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Over pressure protection

PF White Paper

Over pressure protection current practices on low pressure distribution network and new requirement to minimize gas venting from **PHMSA**

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A TYPICAL LOW-PRESSURE SYSTEM

A typical low-pressure system is designed with a **District Regulation Station (DRS) with inlet pressure of 30-100 PSIG** mostly **operated with a pressure lower than 60 PSIG)** with a **pressure delivery between 7-14" WC.**

The DRS is provided with a single over pressure protection system, which usually is a wide-open monitor or a full capacity relief valve.

In case of the worker regulator failure, the wide-open monitor takes over ensuring the pressure does not exceed the Maximum Allowable Operating Pressure (MAOP).

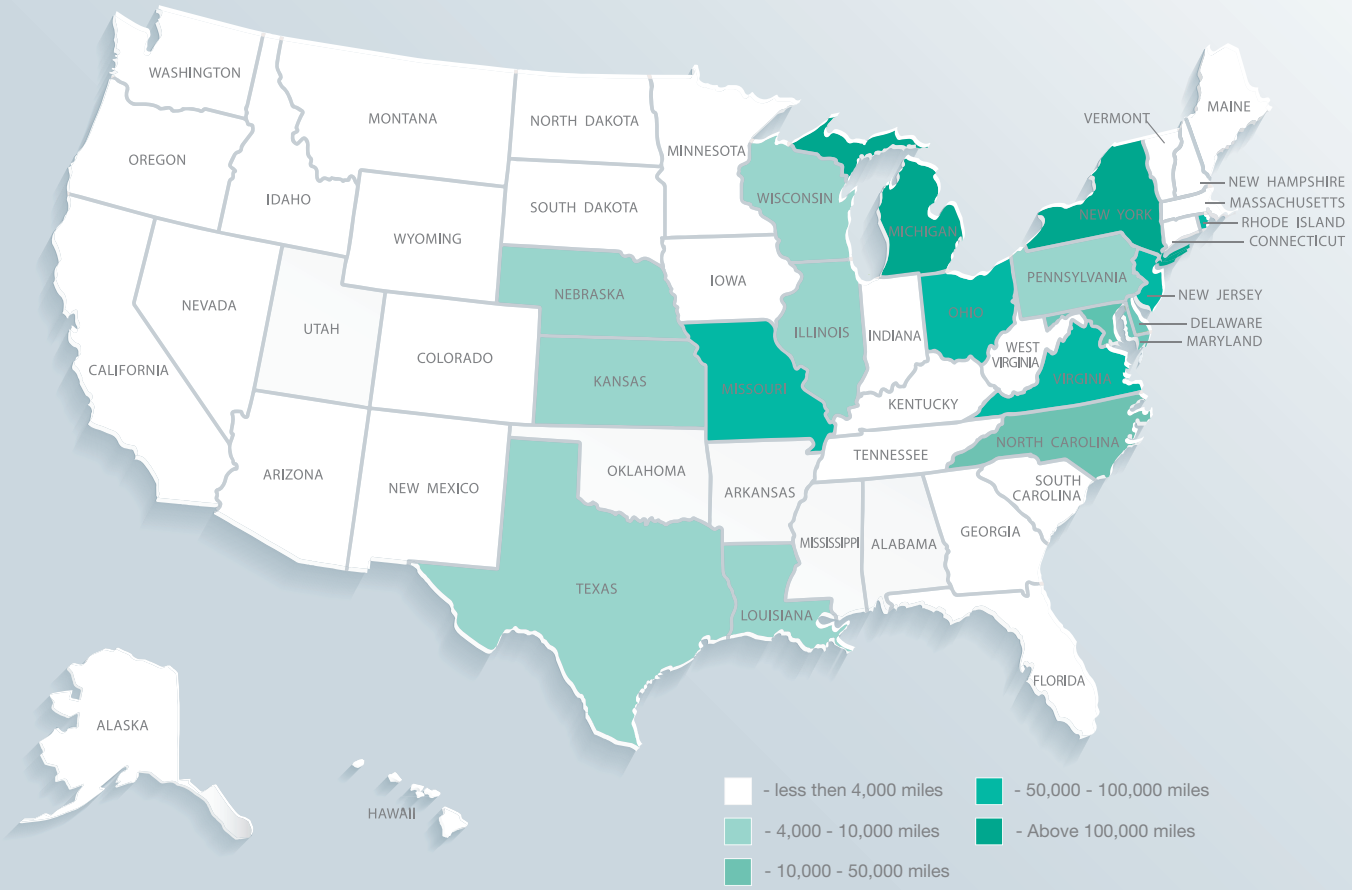
Where the system is protected with a full capacity relief valve, **the valve releases natural gas into the atmosphere** to keep the main line and services operating below the designed MAOP.

Over 600,000 miles of cast iron, ductile iron and copper gas mains and service lines remain in the United States.

Most of these older lines are in the Northeast and Midwest. **recent events have shown the industry inherent risks that can be present in these older low-pressure systems** and as a result, **the National Transportation Safety Board has investigated the problems and made several recommendations.**

Rank	State	Cast iron, ductile iron and copper lines length [miles]	Share of the total length
1	Michigan	203,514	29.8%
2	New York	152,846	22.4%
3	New Jersey	58,722	8.6%
4	Virginia	54,387	8.0%
5	Missouri	52,245	7.6%
6	Ohio	43,463	6.4%
7	North Carolina	29,456	4.3%
8	Pennsylvania	18,131	2.7%
9	Maryland	16,637	2.4%
10	Illinois	11,525	1.7%
11	Wisconsin	9,586	1.4%
12	Nebraska	8,652	1.3%
13	Texas	4,357	0.6%
14	Louisiana	4,009	0.6%

Natural gas main and service lines made of cast Iron, ductile iron and copper in United States (2020)



The chart shows the distribution of older material main and service lines across the nation, where the sum of first six states account for over 80% of the total length.

OPTION A: SAFETY RELIEF VALVE AT A DISTRICT REGULATION STATION (DRS)

One option is to add a secondary over pressure protection with a safety relief valve with full relief to the existing DRS. This option is very sensitive to the physical location where it is installed. In a densely populated urban area where a DRS is located, in a vault or a pit, it may be very challenging to install a relief valve.

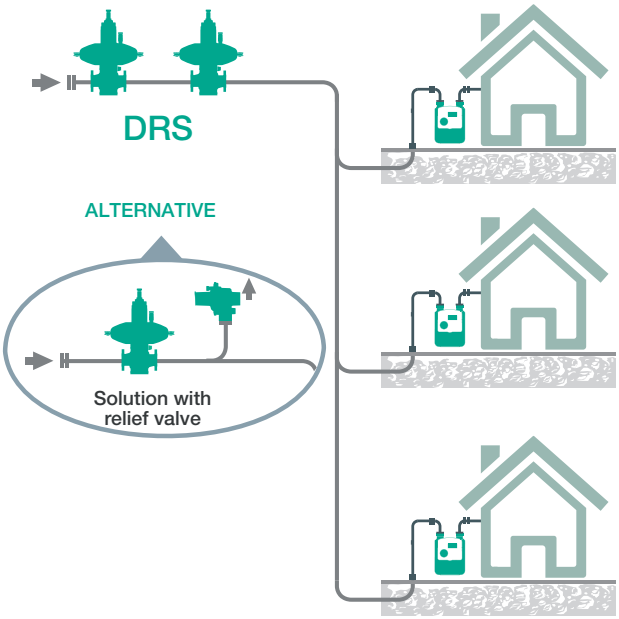
Adding the safety relief valve may be the option with the lowest initial cost, but it does not come without other costs, both financial and environmental. Full relief valves result in exactly that, full relief of the gas lines. This means that operators will be releasing large quantities of methane into the atmosphere and while current natural gas costs are low, **there is a definite financial cost to releasing large amounts of our product into the environment**, never to be captured again.

In **September 2019**, in conjunction with the **NTSB**, the **Pipeline Hazardous Material Safety Administration (PHMSA)** outlined several recommendations for the gas industry.

One of the most important recommendations was to revise Title 49 of the Code of Federal Regulations (CFR) part 192 to require over pressure protection for low

pressure natural gas distribution systems that cannot be defeated by a single operator error or equipment failure.

What does this mean for our industry? Below are several options that gas companies can use to meet these requirements.



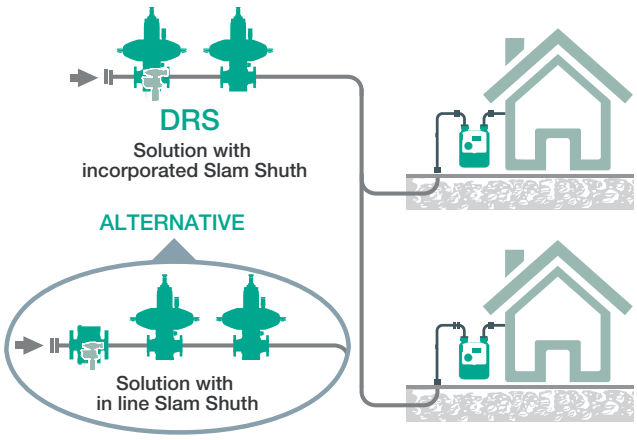
OPTION B: SAFETY SHUT OFF VALVE AT THE DRS

A second option is to add secondary over pressure protection using a slam shut valve (SSV).

When in conjunction with a worker/monitor regulator set up at the DRS, **the SSV will stop the flow of gas when these two regulators have failed**. Typically, if there has been a dual failure of regulators, the operators will want to shut off the flow of gas. It is typically a first responder's initial action when encountering a failed system. In this case, the SSV has already stopped the flow of gas. **If the monitor regulator has the capability to have a built in SSV** option, the **upgrade is usually a minor job with minimal capital investment**. Another option is to add an in-line SSV upstream of the monitor, which would require piping modification.

Having an **SSV as a secondary over pressure protection system** has **additional benefits**. Not only do **most SSVs in the market have over pressure shut off (OPSO) but also can be equipped with under pressure shut off (UPSO)**.

The UPSO is a key feature to stop the gas supply in the event of a major rupture of the downstream gas pipe which is a definite risk present during digging operations.

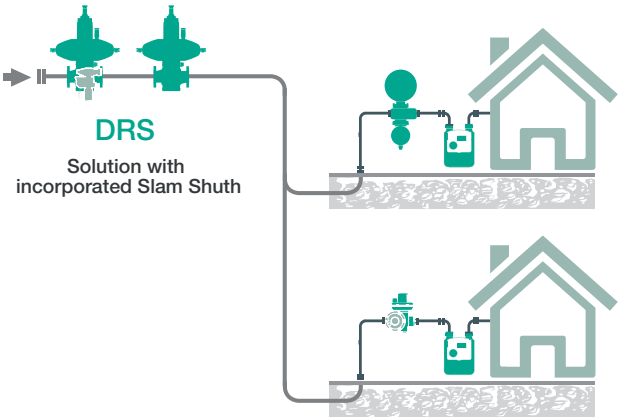


OPTION C: REGULATOR AND OVER PRESSURE PROTECTION AT METER SET

Adding a secondary over pressure protection on the house or commercial meter set, using a regulator with an SSV, is a third option.

Advantages of this include shutting off the flow of gas only after the home or building's regulator has failed.

Most likely after a double failure the operator would want to shut off the gas flow. While following the standard checklist for a responding service technician, they would shut off the flow of gas while diagnosing the problems. Like above, in Option B, having an **SSV serves as an OPSO but some can also work as an UPSO. This can stop the flow of gas in an excess flow condition**.

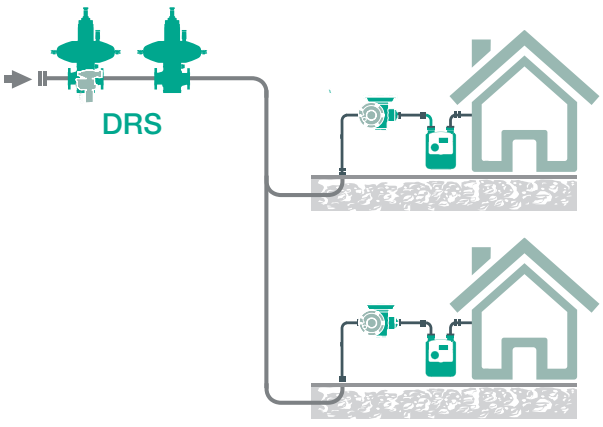


OPTION D: STAND-ALONE SLAM-SHUT VALVE

A final option is to add an over pressure protection system using an SSV, to the existing house or building meter set, that is protecting the home or business. As discussed previously the SSV will stop the flow of gas after both the worker and monitor upstream have failed. After this failure, the rising gas pressures would trip the downstream SSVs and stop the flow of gas into each building equipped with the devices.

This provides increased safety at each customer location and can serve as not only over pressure protection but under pressure protection as well. **One disadvantage of a stand-alone SSV is that it likely cannot be upgraded later if the gas distribution system is upgraded to medium pressure.**

For larger customers, the SSV can be provided with electrical-proving limit switches to communicate with a control room.



2021 AND PHMSA STATUTORY MANDATE

UPDATE INSPECTION AND MAINTENANCE PLANS TO ADDRESS ELIMINATING HAZARDOUS LEAKS AND MINIMIZING THE RELEASE OF NATURAL GAS FROM PIPELINE FACILITIES.

In **June 2021**, PHMSA issued an advisory bulletin requiring pipeline owners and operators to update their Inspection and **Maintenance Plans to Address Eliminating Hazardous Leaks and Minimizing Releases of Natural Gas from Pipeline Facilities** (including, and not limited to, intentional venting during normal operations) from their systems before December 27, 2021. stopped the flow of gas.

O&M plans must be detailed to address the elimination of hazardous leaks and minimization of releases of natural gas from the operator's pipeline facilities; meaning pipeline operators must update their plans to minimize, among other things, fugitive emissions and vented emissions from pipeline facilities.

PHMSA and state inspections, therefore, will evaluate the steps taken to prevent and mitigate both unintentional, fugitive emissions as well as intentional, vented emissions.

Fugitive emissions include any unintentional leaks from equipment such as pipelines, flanges, valves, meter sets, or other equipment. Vented emissions include any release of natural gas to the atmosphere due to equipment design or operations and maintenance procedures.

Common sources of vented emissions include pneumatic device bleeds, blowdowns, incomplete combustion, or over pressure protection venting (e.g., relief valves).

STATISTICS AND INFORMATION TO KNOW

Estimated accidents occurring in the last 5 years on gas distribution and transmission systems (Source: PHMSA)

Estimated hazardous leaks repaired in the last 5 years on gas distribution systems (Source: PHMSA)

Leaks in high-consequence areas in the last 5 years on gas transmission systems (Source: PHMSA)

The NTSB first identified the need for leak-detection and mitigation methods in natural gas transmission and distribution pipelines nearly 50 years ago, but the Pipeline and Hazardous Materials Safety Administration (PHMSA) has yet to require operators to use these life-saving measures, and many operators need clear regulations before acting.

As of today on NTSB's website, Improve Pipeline Leak Detection and Mitigation is included in the **MOST WANTED LIST OF TRANSPORTATION AND SAFETY IMPROVEMENTS 2021-2022.**

Natural gas is composed primarily of methane, therefore leaks and other releases of natural gas emit methane gas into the atmosphere. According to the U.S. Environmental Protection Agency (EPA), methane is a potent greenhouse gas with a global warming potential (GWP) of 28-36 over 100 years. Compared to carbon dioxide, methane gas has a stronger warming effect, but a shorter lifespan in the atmosphere.
Likewise, remediation or replacement of pipeline facilities that are known to leak based on material, design or past operating and maintenance history, can result in enhanced public safety, environmental protection, and economic benefits.

References and sources

49 CFR PART 192—TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE: MINIMUM FEDERAL SAFETY STANDARDS
https://www.ecfr.gov/

Distribution Pipe by Company Data (1990 – 2020)
https://www.aga.org/

Improve Pipeline Leak Detection and Mitigation
https://www.ntsb.gov/safety/

Over pressurization of Natural Gas Distribution System, Explosions, and Fires in Merrimack Valley, Massachusetts
https://www.ntsb.gov/investigations/AccidentReports/

Statutory Mandate to Update Inspection and Maintenance Plans to Address Eliminating Hazardous Leaks and Minimizing Releases of Natural Gas from Pipeline Facilities
https://www.regulations.gov/document/PHMSA-2021-0050-0001

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Currently based in the Italian corporate office, he is a member of ANSI B109 committee and chair of the task force developing the ANSI B109.5 standard.
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