Practical Aspects of Implementing Explosion Protection Measures

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Dust Explosion Hazard Recognition and Control: New Strategies
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How did you get to the “implementation” step?

- Self-motivated
- Corporate Safety directive; review all of our dust collectors and develop a plan
- Incident response; “don’t let it happen again”
- OSHA Inspection with remediation requirements
- Insurance company inspection with protection requirements
And you’ve been to the

• NFPA Dust Symposium
• Loss Prevention Symposium
   Done your
• Process Hazard Analysis
• Risk Analysis

Now what?
“…..implementation”

- What’s the process?
- What are these practical aspects? (Problems)
- What is my role?
Process Steps

- Hazard Areas Identified
- Risk Analysis
  - Site Survey
  - Explosion Protection Design, first round
  - Design Review, Revision
  - Hardware Ordered
  - Installation Contractors
  - Installation Scheduled
  - Installation Performed
  - Commissioning
  - Post-commissioning
Site Survey

• Hours to days
• Confirm hazards, discuss protection objectives, options
• Begin data collection
  – Process conditions, drawings/sketches, P&ID, photos
• Budgetary quotation?
First Round EP Design,

- Review process conditions
- Verify objectives, Options
- Prepare protection design; transfer to drawings
- Budgetary quotation?
Design Review and Revision

• Validate protection objectives, adjust
• Validate process data
• Design modified as needed
• Installation drawings, BOMs prepared
• Hardware ordered (prioritized)
• Installation contractors
• Installation scheduled
Installation

• Cutting, welding, bolting
• Run wires, cables, controllers
• Process interrupted, hot work, etc.
• Physical surprises
Commissioning

• Actual process conditions
• Startup, shutdown, simulated upsets….
• Troubleshoot
• Surprises?
Post-commissioning

- Training
- Inspection and Maintenance
The Practical Issues

The process of protecting a process may result in a change of the process.
The Practical Issues

- Site survey add-ons
- Prioritization of actions
- Process drawings
- On-site expertise
- Can’t design to the process (equipment)
- Hardware installation, creativity
- Product properties
- Process and Operating conditions
- Environmental effects
- Scheduling
- Retro-fits, upgrades
Site Survey can lead to a Design Change
“We need you to look at our dust collector…”
On inspection; indoor, close to a wall

Found 1
...and an inlet from the mill below
Dust collector protected by a ducted vent and inlet isolation
...and isolation on the mill
Required on Outlet if Return Air to Inside

Not Required if Vent to Atmosphere

EXPLOSION ISOLATION
Prepare Installation Drawing based on Design (mechanical, electrical)

Based on process drawings, P&IDs, etc

Lack of (age, lost, out of business)
Out of date (changes not noted)
Un-dimensioned sketches
Request Actual Process Drawings
Reduce to Specific Equipment Drawing

FLOW
8" INLET

FLOW
8" EXHAUST

MAX FILL LEVEL

14"X10" DISCHARGE

PRELIMINARY
Design vs Process

• Can’t apply the first or preferred design to the process
• Change something
Can’t apply the first or preferred design

Vented dust collector; one side available
8.7.1(1) vs 8.7.1(3)

- 9,100 ft³
- And 5 44x69 vents

- 23.5 ft
- 19 ft
- 6 ft

- 20 ft

- 20 ft

- 19 ft

- 20 ft

- 19 ft

- 20 ft

2900 ft³
And 4 36x44 vents

Added 3.5 ft

4 ft
Can’t apply the first or preferred design - Isolation Xmin

TOP VIEW OF FLUID BED DRYER
Can’t apply the first or preferred design - Isolation Xmin

TOP VIEW OF FLUID BED DRYER
Can’t apply the first or preferred design

Silo Venting
Can’t apply the first or preferred design

Calculated required vent area. Add vents at the top or on the side (no room on the top)
Can’t apply the first or preferred design

OK with Intended process operation?

Product covering lower section of vents!
Can’t apply the first or preferred design

Modify process operation.
Bring fill level back down
Hardware Installation; need for creativity

Floor cutout to accommodate Suppressor placement
Hardware Installation; need for creativity
Hardware Installation; need for creativity
Hardware Installation; need for creativity
Hardware Installation; need for creativity
Hardware Installation; need for creativity
Raise high the roof beam....

HRD rotated to fit under beam and above hopper
Product Properties - Sticky
Product Properties - Sticky
Product Properties - Size

Large particle impact
Product Properties - Size

Particle impact on detector at 0 ms; ~ 2 psi
Process and Operation conditions

• Operating conditions
  – Pressure, temperature, flow, maintenance, etc.
  – Operating vs capability
  – Particle characteristics
• Unknown, incomplete, not as expected
Process and Operation conditions

Slow Pressure Rise: Static activation at 250 mbar (3.6 psi)
Process and Operation conditions
High pressure washing of process vessel

Process conditions can affect EP equipment
Environmental Conditions
northern location

Ice Formation
Solution to wet process stream, northern location

Insulation and heat trace
Environmental conditions
Vent hoods on top of silo, northern location
Homework: Protect this process

- Silo
- Restaurant
Summary

• Effective Site Survey is Key
• Clear understanding and communication of objectives and expectations.
• Complete, accurate process conditions with equipment drawings
• Anticipate that process conditions may need to be adjusted, or the design changed
• A stable protection system requires a stable process