [*i.e.* $Ca(OH)_2$] to remove the pericarp and to improve processibility, digestibility and nutritional value for human consumption.

Cooking and steeping dried maize kernels in an alkaline lime solution (pH 11 – 12.4) results in:

- Increases pH which **dissolves and hydrolyzes** components in the pericarp facilitating removal
- Enhances **water absorption**
- Promotes **gelatinization**
- Improves **workability** of the masa
- Increases **calcium content**
- Influences **taste, color, texture, and product pH**

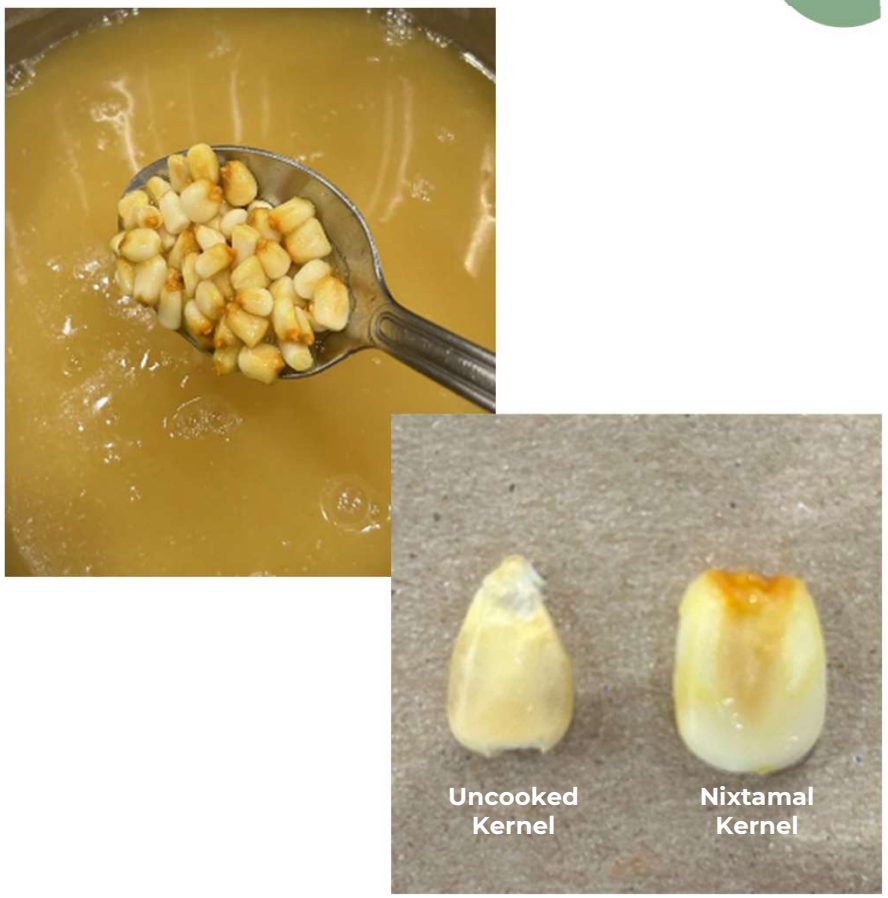
Lime in the Nixtamalization Process

Cooking

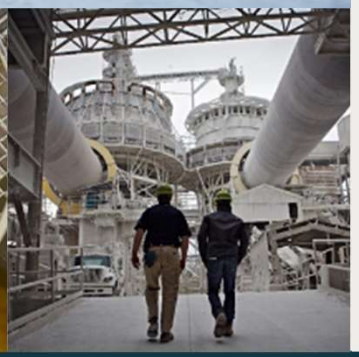
- Proportion of corn, water, hydrated lime: 100 : 200-300 : 1 (wt%) ratio, respectively.
- Lime is typically prepared as a slurry and pumped to the cooking vessel or added directly as dry powder
- Cooking stage starts once the liquid has reached 180 °F and cooks from 15-45 mins based on final use application of the masa.

Steeping

- Heating is removed, and the "Steeping Stage" begins once temperature is below 140°F.
- Transferred to a soaking vessel, where the corn continues to steep for ≈12-16 hrs.
- The resulting nixtamal can then be rinsed and milled to form masa dough.



What is important in choosing a lime product for nixtamalization?



Meets Food-Grade Standards

- FDA registered production facilities.
- Product meets FCC specifications
- GFSI recognized Quality Control System

Delivery Demands

- Annual volume requirements
- Packaging options compatible with equipment
- Supply Chain/Logistics Services and Reliability

What is important in choosing a lime product for nixtamalization? - **Consistency is the Key**

FCC SPECIFICATIONS (14th Edition)	
Assay $Ca(OH)_2$	95.0% - 100.5%
Carbonate	Passes Test
Magnesium & Alkali Salts	4.8% max
Fluoride	50 ppm max
Lead	2 ppm max
Arsenic	3 ppm max
Acid Insoluble Substances	0.5% max

Food Grade Consistency

- Fluorides – 50ppm max
- Lead – 2ppm max
- Arsenic – 3ppm max

Lime sizing consistency

- Particle size distribution
- Surface Area
- Supply Chain/Logistics Services and Reliability

Product Quality

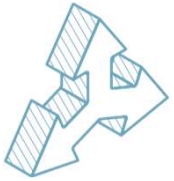
- High calcium content
- Low impurities
- Consider fuel source (natural gas or coal/pet coke)

FSSC certified for food safety assurance

Process-based approach to food safety management, providing continuous assurance

Recognized Globally

Accepted by key accreditation bodies around the world, including the Global Food Safety Initiative (GFSI)



Integrated and Comprehensive

Incorporates and builds upon ISO 22000, HACCP, PAS 220 PRPs, as well as integrating with other important certifications and schemes, such as ISO 9001

Process-Based for Continuous Compliance

Certifies the management process, which promotes continuous compliance and safety assurance through rigorous auditing, monitoring, and controls

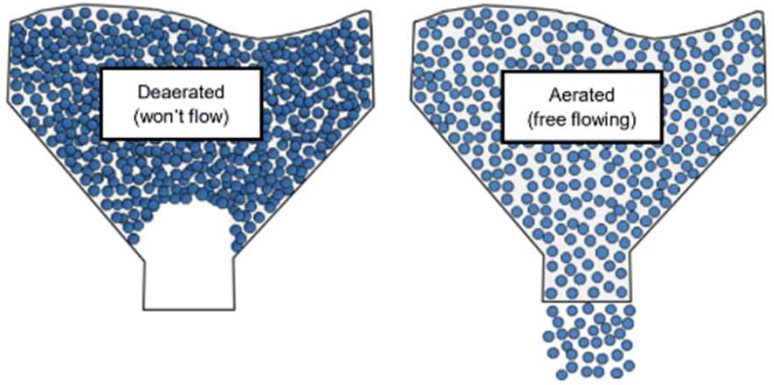
MLC maintains rigorous standards, certifications, and protocols to protect the quality and safety of food-grade products.

Considerations for Receiving Material

- **Inventory Considerations**
  - Keep product Best Used-By Date in mind
  - Keep unused product protected from air
  - Climate controlled storage is best practice for bagged material
- **Delivery Options:**
  - Bulk
  - Super Sacks
  - 50 lb. Bags
  - Calcium Hydroxide Slurry

Material Handling of Dry Hydrated Lime

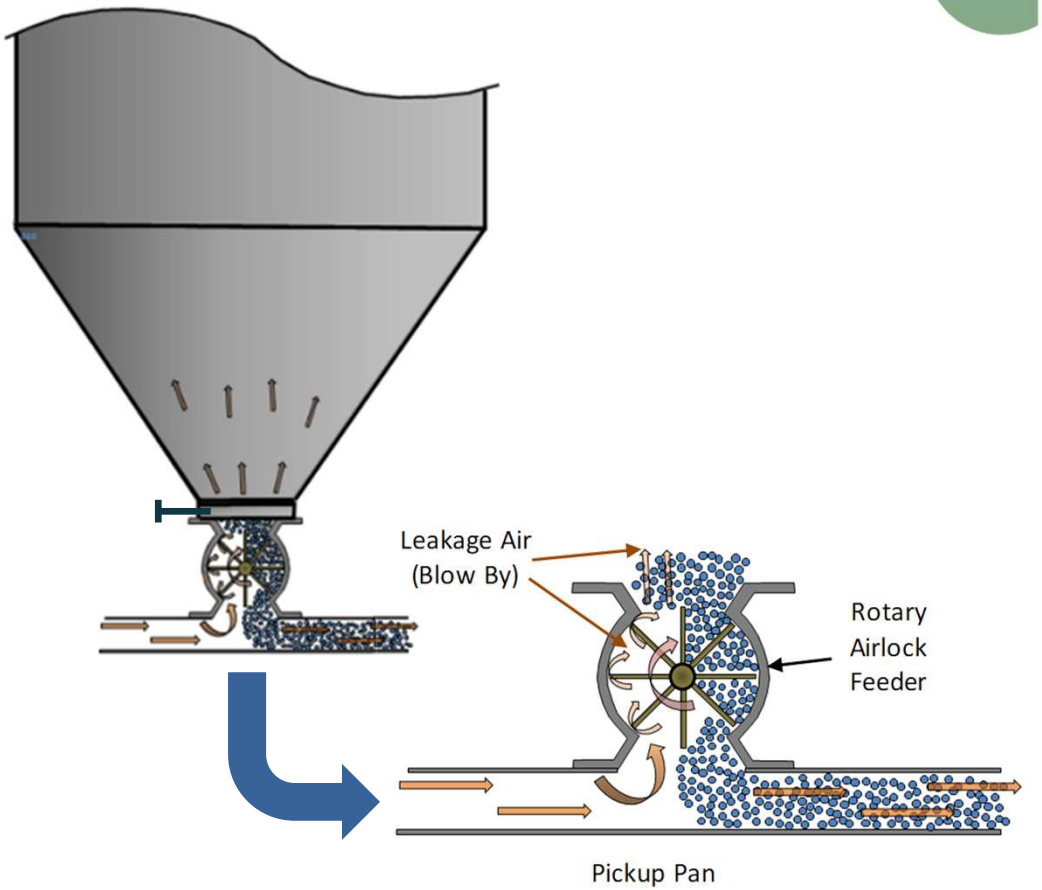
- Lime has its own personality for material flow. It is **aeratable but cohesive**.
- **Consolidated hydrate is cohesive**
  - Propensity for bridging and ratholing
- **Fluidized hydrate flows like water**
  - Free moving
- **Keys to reliable flow for dry hydrates!**
  - Keep a consistent bulk density (aeration)
  - Proper flow promotion and control systems
  - Intentional conveying line and silo design



Moving Material from Storage

Silo Discharge

- **Knife gate directly under the silo cone** is recommended
- **Flow promoters**
  - Aeration is generally preferred to vibration.
- **Batching: Volumetric vs. Gravimetric**
  - Gravimetric is preferred
  - Proper flow promoters will help with volumetric feeding



Making a Slurry of Hydrated Lime

- **Mixing order Matters**
  - First water then hydrate
- **Direct addition of dry lime**
  - Feed slowly, do not “slug” material.
  - Feeding too fast or weak mixing can lead to “lime-bergs”
- **Agitation**
  - Goal is a strong Vortex to incorporate solids.
  - Intermittent agitation is best for long standing slurry
- **Goal should be a high-density slurry**
- **Density Meter**
  - Needed for continuous systems
  - Not necessary in properly design batch systems

Conveying Hydrated Lime Slurry

- **Pump Styles**
  - Positive displacement pumps tend to be best for dosing operations
  - Centrifugal pumps are okay to use in recirculation system with low backpressure
- **Minimum Pumping velocity for settling**
  - Line sizing and pump capacity should be considered
- **A high-density slurry** is your ally against scaling
- Routine **Flushing** is helpful

Utilize best practices when handling lime

Lime is highly alkaline material (pH ≈12.4) and has the potential to cause irritation or burns. Quicklime reacts rapidly with moisture to generate heat.

Protect the skin

Protect respiratory passages

Protect the eyes

As with any chemical/ingredient, proper protections and controls should be utilized to mitigate risk and exposure as a result of handling the material.

Best practices for handling lime

Skin Protection

Wear a long-sleeved shirt. Rolled/short sleeves are not recommended.

Wear high top shoes or laced boots.

Wear trouser legs tied or taped over shoe tops. Do not wear shorts.

Gloves should be worn and can be taped at shirt sleeve to prevent exposure.

Wear hat or cap to protect scalp from accumulated dust.

Do not wear clothes that bind too tightly around neck or wrists. Chafing may increase skin irritation.

Apply a protective barrier cream to exposed body parts when you will be exposed to lime dust for a prolonged period.

Showers and/or other means of washing hydrated lime from the body should be available.

Best practices for handling lime

Eye Protection

Wear safety glasses with side shields at a minimum.

Use safety goggles if a visible dust is created.

Do NOT wear contact lenses while handling lime.

Ensure you have eye wash equipment in service and can get to it if needed.

Take care when removing glasses or goggles to prevent accumulated dust from falling into eyes.

Best practices for handling lime

Respiratory Protection

Wear a dust mask (such as a paper N95 rated mask) if there is airborne dust or if dust will be created. Make sure that it fits properly and make sure you wear it.

Full face respirator or PAPR are optional based upon site Hazard Assessment results.

Engineering controls such as dust collection may be required.

Recommended first aid supplies

West Penetone Skin Protective Cream 311

www.penetone.com

EyeSaline Wall Station

Amazon
Grainger

Stye Sterile Lubricant Eye Ointment

www.stye.com
Amazon
Walgreens

5:1 ratio of vinegar and water blend for rinsing skin*

* Never use vinegar in the eyes!

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Responding to Spills

- **All spills should be responded to in accord with your specific site requirements**.
  - Hydrated lime is **not** listed as a “hazardous substance” by the EPA.
  - Waste material can be disposed at approved landfills as "special waste" in accordance with U.S. Federal, State, and Local requirements.
- **Product should be collected using means to minimize dusting.**
  - Residual amounts can be flushed with large amounts of water.
  - Equipment can be washed with water, a mild vinegar and water solution, or detergent and water.
- **If dust is created**: wear an ANSI approved mask, and/or face shield/goggles. Consider long sleeved clothing and gloves to prevent contact with skin.
- **Do not step into dry lime**. Lime over shoe tops is an exposure.
- **Wet lime on the ground is a serious SLIP HAZARD**. Avoid stepping or walking into areas where hydrate is located, especially if the ground is wet.
- **Recover uncontaminated product where possible and reutilize or recycle for other beneficial purposes**.
  - Store collected materials in dry, sealed plastic bags or metal containers.