

# 1060 - Pickling

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### **1. GENERAL**

1. Injecting significant amounts of odorant into pipelines to saturate the internal walls of the pipeline with odorant ("pickling") may be necessary to prevent odorant from being absorbed out of the gas stream during normal operation. Pipelines with little or no flow may be subject to the loss of odorant due to the scale on the internal surface of steel pipelines or the internal surface of plastic pipelines absorbing the odorant.

After a pipeline has been pickled, it should be monitored periodically for odor to verify that the odorant is readily detectable in accordance with [O&M Ch. 11-F, Odorization](#). If the odorant is not readily detectable, additional injections using a portable odorant injection unit (contact Measurement personnel to obtain unit with qualified operator) and other steps may be necessary to return the odorant to a readily detectable level [1% gas-in-air].

Monitoring points should be established along the new pipeline and within the downstream existing section. When the monitoring points show sufficient odor intensity levels, monitoring frequency can be reduced.

### **2. Steel Pipelines**

New steel mains containing an internal surface area exceeding approximately 4000 ft<sup>2</sup> that will remain with little or no flow should be pickled. It may also be desired to pickle new mains of large diameter or excessive length regardless of anticipated flow. The table below contains minimum pipe lengths that require pickling if low or no flow conditions exist.

#### **1. Nominal Diameter - Length**

2" - 7400'

4" - 3700'

6" - 2500'

### 3. Plastic Pipelines

1. Plastic mains do not typically require pickling (Reference: Plastic Pipe Institute, *Odorants in Plastic Fuel Gas Distribution Systems*, TN-4/2009). If operating conditions require injecting odorant into a plastic pipeline, ensure odorant is vaporized when it enters the main. To ensure odorant vaporizes upon entry into pipeline, inject very small amounts with significant flow (lower operating pressure as much as possible to increase flow) in the pipeline. No liquid odorant should be introduced into a plastic main without ensuring vaporization because the liquid odorant is a petroleum-based product that could damage the plastic pipe. Odorant injection into plastic pipelines should only be performed if necessary.

## 2. GUIDANCE FOR PICKLING

1. New pipelines and in-service pipelines that have been pigged, cleaned or hydrostatically tested may require conditioning or pickling of the internal surfaces so that odorized gas does not lose odorant when the line is put into service.
2. This document provides an overview of the conditioning process, including guidelines for conditioning methods, equipment and monitoring requirements, considerations for project planning and validation of project completion.
3. Odorant conditioning should be incorporated into the early planning stages of a new steel pipe installation.
4. Note: It is not possible to specify the exact amount needed prior to project execution due to the number of variables and complexity of processes involved. However, a generally acceptable range of odorant rates are in the range of 0.0015 - 0.0265 mL/ft<sup>2</sup> of internal pipeline surface area. (Research as also seen rates as high as 0.2-0.4 mL/ft<sup>2</sup> for TBM [tert-butyl mercaptan] and 0.05 mL/ft<sup>2</sup> for THT [Tetrahydrothiophene])

## 3. SYSTEM PARAMETERS AND PROJECT PREPARATION

1. Every conditioning project is unique, and the two most important steps in planning include research and documentation of relevant system parameters. The pressure, flow (if applicable) and odorant dosage rates should also be documented. This information will help in determination of necessary adjustments in odorant dosage and determination of breakthrough.
2. Recording pipeline system parameters should include, but not be limited to:
  1. pipeline length
  2. diameter
  3. pressure
  4. flow conditions
  5. affected customers
  6. target system odorization rate
  7. odorant blend
  8. venting or flaring of gas

3. A pipeline sketch should be completed to show
  1. below- and above-ground taps
  2. odor monitoring points
  3. distances between these points
  4. injection points.
4. Variability in flows should be determined, including daily and seasonal changes as well as minimum and maximum flows during and after conditioning.
5. Recommended parameters for each monitoring point include:
  1. odor-intensity
  2. odorant-concentration measurements
  3. date and time of readings.
6. The components of odorant blends may breakthrough at different times, and the resulting odor may be different from upstream pipe odor.
7. If low odor levels are detected downstream after project completion, repeat conditioning or supplemental odorization, using any acceptable method, may be required.

#### **4. CONDITIONING METHODS**

Static - heavily odorized gas is isolated in a pipeline segment for conditioning. The static method is more readily applied to short pipeline segments due to non-uniform distribution of the odorant.

Flowing - in which heavily odorized gas flows in the pipe to be conditioned. Long pipeline segments may be better conditioned with the flowing method.

Odorant conditioning should be incorporated into the early planning stages of a new steel or plastic pipe installation.

Steel pipelines can be conditioned with either method, but only the flowing method should be used for plastic pipe. Plastic pipelines may not require conditioning after the initial air-to-gas purge if odor is readily detectable.

##### **1. Static Method**

###### **1. Preparation.**

1. The new pipeline segment should be tied-in and have main line valves or other devices to stop gas flow. Laterals or regulator stations feeding off the isolated section should be isolated as well.
2. An odorant injection tap and one or more taps for monitoring must also be available. One monitoring tap should be located close to the Tail-End of the isolated pipe.

3. The project plan must allow not only for the purging and conditioning procedure, but also for the time that the pipeline containing highly odorized gas will remain isolated.
4. Prior to conditioning, the pipe should be as clean as possible. This can be completed with a steel brush or other appropriate pig.

## 2. Odorant Introduction.

1. Addition of odorant should only take place after the pipeline has been purged to 100 percent gas or company standard.
2. At the injection tap, the desired quantity of liquid odorant is slowly mixed with gas, the liquid vaporizes and the highly odorized gas flows toward the downstream end of the pipeline.
3. Venting, filtering, flaring or some other method to create flow toward the Tail-End is required.
4. The downstream end is monitored for odor and odorant, and when detected, the pipeline should be immediately isolated by closing the Tail-End valve.
5. The initial rate of injection or "dosage" should be slow to promote vaporization of the liquid and prevent pooling at the bottom of the pipe.
6. Consideration should be given for the use of a diffusion injection probe during conditioning operations.
7. A low-odorant level start with subsequent repeat conditioning, if needed, is preferable to a high-odorant level start that may cause an over-saturated pipeline, increased leak calls, perceived safety issues, etc.

## 3. Conditioning and Completion

1. After the flow has stopped, adequate time is needed for completion of the chemical and physical processes required to pickle the pipe, and some or all of the odorant will be absorbed by the pipe. This time could be as short as 24 to 48 hours or as long as multiple weeks.
2. The endpoint could be selected as a set period of time based on prior experience, consistent odor-level readings at the downstream monitoring tap for several monitoring periods or another suitable metric.
3. Conditioning during the project can be considered complete when monitoring indicates that odor intensity in the exit gas is adequate and stable at system targets without supplemental odorization.
4. Measurement of odorant concentrations can provide additional verification of completion. However, if at any point during or after conditioning, insufficient odor is detected inside the isolated pipeline, repeat of the conditioning process may be required.

## 4. Monitoring

1. Each monitoring point along the isolated pipeline must be checked for odor intensity and/or odorant concentration at periodic intervals specified in the procedure.
2. When the monitoring points consistently show sufficient odor-intensity levels, the pipeline can be placed in service.
3. Odorant-concentration measurements may also be helpful to complement odor-intensity tests. These tests should also be considered in

## 2. Flowing Method

In flowing the method, odorized gas flows through the unconditioned pipe and is consumed either in a blowdown, flare or filter at the downstream end of the pipe or in the downstream gas system. This "in-situ" method of deactivating oxidation sites is used to condition long lengths of pipe or a pipe segment in a bi-directional system with limited connections. A comprehensive monitoring plan is essential to avoid over- or under-odorization.

Supplemental odorization may be necessary if consumption of odorant is beyond prescribed limits resulting in inadequate odorized gas downstream of the locations.

### 1. Preparation

1. The new pipeline segment should be tied-in and have means to prevent gas flow using main line valves or other flow stopping devices in the event that the odorization rate becomes too high or too low. If the pipeline is located in a populous area and an excessive amount of odorant is injected, nuisance odorant calls may be experienced.
2. The time required to condition a pipeline using the flowing conditioning method can vary from several hours to multiple weeks. The main factors that affect the time required to condition a pipeline using this method are pipeline cleanliness, amount of rust and gas flow rate.

### 2. Odorant Introduction

1. Addition of odorant should only take place after the pipeline has been purged to 100 percent gas or company standard. Odorant is introduced into the gas stream at the desired injection rate. The injection point can be located at the front or Tail-End of the pipe to be conditioned.
2. A low odorization rate should be used initially, and gradual changes can be implemented until adequate odor intensity is reached.
3. Higher gas flow rates allow the operator to introduce greater amounts of odorant while keeping the odorization rate (lb/MMcf) required for adequate odor intensity in the gas flowing out of the new section of pipe.

### 3. Conditioning and Completion

Continuous flow conditioning can be set up with a front-end odorant injection and a tail-end supplemental injection. The front-end injection conditions the new pipe and the Tail-End injection maintains an adequate odorant concentration downstream of the new pipe.

Either Front-End or Tail-End method can be used to condition steel pipe. For plastic pipe, the Tail-End is the appropriate method. Installation of odorizers at both the Front-End and Tail-Ends may decrease the time needed for conditioning.

For both configurations, conditioning under the pipeline conditions during the project can be considered complete when monitoring indicates that odor intensity in the exit gas is adequate and stable at system target levels without supplemental odorization. Measurement of odorant concentrations can provide additional verification of completion. However, if conditions change, additional conditioning may be required.

#### 1. Front-end injection

The gas at the upstream end of the pipe will contain higher odorant concentrations than the system gas, but the concentration will gradually decrease along the length of the new pipe due to odorant loss. Breakthrough occurs when the odorant levels begin to

increase at the Tail-End. The rate of odorant injection at the Front-End must then be adjusted so that the gas exiting the new pipe is odorized at the target system levels.

## 2. Tail-end injection

The flowing gas will gradually lose odorant along the length of the new pipe. The rate of supplemental odorant injection at the Tail-End must be controlled so that the gas exiting the new pipe maintains odor intensity and odorant-concentration equivalent to the system targets. Breakthrough occurs when the odorant levels begin to increase at the Tail-End. The rate of supplemental odorant injection at the Tail-End must then be adjusted so that the gas exiting the new pipe is odorized at the target system levels.

Conditioning a line with only a Tail-End odorizer may be a slower alternative because the gas flowing in the new section of pipe is odorized at the usual system injection rate.

## 4. Monitoring

1. Odorant-concentration measurements may also be helpful to complement odor-intensity tests.
2. A variation of the flowing method involves placement of a new line in parallel with an existing in-service line that is to be retired. Gas flows through both the new line and old line with a downstream tie-in of the two pipes. Odor intensity is monitored on both lines and on the combined flow downstream of the tie-in. Conditioning is complete when the odor-intensity levels are stable for individual and combined flows.

## 5. EQUIPMENT

The equipment suggested for pipeline conditioning includes:

1. Odorant injection device
2. Flow measurement device
3. Odorant and pressure vessel
4. Monitoring instruments for odor intensity level and odorant concentration

Additional equipment may be required to provide supplemental odorization, if necessary, and to mitigate minor odorant spills or vapor releases.

## 6. POST-CONDITIONING MONITORING

1. After pipeline conditioning, odor intensity monitoring is conducted to ensure that the natural gas odor is readily detectable.
2. It is suggested to monitor daily for one week after conditioning. Depending on the odor readings, monitoring may be required at more frequent intervals than routine periodic sampling.
3. If possible, odorant concentration should also be determined in the field with either permanent or portable instruments.
4. Pipelines that have been installed but not yet placed in service or that are under limited service should receive special to ensure low-flow conditions have not resulted in odor fade. For stagnant or low-flow pipelines, extended monitoring may be appropriate until expected flow rates are achieved.

5. In the event insufficient odor intensity is identified, remedial action should be taken to increase the odorant concentration in the gas stream with additional pipeline conditioning or continuous supplemental odorant injection until acceptable odor levels are achieved.

(UNCONTROLLED IF PRINTED)