

Safe Design of Portland Cement Plants



**L. Harvey Kirk III, MSHA
Atlantic Alliance Symposium**

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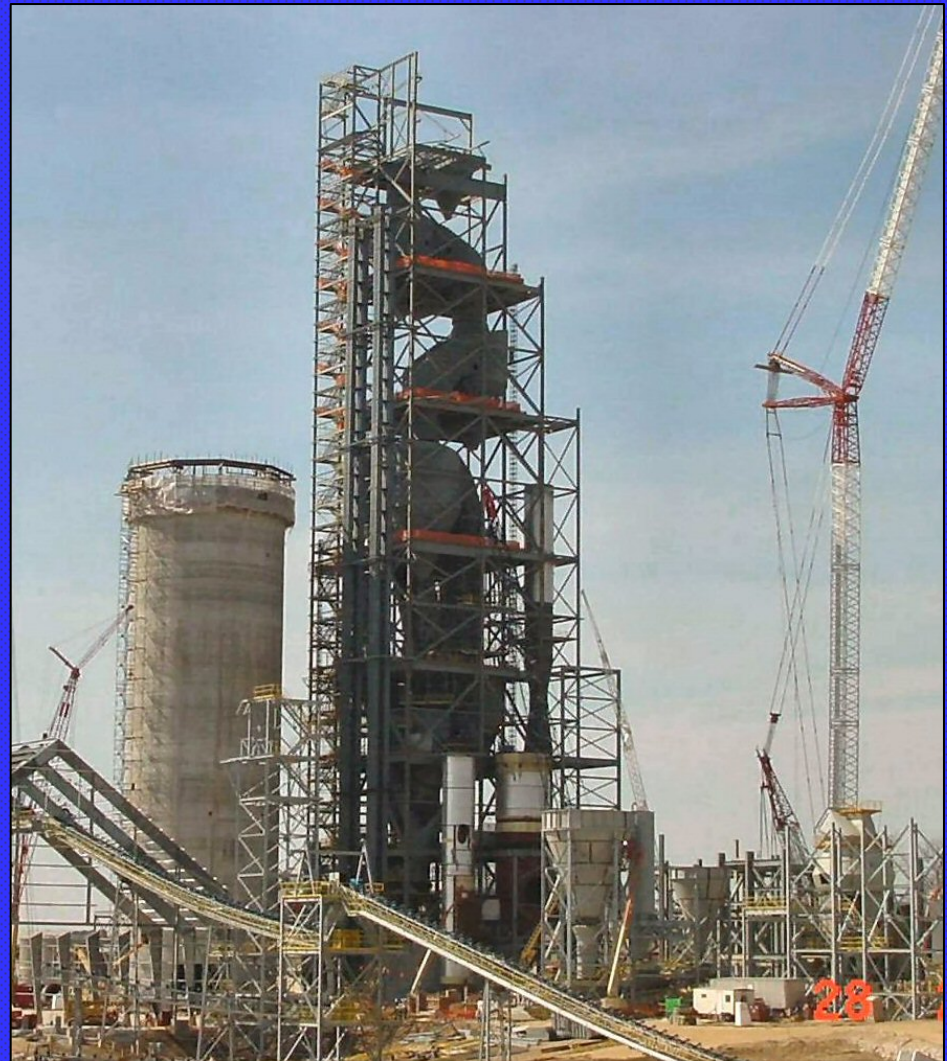
Safe by Design (Inherently Safe)

A process, plant, equipment or product that has purposely incorporated in it certain physical and/or chemical characteristics that noticeably reduce hazardous conditions and the risk of injury and illness resulting from its use or operation.



Safe by Design - A Personal Experience

- \$400 M plant expansion & modernization
- Double plant production capacity
- Equipment & technology: quantum leap up



Safety Pre-Planned for Construction Phase

- Early decision by Corporate Risk Mgmt & Insurance broker
- OCIP – Owner Controlled Insurance Policy



Safe by Design Promoted at Plant Level

- No corporate safety dept.
- Began as part of plant input & review process
- Champions:
Plant Mgr. &
Manufacturing VP



- Plant-level team assembled
 - All engineers & technical managers
 - Production, Maintenance, Environmental, Project, Quality, Safety
 - Key process & maintenance personnel



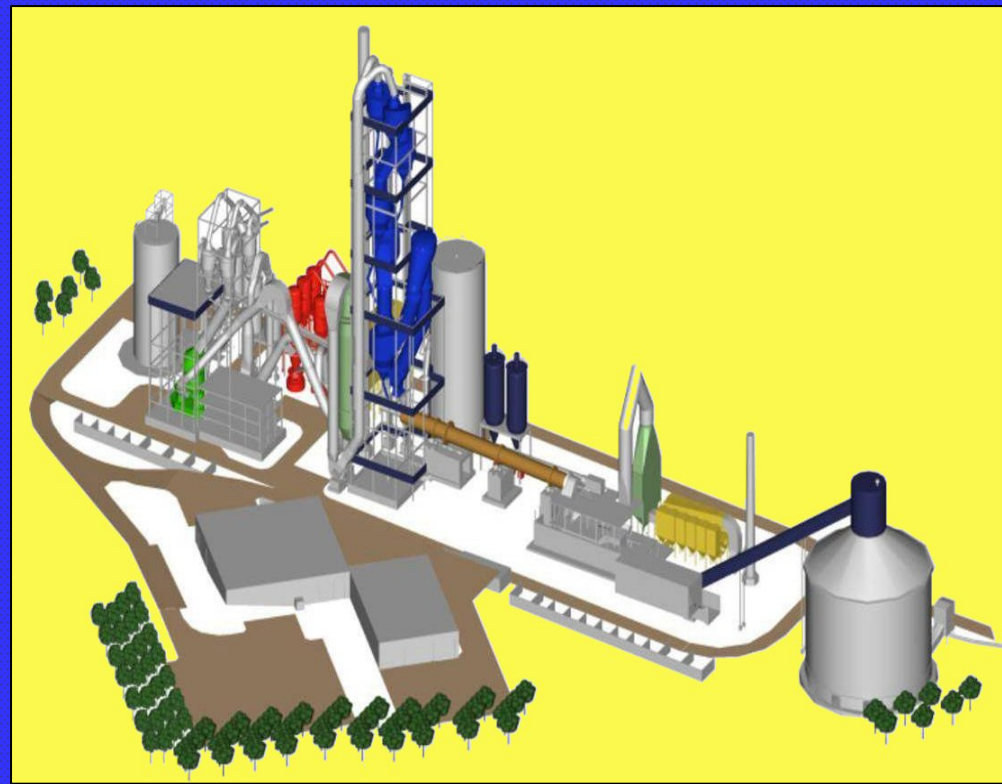
Safety woven throughout project

- Began at concept level
- Specifications
- Design review
- Contractor pre-bid / qualification
- Construction phase
- Commissioning & Start-up



Key Safety Concepts & Concerns

- Fire / explosion
- Preheater vessels
- Noise attenuation
- Equipment guarding
- Manual material handling
- Fall protection / Safe access
- Maintenance safety / Lockout systems
- Signage / Color coding
- Illumination



Design Specifications

- A lesson learned...
- Safety specifications written, just as for:
 - Site preparation and grading
 - Mechanical and electrical systems
 - Structural steel, concrete, etc.
- Resources
 - MSHA and corporate standards
 - Best Practices
 - Construction, Chemical, Europe, ASSE, Local, Personal
- All other specs reviewed for and modified to address safety issues
- Incorporated into Purchase Orders



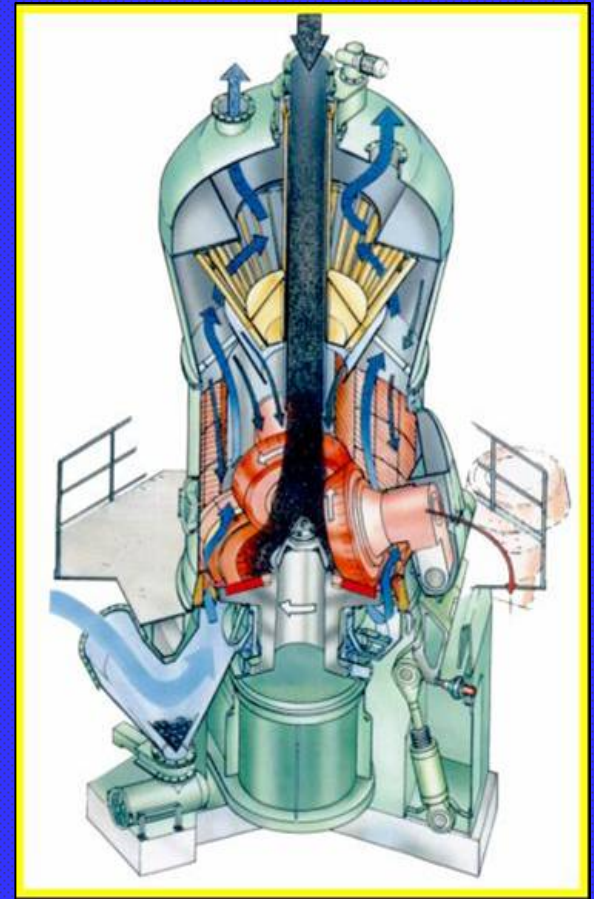
First of all... No explosions, please

Coal Fire & Explosion Prevention

- Modern coal mill & peripheral equipment
- Pulverization in inert atmosphere
- CO sensors for incipient combustion



Coal Mill DC bags grounded to eliminate static charges



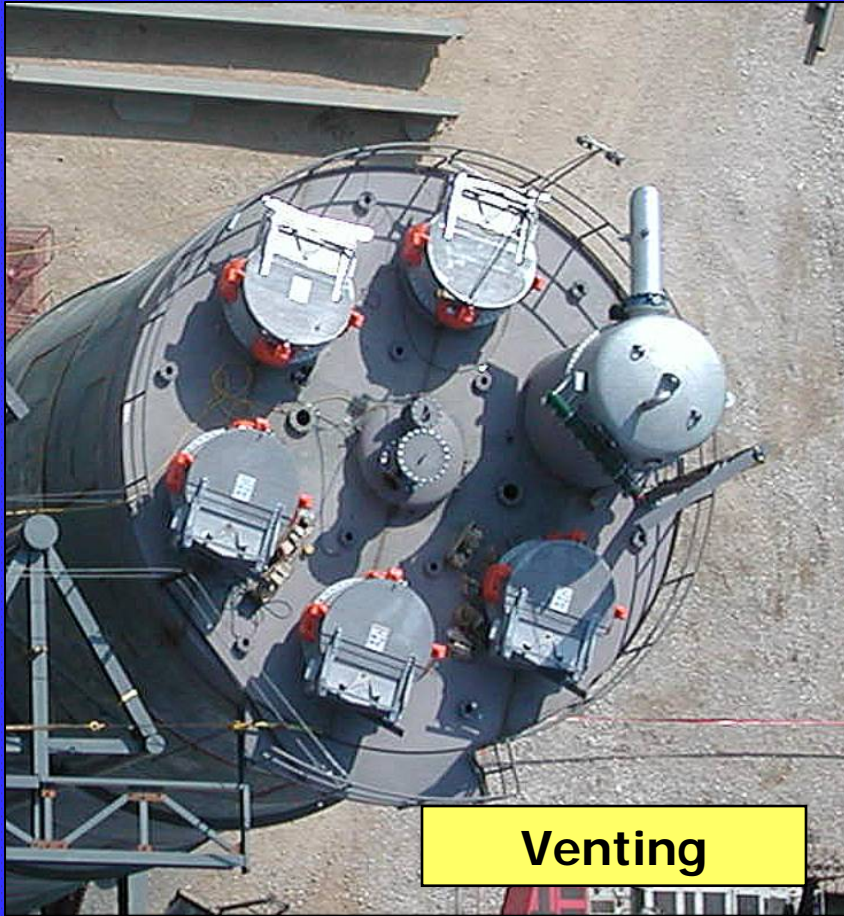
Coal Fire & Explosion Protection

Redundant systems

- Explosion venting
- CO₂ inundation
- Suppression
- Isolation



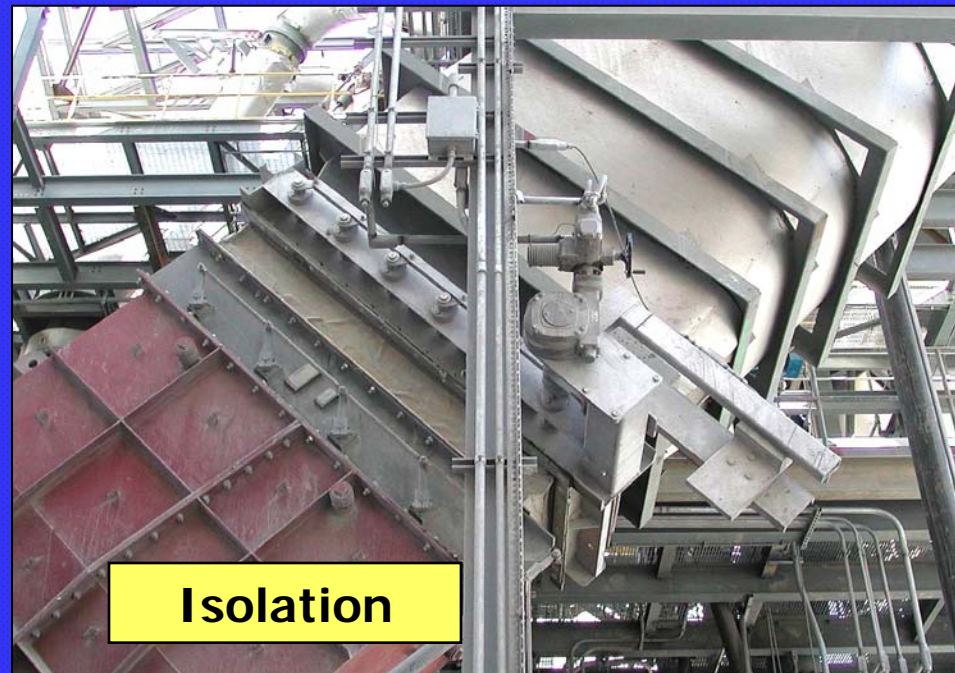
Explosion Protection



Venting

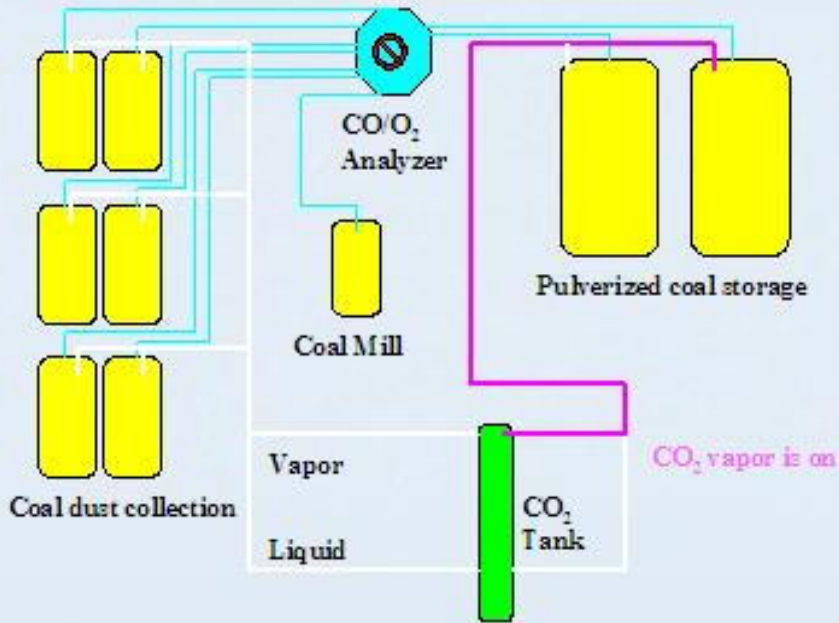


Suppression



Isolation

CO₂ can be directed to individual problem areas



CO₂ Inerting System



SA = Simple Asphyxiant,
Odorizer added



CO₂ Injection



Vapor or Liquid

Noise Attenuation

- Individual equipment: spec ≤ 85 dBA
- Fans, mills, compressors & blowers
- Silencers
- Noise barrier materials
- Noise absorbing materials
- Power transmission equipment
- Vibration dampening
- Laboratory equipment included



Silencer




Separation



Insulated housing



Silencers

A large, vertical duct system is wrapped in a thick, grey, fibrous decoupling material. The material is applied in a crisscross pattern, creating a grid of rectangular sections. The ductwork is supported by a metal frame with orange-painted sections.

**Decoupling
material on
ductwork**



**Silencer &
Anti-vibration
mount**



**Sound
absorbing
material**



**Silencer;
Fan duct
insulation not
yet installed**



Duct wrapping



**Verification:
noise levels
attenuated to
specification**

Signs & Labels

Grinding Aid {UCAR CGA-4,
Rox Ind. RI-95,
NFA-2

HEALTH	3
FLAMMABILITY	0
REACTIVITY	1

(Low & Mid) SKIN
PERSONAL PROTECTION Inhalation
Ingestion



NOTICE
Noise Level
75 dBA

Dome: Circular Reclaimer Electric Room, Inside w/ Door Closed

CAUTION
CONFINED SPACE
USE LOCK-OUT & ENTRY PROCEDURES PRIOR TO ENTRY

CAUTION
Wear Hearing Protection When Equipment Operates
93 - 104 dBA

Storage Hall, North side, F02-001 Reclaimer operating inside

DANGER
NO SMOKING
NO OPEN FLAMES

Travelways & Work Platforms



Work Platforms & Travelways



**Folding & other non-conventional
work platforms installed**





350-lb. skylights, perimeter fall protection cables and other anchor points installed (for construction & maintenance later)

Missed crossover walkways between buildings



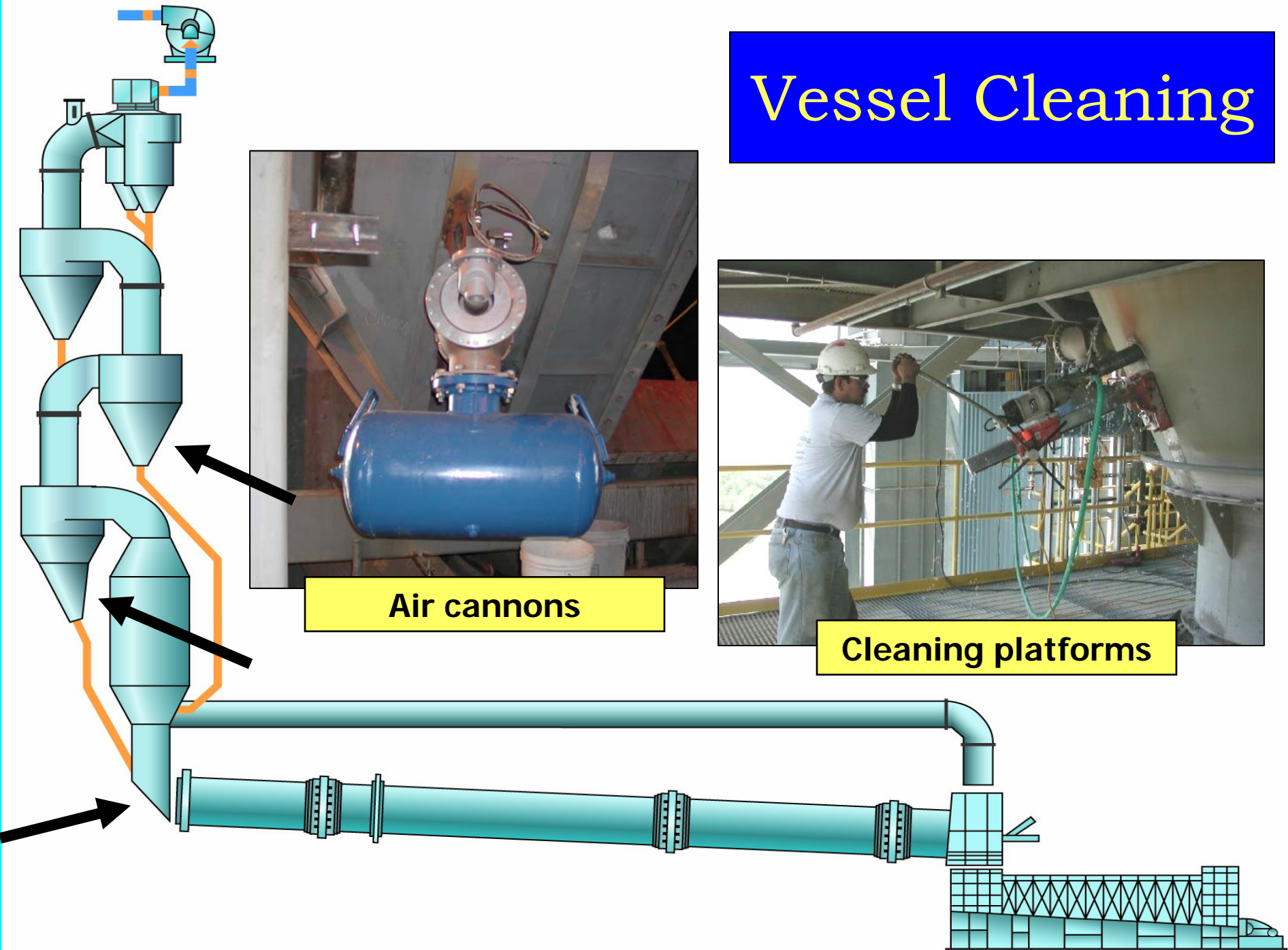
Vessel Cleaning



Air cannons



Cleaning platforms



Lockout Systems



**No Local Disconnect Switches
(Some Installed Later)**

Equipment Guarding

- Specification: Meet MSHA requirements
- Purchase Order: Meet MSHA & OSHA requirements
 - Suppliers were back-charged & payment delayed
 - Deficiencies corrected before start-up
- Engineer worked one month designing guards
 - Used MSHA Guide to Equipment Guarding

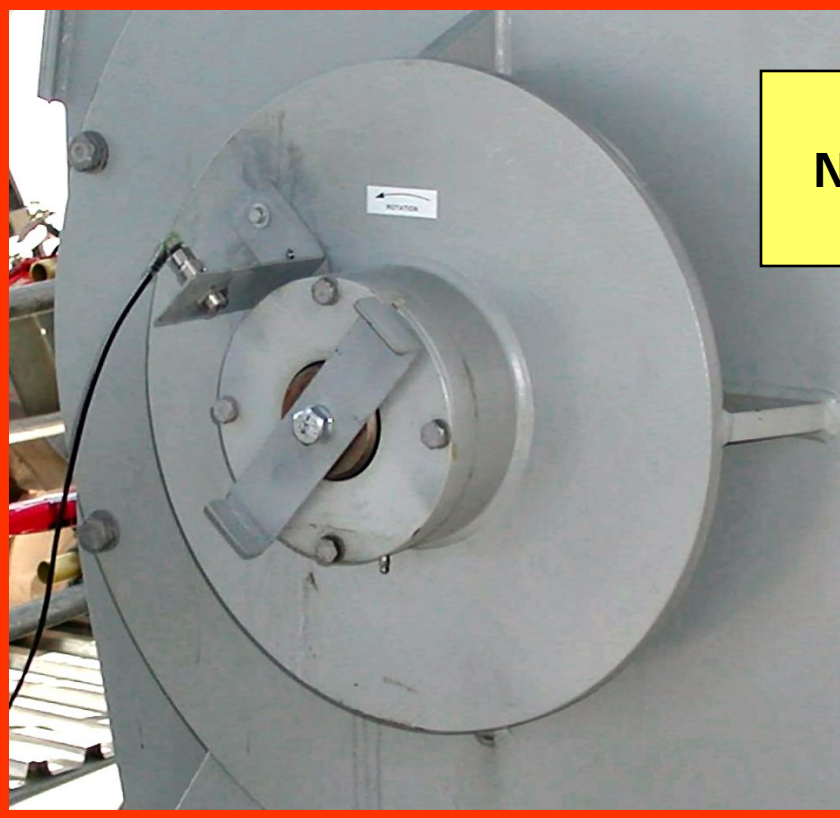


**As-received:
Stop cord only**



**As-built:
Guards all around**

**As-received:
No motion sensor
guard**



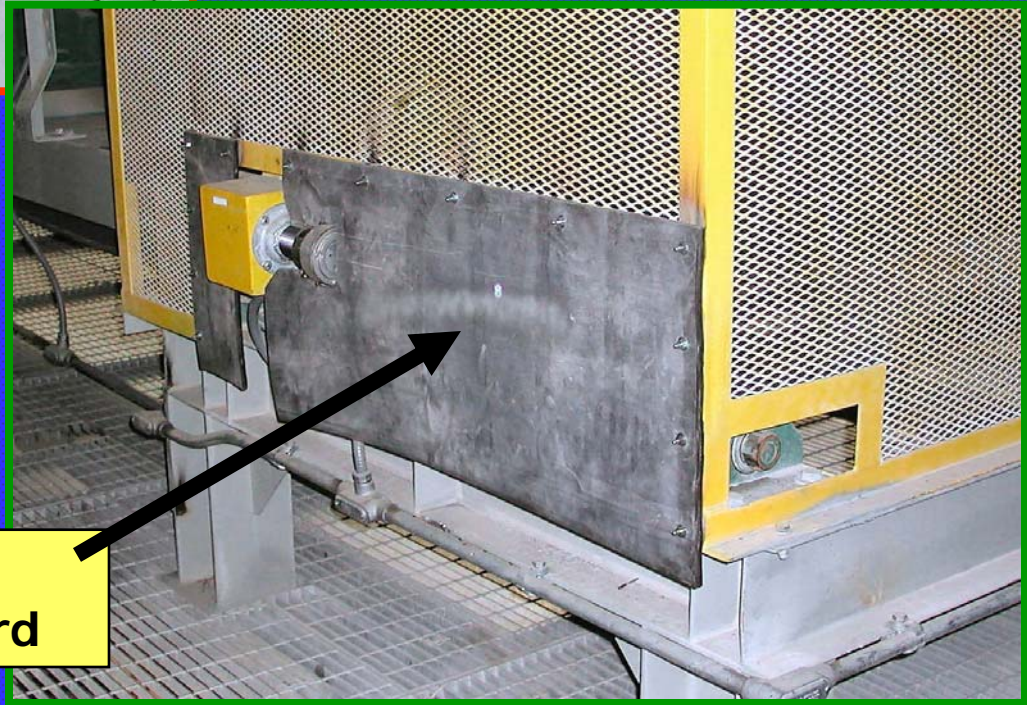
**As-Built:
Guard fabricated and
installed on-site**





Lifting eye & hoist provided

**As-received:
Inadequate guard**



**As-built:
Improved guard**

Manual Material Handling

In addition to automatic packer & palletizer...



Vacuum-Assist Bag Lifter



Auto-Leveling / Rotating Pallet Supports

Radioactive Source Devices for Measurement



Radioactive source

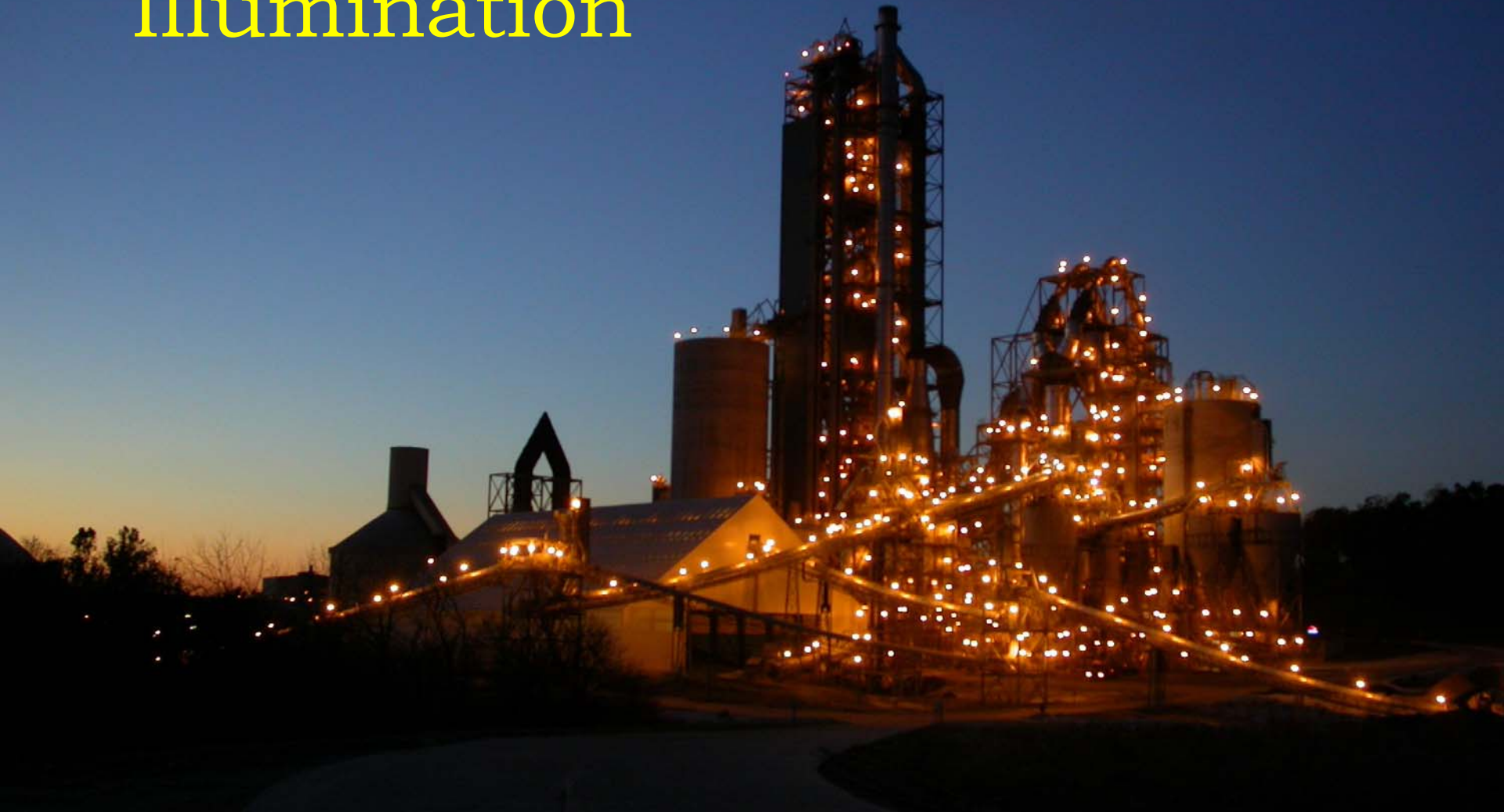


Gamma ray receiver
and sensor "tail"



Extra shielding &
sign installed in
some locations

Illumination



Specified Conformance to ANSI / ISO Standards

Thank You -- Any Questions ???

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