FAQs for Pipeline Construction
Revision Date: June 15, 2012

These Frequently Asked Questions (FAQs) and their responses are intended to provide insight into PHMSA's approach to the issues they describe. They are intended to facilitate understanding of the code, enhance communication with all stakeholders, and provide information to operators concerning PHMSA's inspection approach. Nothing in these FAQs alters the content of the code, constitutes new requirements, or represents interpretations of the code. Official written interpretations may be requested in accordance with 49 CFR 190.11.

1. **Why are there so many construction issues lately?**
   There was a boom in pipeline construction from 2007 through 2011. As a result, there have been more inspections of pipelines under construction.

   It is possible that the increased number of construction problems is simply the result of more miles of pipe being constructed. PHMSA's inspection findings, however, indicate that some construction concerns could be laying the foundation for future problems with pipeline integrity. The high rate of construction could have stretched the construction resources thin and added pressures to finish a job with fewer resources. Attention to quality by all involved in the process of pipeline construction is needed to assure quality pipe and minimize future problems.

   Revised: 6/15/12

2. **What kinds of issues has PHMSA found?**
   PHMSA construction inspections have found issues in all areas associated with pipeline construction. Pipeline coating has been the area where the most issues have been identified. In the course of inspecting 35 pipeline construction projects, PHMSA has identified problems in these areas:

Issue Area	No. of problems
Coatings	117
Welding	87
Excavation	20
Nondestructive Testing	20
Pipe Materials	12
Bending	9
Lowering/Installation in Ditch	7
Hydrostatic Testing	4
Design	3
Miscellaneous	5

   Original: 8/7/09

3. **Why are coating issues of such concern if pipe is protected by cathodic protection?**
   Coating and cathodic protection (CP) are both intended to prevent external corrosion of buried pipelines. They are intended as defense-in-depth – two layers of protection. Good coating is necessary because CP is not always good enough. There may be issues that reduce the

effectiveness of CP, such as shielding. There may be problems with the CP system that go undetected for some period. Experience has shown that corrosion can do significant damage to a pipeline if CP is not adequate, even for a period of a few months. It is necessary to assure that pipeline coating is good to provide continued assurance of protection against corrosion even if CP problems occur.

Original: 8/7/09

4. **What is the cause of recent pipeline construction issues?**
   There are several causes. Pipeline material issues can result from problems that occur at the mills where steel is made and where it is made into pipe. Issues that occur at the construction site can result from poor/wrong materials or from poor construction practices.

   Original: 8/7/09

5. **Don't pipeline standards provide enough guidance for construction?**
   There have been recent advances in pipeline technology, including for example more use of high-strength steels. There are some instances in which the standards need to catch up to current practice. The standards do provide adequate guidance for many issues. PHMSA's evaluation of many of its inspection findings from construction projects has found that the details specified in the standards are often not realized in the installed pipe.

   Original: 8/7/09

6. **Aren't construction procedures adequate?**
   PHMSA has found that the procedures for most pipeline construction projects are adequate and reflect the recommendations of consensus standards. The procedures are not always followed, though. This could be a result of inadequate training or understanding of the procedures by those who must implement them.

   Original: 8/7/09

7. **Isn't Quality Control supposed to find problems?**
   Quality Control (QC) is used on pipeline construction projects to assure that the quality of construction meets required specifications. It is an extra layer of defense beyond having adequate procedures and doing things correctly. QC can find problems, which are indicative of problems in the construction. The correct response is to identify the reasons why the construction problems are occurring and correct them. It is not acceptable to simply rely on QC to find problems as the only means of assuring quality construction.

   Original: 8/7/09

8. **Are pipeline construction personnel adequately qualified?**
   The personnel qualification requirements in PHMSA regulations apply to operators of pipelines, not to construction personnel. The owners of pipeline projects are responsible for assuring that their construction personnel are adequately qualified. Deficiencies in personnel qualification – lack of understanding of what they are supposed to do – has been found to be a contributing factor to many construction inspection deficiencies.

   Original: 8/7/09

9. **Don't high-strength steels make pipelines safer?**
   Pipelines are designed with a safety margin. As high-strength steels are used, new pipelines are

being designed to use thinner-walled and higher strength steel pipe, and may operate at higher pressures. It is thus important to assure that the high-strength pipe material meets specifications to assure that the required safety margin is maintained.

Revised: 6/15/12

10. What kinds of pipe material problems have been seen?

In some pipeline construction projects, the material properties of the high-strength steel have been found to vary among the many sections, or "joints," of pipe that are purchased. A principal property is the yield strength, the amount of stress that the steel can withstand before it begins to yield, changing its shape/physical dimensions. Some pipe joints have been found to have a yield strength as much as 15 percent below that specified. Pipeline design, including the required safety margin, generally assumes that the pipe is as strong as the specification requires. Pipe that is below specification values thus can reduce the safety margins.

Revised: 6/15/12

11. How have pipeline construction problems been identified?

Some problems have been identified by PHMSA safety inspectors reviewing procedures and observing pipeline construction. Problems have also been identified through testing done to verify pipeline construction. This has included failures experienced during hydrostatic testing (e.g., failure of welds, expansion of pipe and fittings that has exceeded its yield strength). Problems with pipeline coating have been identified using a number of types of indirect examinations that are designed to find "holidays" or damage to the pipeline coating. Post-construction inspections with in-line inspection tools (sometimes called "smart pigs") have also found problems such as denting and gouges.

Revised: 6/15/12

12. What kinds of problems have led to coating issues?

The single most-significant cause of identified coating problems has been failure to follow manufacturer's instructions and operator procedures. This problem has been identified in instances in which field-applied coatings have been identified as inadequate. It has also been identified in inadequate inspections of coatings using electronic defect detectors (commonly known as "jeeping"). Failure to properly prepare the pipe surface, removing all dirt and rust, has also resulted in problems.

Revised: 6/15/12

13. What kinds of problems have led to welding issues?

Again, the most significant cause of welding issues is failure to follow procedures. Problems with pre-heating and pipe alignment (misalignment of the pipe bevels) have also contributed to inadequate welds.

Revised: 6/15/12

14. Isn't non-destructive testing required after welding? Why is it not finding the problems?

Non-destructive testing (NDT) is required following welding. Ultrasonic inspection and radiographic inspection (similar to X-rays) are the most common techniques used. These inspection techniques are designed to find gaps in the weld and foreign materials (i.e., inclusions) in the weld metal.

Welds in high-strength steels are more susceptible to hydrogen-induced cracking. Hydrogen from the welding rods dissolves in the molten weld metal. This hydrogen comes out of solution as the metal cools. If all of the hydrogen is not allowed to escape, it can result in delayed cracking of the finished weld. In some recent cases, reviews of NDT records following weld failures have found that there were no cracks or inclusions in the welds. In these cases, it is likely that hydrogen-assisted cracking occurred after the post-welding NDT was done.

Original: 8/7/09

15. Can welders be qualified to work on any pipeline project?

Pipeline safety regulations make assuring proper qualification of welders the responsibility of the pipeline operator. Welders are often contract personnel who work on many pipelines for different operators. Pipeline operators can, and sometimes do, run joint qualification programs, but the responsibility remains with each individual operator to assure its welders are qualified.

Original: 8/7/09

16. Isn't there a way to reduce the amount of hydrogen that dissolves in weld metal and thus reduce the incidence of hydrogen-assisted cracking?

Yes. Hydrogen is present in the coating of the most commonly-used welding electrodes. Low-hydrogen electrodes exist and are beginning to be used in pipeline construction welding. The extent to which low-hydrogen electrodes are used remains small, however. Proper heat treatment, including time at temperature to allow hydrogen to diffuse out of the weld metal, can also help reduce hydrogen-assisted cracking.

Original: 8/7/09

17. Is there any pattern to the welding problems that have been identified?

Pipeline construction welding problems have been found most often on projects involving new, high-strength steels.

Original: 8/7/09

18. Can better management practices help assure quality?

Yes. Application of Quality Management Systems (QMS) can help assure quality. QMS is more than QA/QC of the finished product. It includes assuring that procedures are correct, reflect the provisions of relevant standards, and are followed during construction.

Original: 8/7/09

19. How can we assure that coating is not damaged during direct bore and similar installations?

Use of indirect assessments such as direct current voltage gradient (DCVG) following installation has identified instances of coating damage resulting from installation.

Original: 8/7/09

20. What kinds of problems have been noted during State inspections of pipeline construction?

The most common findings from State pipeline construction inspections have included:

- Poorly Qualified Construction Personnel
- Poorly Qualified Inspectors by Operators
- Storage and Handling of Pipe
- Improper Procedures

- Failure to Follow Procedures
- Lack of Procedures
- Span of Control of Inspectors Used by Operators

Original: 8/7/09

21. How does a pipeline operator control material problems that occur during steel and pipe manufacturing?

Pipeline operators need to assure that their specifications are adequate. They must also assure that steel and pipe mills, fitting and hot bend manufacturers have, and follow, quality management programs designed to ensure the production of quality materials (pipe, steel, fittings, and hot bends). Finally, operators need to inspect the materials that they receive, including during manufacturing, carefully to assure that their specifications have been met.

Revised: 6/15/12

22. What kinds of pipe material problems have been found?

Material deficiencies identified in pipe for new pipeline construction projects include:

- Incorrect chemical composition
- Low and variable yield strength
- Laminations and Inclusions
- Incorrect pipe bevel ends – high/low and flat spots on pipe ends

Revised: 6/15/12

23. What factors can contribute to low and variable yield strength?

Factors that can affect yield strength include:

- Wrong heat chemistry from steel supplier
- Pipe test locations for yield/ultimate tensile strengths at steel and pipe mills
- Plate/coil ordered under strength based on the type pipe rolling process
- Incorrect plate/coil rolling process
- Improper plate/coil cooling rates
- Plate/coil switch at pipe mill

Original: 8/7/09

24. What kind of fitting and hot bend material problems have been found?

Material deficiencies identified in fittings and hot bends for new pipeline construction projects include:

- Low and variable yield strength
- Incorrect strength/grade of material used for manufacturing the fitting
- Incorrect pipe bevel ends – high/low and misalignment of hot bend ends

Original: 6/15/12