Redesign Blowdown Systems and Alter ESD Practices

Technology / Practice Overview

Description

When compressor stations are taken offline for maintenance or the system shuts down, the gas within the compressors and associated piping is either manually or automatically vented to the atmosphere (i.e., blowdown). Emergency shutdown (ESD) systems are designed to automatically evacuate hazardous vapors from sensitive areas during plant emergencies and shutdowns. Some ESD systems route these vapors to a flare stack where they are combusted, while other systems simply vent the evacuated vapors to the atmosphere via a vent stack.

Partners report a number of opportunities to reduce emissions from blowdown systems and ESD practices, including:

- ★ Redesigning blowdown systems and altering ESD practices
- ★ Installing YALE® Closures
- ★ Designing isolation valves to minimize gas blowdown volumes
- ★ Moving fire gates valves in to minimize blowdown volumes

Partners report that modifying ESD vents and blowdown piping enables collection and re-routing of the gas to the sales line, the fuel box, lower pressure mains for nonemergency use (e.g., ESD testing), or flare systems.

Department of Transportation (DOT) regulations require that emergency shut down (ESD) systems at gas compressor stations be fully tested on an annual basis. One common practice is to activate the entire system, which discharges very large volumes of gas to the atmosphere. A DOT acceptable alternative is to test

- [ ] Compressors/Engines
- [ ] Dehydrators
- [ ] Directed Inspection & Maintenance
- [ ] Pipelines
- [ ] Pneumatics/Controls
- [ ] Tanks
- [ ] Valves
- [ ] Wells
- [x] Other

Applicable Sector(s)

- [ ] Production
- [ ] Processing
- [x] Transmission
- [ ] Distribution

Other Related Documents:

Reducing Emissions When Taking Compressors Offline, Lessons Learned

Economic and Environmental Benefits

Methane Savings

Estimated annual methane emission reductions	***Install YALE® Closures:*** *1,800 Mcf per year*

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost	Payback (months)
$7.00 / Mcf	1,800 Mcf	$13,400	$8,000	$0	8 Months
$5.00 / Mcf	1,800 Mcf	$9,600	$8,000	$0	10 Months
$3.00 / Mcf	1,800 Mcf	$5,700	$8,000	$0	17 Months

** Whole gas savings are calculated using a conversion factor of 94% methane in pipeline quality natural gas.*

Additional Benefits

- Safety of operations
- Operations & maintenance savings

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each individual dump valve with the discharge stack blind flanged. This greatly reduces gas emissions, but has higher labor costs associated with installing and removing a blind flange on each ESD valve.

One partner reports using YALE® closures to make the individual ESD valve testing alternative cost effective, saving the gas emissions from a total station dump. The YALE® closure is a screwed-on pipe cap with a built in needle valve that bleeds the gas pressure off the ESD valve stack for safely removing the YALE® device.

Other partners report reducing vented volumes as a result of compressor station shutdowns by placing fire gate valves and isolation valves closer to the station or compressor equipment. Partners report implementing this project during the design stages of new stations or equipment as well as for existing stations. This system design change reduces the volume of gas-filled pipe that must be purged. The reduced gas loss will depend on the length, size, and operating pressure of the piping excluded by the new placement of the relevant valves.

Operating Requirements

Redesign of blowdown systems and altering ESD practices should be done in accordance with acceptable industry safety standards (OSHA, API, ANSI, ASME, PSM).

To receive the YALE® closure cap, the ESD valve must have a vent stack with a threaded end.

Applicability

This practice applies to all compressor stations and ESD valves.

Methane Emissions

During ESDs, rerouting combustible gases eliminates potential hazards in the operating area as well as reducing methane emissions. Emissions savings vary by compressor station size, operating pressure, and facility complexity. Partners reported annual emission reductions ranging from less than 100 Mcf per year to more than 72,000 Mcf per year. For one partner, installation of a blowdown recovery system at 7 compressor stations recovered 1,155 Mcf of gas that would have otherwise been vented to the atmosphere. An additional 1,275 Mcf savings was obtained by piping connections that lowered atmospheric venting pressure to approximately 60 psi.

When installing YALE® closures, methane emissions savings may be estimated by subtracting the volume of gas contained in the blocked in ESD stacks at line pressure from the ESD valve relief rate when cycled open and closed. For an 8-inch ESD valve with a 3-foot stack, the open relief rate is about 400 Mcf per minute on a 500-psig system, and the volume of gas in the closed stack is about 40 scf. Retrofitting ten ESD valves at a typical compressor station would save about 1,800 Mcf per year.

One partner relocated two unit isolation valves at a compressor station, which excluded 200 feet of 24 inch 600 psig pipeline from blowdown five times per year. This action produced annual methane emission reductions of 130 Mcf. Another Partner achieved annual methane emission reductions of 1,700 Mcf by relocating fire gate valves to exclude 2,000 feet of 24 inch, 900 psig pipeline from blowdown.

Methane Content of Natural Gas

The average methane content of natural gas varies by natural gas industry sector. The Natural Gas STAR Program assumes the following methane content of natural gas when estimating methane savings for Partner Reported Opportunities.

Production	79 %
Processing	87 %
Transmission and Distribution	94 %

Economic Analysis

Basis for Costs and Emissions Savings

For this analysis, methane emissions savings of 1,800 Mcf per year are based on a typical compressor station with 8 compressors, and having ten 8-inch ESD valves. The test is assumed to be conducted at a time when the station pressure is at 500 psig. Each valve is tested once per year using YALE® closures as an alternative to an annual total station dump, cycling all ten valves open and closed in one minute.

The costs of implementation will vary significantly depending on the required facility changes to redesign blowdown systems. The installation of YALE® closure devices range in cost from $785 to $1,600 for 8-inch to 12-inch sizes, not installed.

Discussion

Depending on the volume of gas savings, the price of gas, and operating practices, redesigning blowdown systems

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and altering ESD practices can have a favorable payback period. Gas savings from rerouting blowdown systems to a sales line or for local fuel use should justify the piping and operating costs.

The primary considerations for the reporting partner's installation of YALE® closures was to save operating labor required to install blind flanges on each ESD valve stack as an alternative to a total station dump. However, for operators currently performing annual total station dump tests, the gas savings alone would justify the installation costs of modifying the ESD valve stack to receive YALE® closures and the cost of the YALE® closure devices.

The incremental cost of relocating unit isolation valves and fire gate valves to minimize blowdown volumes during the design stages is negligible. If the project is implemented in an existing station the economics are significantly different. For example, installing a 6 inch trunnion mounted ball valve can cost more than $4,000 for 600 psi service. A 600 series, 24 inch trunnion mounted ball valve can cost $30,000 plus estimated installation costs of $10,000. Methane emissions are determined by the length, diameter, and operating pressure of the piping system to the compressor station.

EPA provides the suggested methane emissions estimating methods contained in this document as a tool to develop basic methane emissions estimates only. As regulatory reporting demands a higher-level of accuracy, the methane emission estimating methods and terminology contained in this document may not conform to the Greenhouse Gas Reporting Rule, 40 CFR Part 98, Subpart W methods or those in other EPA regulations.