

Advisory Bulletin (ADB-02-7)

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Billing Code: 4910-60-P

DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

Notification of the Susceptibility to Premature Brittle-like Cracking of Older Plastic Pipe.

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Notice; issuance of advisory bulletin.

SUMMARY. RSPA is issuing this follow-up advisory bulletin to owners and operators of natural gas distribution systems to inform them of the susceptibility to premature brittle-like cracking of older plastic pipe and the voluntary efforts to collect and analyze data on plastic pipe performance. A Special Investigation Report issued by the National Transportation Safety Board (NTSB) described how plastic pipe installed in natural gas distribution systems from the 1960s through the early 1980s may be vulnerable to brittle-like cracking resulting in gas leakage and potential hazards to the public and property. On March 11, 1999, RSPA issued two advisory bulletins on this issue. The first bulletin reminded natural gas distribution system operators of the potential poor resistance to brittle-like cracking of certain polyethylene pipe manufactured by Century Utility Products, Inc. The second bulletin advised natural gas distribution system operators of the potential vulnerability of older plastic pipe to brittle-like cracking.

ADDRESS: This document can be viewed on the Office of Pipeline Safety (OPS) home page at: <http://ops.dot.gov>.

FOR FURTHER INFORMATION CONTACT: Gopala K. Vinjamuri, (202) 366-4503, or by email at gopala.vinjamuri@rspa.dot.gov.

SUPPLEMENTARY INFORMATION

I. Background

On April 23, 1998, NTSB issued a Special Investigation Report (NTSB/SIR-98/01), Brittle-like Cracking in Plastic Pipe for Gas Service, that describes how plastic pipe installed in natural gas distribution systems from the 1960s through the early 1980s may be vulnerable to brittle-like cracking resulting in gas leakage and potential hazards to the public and property. An NTSB survey of the accident history of plastic pipe suggested that the material may be susceptible to

premature brittle-like cracking under conditions of local stress intensification because of improper joining or installation procedures. Hundreds of thousands of miles of plastic pipe have been installed, with a significant amount installed prior to the early-1980s. NTSB believes any vulnerability of this material to premature cracking could represent a potentially serious hazard to public safety. Copies of this report may be obtained by calling NTSB's Public Inquiry Office at 202-314-6551.

RSPA has already issued two advisory bulletins on this issue. The first advisory bulletin, ADB-99-O1, which was published in the Federal Register on March 11, 1999 (47 FR 12211), reminded natural gas distribution system operators of the potential poor resistance to brittle-like cracking of certain polyethylene pipe manufactured by Century Utility Products, Inc. The second advisory bulletin, ADB99-02, also published in the Federal Register on March 11, 1999 (47 FR 12212), advised natural gas distribution system operators of the potential brittle-like cracking vulnerability of plastic pipe installed between the 1960s and early 1980s.

The phenomenon of brittle-like cracking in plastic pipe as described in the NTSB report and generally understood within the plastic pipeline industry relates to a part-through crack initiation in the pipe wall followed by stable crack growth at stress levels much lower than the stress required for yielding, resulting in a very tight slit-like openings and gas leaks. Although significant cracking may occur at points of stress concentration and near improperly designed or installed fittings, small brittle-like cracks may be difficult to detect until a significant amount of gas leaks out of the pipe, and potentially migrates into an enclosed space such as a basement. Premature brittle-like cracking requires relatively high localized stress intensification that may be a result from geometrical discontinuities, excessive bending, improper installation of fittings, and dents and gouges. Because this failure mode exhibits no evidence of gross yielding at the failure location, the term brittle-like cracking is used. This phenomenon is different from brittle fracture, in which the pipe failure causes in fragmentation of the pipe.

The NTSB report suggests that the combination of more durable plastic pipe materials and more realistic strength testing has improved the reliability of estimates of the long-term hydrostatic strength of modern plastic pipe and fittings. The report also documents that older polyethylene pipe, manufactured from the 1960s through the early 1980s, may fail at lower stresses and after less time than was originally projected. NTSB alleges that past standards used to rate the long-term strength of plastic pipe may have overrated the strength and resistance to brittle-like cracking of much of the plastic pipe manufactured and used for gas service from the 1960s through the early 1980s.

In 1998, NTSB made several recommendations to trade organizations and to RSPA on the need for a better understanding of the susceptibility of plastic pipe to brittle-like cracking. This advisory bulletin responds to one of the NTSB

recommendations. It is that RSPA "[d]etermine the extent of the susceptibility to premature brittle-like cracking of older plastic piping (beyond that marketed by Century Utilities Products Inc.) that remains in use for gas service nationwide. Inform gas system operators of the findings and require them to closely monitor the performance of the older plastic piping and to identify and replace, in a timely manner, any of the piping that indicates poor performance based on such evaluation factors as installation, operating, and environmental conditions; piping failure characteristics; and leak history."

In order to obtain the most complete information on the extent of the susceptibility to premature brittlelike cracking of older plastic pipe, a meeting was convened in May 1999 with all the stakeholders to determine how information on older plastic pipe could be assembled. The meeting included representatives of the American Gas Association (AGA), the American Public Gas Association (APGA), the Gas Research Institute (GRI) (now the Gas Technology Institute), the Midwest Energy Association (MEA), and the Plastic Pipe Institute (PPI).

As a result of the May 1999 meeting, the Joint Government-Industry Plastic Pipe Study Committee was formed to address the recommendations of the NTSB Special Investigation Report. The committee held three separate meetings to prepare a draft response to the NTSB recommendations and a draft industry notification of brittle-like cracking problems, the subject of this advisory bulletin. The committee membership consisted of a representative from OPS, a gas distribution operator from AGA, and the Transportation Safety Institute. Meetings were facilitated by General Physics Corporation, Columbia, MD. One of the committee findings was that there is a lack of data available from the industry to completely identify older plastic pipe that is still in service and may be susceptible to brittle-like cracking.

This finding led to the formation of the Plastic Pipe Database Committee (PPDC) to develop a process for gathering data on future plastic pipe failures with involvement from the states, which have assumed the authority from OPS over gas distribution systems, where most of the plastic pipe is installed. The PPDC is comprised of representatives from Federal and State regulatory agencies and from the natural gas and plastic pipe industries. Members include AGA, APGA, PPI, the National Association of Regulatory Utility Commissioners (NARUC), the National Association of Pipeline Safety Representatives (NAPSR), and OPS.

The PPDC database is expected to improve the knowledge base of gas utility operators and regulators and is intended to help reveal any failure trends associated with older plastic piping materials. The PPDC's mission is "to develop and maintain a voluntary data collection process that supports the analysis of the frequency and causes of in-service plastic piping material failures." It provides an opportunity for government and industry to work together to evaluate the extent of plastic pipe performance problems and to mitigate any risks to safety. The PPDC started gathering data in January 2001 from OPS and State pipeline

safety agencies. For more information on the PPDC, go to the AGA web page (www.aga.org), and enter "PPDC" in the keyword search.

II. Advisory Bulletin (ADB-02-7)

To: Owners and Operators of Natural Gas Distribution Pipeline Systems

Subject: Notification of the Susceptibility to Premature Brittle-like Cracking of Older Plastic Pipe.

Advisory: In recent years, brittle-like cracking has been observed in some polyethylene pipes installed in gas service through the early 1980s. This brittle-like cracking (also known as slow crack growth) can substantially reduce the service life of polyethylene piping systems.

The susceptibility of some polyethylene pipes to brittle-like cracking is dependent on the resin, pipe processing, and service conditions. A number of studies have been conducted on older polyethylene

pipe. These studies have shown that some of these older polyethylene pipes are more susceptible to brittle-like cracking than current materials. These older polyethylene pipe materials include the following:

- Century Utility Products, Inc. products.
- Low-ductile inner wall "Aldyl A" piping manufactured by Dupont Company before 1973.
- Polyethylene gas pipe designated PE 3306. (As a result of poor performance this designation was removed from ASTM D-2513.)

The environmental, installation, and service conditions under which the piping is used are factors that could lead to premature brittle-like cracking of these older materials. These conditions include, but are not limited to:

- Inadequate support and backfill during installation
- Rock impingement
- Shear/bending stresses due to differential settlement resulting from factors such as:
 - o Excavation in close proximity to polyethylene piping

- o Directional drilling in close proximity to polyethylene piping
- o Frost heave
- Bending stresses due to pipe installations with bends exceeding recommended practices
- Damaging squeeze-off practices

Service temperatures and service pressures also influence the service life of polyethylene piping. Piping installed in areas with higher ground temperatures or operated under higher operating pressures will have a shorter life.

Gas system operators may experience an increase in failure rates with a susceptible material. A susceptible material may have leak-free performance for a number of years before brittle-like cracks occur. An increase in the occurrence of leaks will typically be the first indication of a brittle-like cracking problem. It is the responsibility of each pipeline operator to monitor the performance of their gas system. RSPA issues the following recommendations to aid operators in identifying and managing brittle-like cracking problems in polyethylene piping involving taking appropriate action, including replacement, to mitigate any risks to public safety.

Because systems without known susceptible materials may also experience brittle-like cracking problems, RSPA recommends that all operators implement the following practices for all polyethylene piping systems:

1. Review system records to determine if any known susceptible materials have been installed in the system. Both engineering and purchasing records should be reviewed. Based on the available records, identify the location of the susceptible materials. More frequent inspection and leak surveys should be performed on systems that have exhibited brittle-like cracking failures of known susceptible materials.
2. Establish a process to identify brittle-like cracking failures. Identification of failure types and site installation conditions can yield valuable information that can be used in predicting the performance of the system.
3. Use a consistent record format to collect data on system failures. The AGA Plastic Failure Report form (Appendix F of the AGA Plastic Pipe Manual) provides an example of a report for the collection of failure data.
4. Collect failure samples of polyethylene piping exhibiting brittle-like cracking. Evidence of brittle-like cracking may warrant laboratory testing. Although every failure may not warrant testing, collecting samples at the time of

failure would provide the opportunity to conduct future testing should it be deemed necessary.

5. Whenever possible record the print line from any piping that has been involved in a failure. The print line information can be used to identify the resin, manufacturer and year of manufacture for plastic piping.

6. For systems where there is no record of the piping material, consider recording print line data when piping is excavated for other reasons. Recording the print line data can aid in establishing the type and extent of polyethylene piping used in the system.

(49 U.S.C. chapter 601; 49 CFR 1.53)

Issued in Washington, DC, on November 21, 2002.

Stacey L. Gerard
Associate Administrator for Pipeline Safety.

[FR Doc. 02-30055 Filed 11-25-02; 8:45 am]

Advisory Bulletin (ADB-02-7) - Correction

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DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

Notification of the Susceptibility to Premature Brittle-Like Cracking of Older Plastic Pipe

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Notice; correction.

SUMMARY: In the Federal Register of November 26, 2002, (67 FR 70806) the Research and Special Programs Administration (RSPA) published a notice document issuing an advisory bulletin on the susceptibility to premature brittle-like cracking of older plastic pipe (ADB-02-7). RSPA is submitting this correction notice to reflect minor wording changes and include a website address.

EFFECTIVE DATE: This correction takes effect November 26, 2002.

FOR FURTHER INFORMATION CONTACT: Gopala K. Vinjamuri, (202) 366-4503, or by email at gopala.vinjamuri@rspa.dot.gov.

SUPPLEMENTARY INFORMATION:

Correction

The last sentence in the first paragraph of the Supplementary Information heading under I. Background, reads:

Copies of this report may be obtained by calling NTSB's Public Inquiry Office at 202-314-6551.

We are revising this sentence to add NTSB's website address. The sentence is revised to read as follows:

Copies of this report may be obtained by calling NTSB's Public Inquiry Office at 202-314-6551, or on the NTSB website at www.nts.gov.

In the fourth paragraph under SUPPLEMENTARY INFORMATION, the first sentence reads:

The NTSB report suggests that Remove the word ``suggests" and replace with the word ``states".

In the fourth paragraph under Supplementary Information, the third sentence reads:

NTSB alleges that Remove the word ``alleges" and replace with the word ``concluded".

Under II. Advisory Bulletin (ADB-02-7) of the SUPPLEMENTARY INFORMATION heading, in the second paragraph under Advisory. The fourth sentence reads:

These older polyethylene pipe materials include the following:

The sentence is revised to read as follows:

These older polyethylene pipe materials include, but are not limited to:

Issued in Washington, DC on November 27, 2002.
James K. O'Steen,
Deputy Associate Administrator for Pipeline Safety.
[FR Doc. 02-30615 Filed 12-2-02; 8:45 am]

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Advisory Bulletin ADB-99-01

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DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration

Potential Failure Due to Brittle-Like Cracking Certain Polyethylene Plastic Pipe
Manufactured by Century Utility Products Inc

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Notice; issuance of advisory bulletin on Century polyethylene gas pipe
to owners and operators of natural gas distribution systems.

SUMMARY: This advisory bulletin is directed at owners and operators of natural
gas distribution systems that have installed plastic pipe extruded by Century
Utility Products Inc. from Union Carbide Corporation's DHDA 2077 Tan medium
density polyethylene resin (Century pipe). Pipe manufactured between 1970 and
1973 may fail in service due to its poor resistance to brittle-like cracking.
Operators with Century pipe in their systems should closely monitor this pipe for
leaks with increased leak survey frequency. Century pipe that may be improperly
installed, repaired, or operating in an environment that impairs pipe strength
should be replaced.

ADDRESSES: This document can be viewed on the Office of Pipeline Safety
(OPS) home page at: <http://ops.dot.gov>.

FOR FURTHER INFORMATION CONTACT: Gopala (Krishna) Vinjamuri at (202)
366-4503, or by E-mail at vinjamuri@rspa.dot.gov.

SUPPLEMENTARY INFORMATION:

I. Background

The National Transportation Safety Board (NTSB) recently published the results
of a special investigation into accidents that involved plastic pipe currently in use
to deliver natural gas to residential and business use. The report, Brittle-Like
Cracking in Plastic Pipe for Gas Service (NTSB/SIR-98/01; April 23, 1998)
suggested that "[d]espite the general acceptance of plastic piping as a safe and
economical alternative to piping made of steel and other materials, [a] number of
pipeline accidents investigated have involved plastic piping that cracked in a
brittle-like manner." Copies of this report may be obtained from NTSB Public
Inquiry Office by calling 202-314-6551.

The phenomenon of brittle-like cracking in plastic pipe as described in the NTSB
report and generally understood within the plastic pipeline industry relates to a

part-through crack initiation in the pipe wall followed by stable crack growth at stress levels much lower than the stress required for yielding, resulting in a very tight slit-like opening and gas leak. This failure mode is difficult to detect until significant amount of gas leaks out of the pipe, and potentially migrates into closed space such as basements of dwellings. Premature brittle-like cracking requires relatively high localized stress intensification that may be a result from geometrical discontinuities, excessive bending, improper fitting assemblies, and/or dents and gouges. Because this failure mode exhibits no evidence of gross yielding at the failure location, the term brittle-like cracking is used. This phenomenon is different from brittle fracture, in which the failure results in fragmentation of the pipe.

NTSB also alleged that the guidance provided by manufacturers and industry standards for the installation of plastic pipe is inadequate for limiting stress intensification, particularly at plastic service connections to steel mains, many of these connections may have been installed without adequate protection from shear and bending forces that may result in brittle-like cracking.

Century Pipe

Between 1970 and 1973, Century Utility Products Inc. (a/k/a AMDEVCO), now defunct, marketed medium density polyethylene plastic pipe and fittings (Century pipe) in sizes ranging from 1/2 inch to 4 inches for use in natural gas distribution. These plastic pipes and fittings were manufactured by extrusion from Union Carbide Corporation's DHDA 2077 Tan resin, and was marked PE 2306 in accordance with American Society for Testing and Materials (ASTM) standards. Following investigation of a series of incidents, including the December 2, 1979, explosion in a residence in Tuscola, Illinois, and the October 17, 1994, accident in Waterloo, Iowa, that resulted in several fatalities, it was established that the Union Carbide's DHDA 2077 Tan resin lacks adequate resistance to brittle-like cracking and is prone to relatively short life when subjected to high local stress concentration. The pipe in the Tuscola, Illinois, accident failed in less than 8 years, and the pipe in the Waterloo, Iowa, accident failed within 23 years in service. It has been established that Century pipe exhibited significantly higher leak rate in comparison with other polyethylene, steel, and cast iron pipe used in natural gas distribution systems.

Following the Waterloo, Iowa, accident, RSPA has taken number of actions, including gathering Century pipe installation data. Also, remedial action has been taken by various operators in mid-western states where much of the Century pipe produced was known to have been installed. It is RSPA's understanding that the operators having Century pipe in their systems have initiated close monitoring and some have replacement program in progress.

NTSB recommended that RSPA notify owners and operators of natural gas systems who continue to use Century pipe of the potential for premature failures by brittle-like cracking and the need to "[d]evelop a plan to closely monitor the

performance of and to identify and replace, in a timely manner, any piping that indicates poor performance based on such evaluation factors as installation, operating and environmental conditions, piping failure characteristics and leak history."

II. Advisory Bulletin (ADB-99-01)

To: Owners and Operators of Natural Gas Distribution Pipeline Systems.

Subject: Susceptibility of certain polyethylene pipe manufactured by Century Utility Products Inc. to premature failure due to brittle-like cracking.

Purpose: To advise natural gas distribution pipeline owners and operators of the need to closely monitor and replace as necessary polyethylene natural gas pipe manufactured by Century Utility Products Inc. between 1970 and 1973 that is susceptible to brittle-like cracking.

Advisory: All owners and operators of natural gas distribution systems who have installed and continue to use polyethylene pipe extruded by Century Utility Products Inc, (now defunct) from the resin DHDA 2077 Tan resin manufactured by Union Carbide Corporation during the period 1970 to 1973 (Century pipe) are advised that this pipe may be susceptible to premature failure due to brittle-like cracking. Premature failures by brittle-like cracking of Century pipe is known to occur due to poor resin characteristics, excessive local stress intensification caused by improper joints, improper installation, and environments detrimental to pipe long-term strength. All distribution systems containing Century pipe should be monitored to identify pipe subject to brittle-like cracking. Remedial action, including replacement, should be taken to protect system integrity and public safety.

In addition, in light of the potential susceptibility of Century pipe to brittle-like cracking, RSPA recommends that each natural gas distribution system operator with Century pipe revise their plastic pipe repair procedure(s) to exclude pipe pinching for isolating sections of Century pipe. Additionally, RSPA recommends replacement of any Century pipe segment that has a significant leak history or which for any reason is of suspect integrity.

Authority: 49 U.S.C. Chapter 601; 49 CFR 1.53.

Issued in Washington, DC on March 5, 1999.
Richard B. Felder,
Associate Administrator for Pipeline Safety.
[FR Doc. 99-6013 Filed 3-10-99; 8:45 am]
BILLING CODE 4910-60-P

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DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration

Potential Failures Due to Brittle-Like Cracking of Older Plastic Pipe in Natural Gas Distribution Systems

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Notice; issuance of advisory bulletin on brittle-like failures of plastic pipe to owners and operators of natural gas distribution systems.

SUMMARY: RSPA is issuing this advisory bulletin to owners and operators of natural gas distribution systems to inform them of the potential vulnerability of older plastic gas distribution pipe to brittle-like cracking. The National Transportation Safety Board (NTSB) recently issued a Special Investigation Report (NTSB/SIR-98/01), Brittle-like Cracking in Plastic Pipe for Gas Service, that described how plastic pipe installed in natural gas distribution systems from the 1960s through the early 1980s may be vulnerable to brittle-like cracking resulting in gas leakage and potential hazards to the public and property. RSPA has also issued an additional advisory bulletin (ADB-99-01) reminding natural gas distribution system operators of the potential poor resistance to brittle-like cracking of certain polyethylene pipe manufactured by Century Utility Products, Inc.

ADDRESSES: This document can be viewed on the Office of Pipeline Safety (OPS) home page at: <http://ops.dot.gov>.

FOR FURTHER INFORMATION CONTACT: Gopala K. Vinjamuri, (202) 366-4503, or by email at gopala.vinjamuri@rspa.dot.gov.

SUPPLEMENTARY INFORMATION:

I. Background

The National Transportation Safety Board (NTSB) recently issued a Special Investigation Report (NTSB/SIR-98/01), Brittle-like Cracking in Plastic Pipe for Gas Service, that described how plastic pipe installed in natural gas distribution systems from the 1960s through the early 1980s may be vulnerable to brittle-like cracking resulting in gas leakage and potential hazards to the public and property. An NTSB survey of the accident history of plastic pipe suggested that the material may be susceptible to premature brittle-like cracking under conditions of local stress intensification because of improper joining or installation procedures. Hundreds of thousands of miles of plastic pipe have been installed,

with a significant amount installed prior to the mid-1980s. NTSB believes any vulnerability of this material to premature failure could represent a potentially serious hazard to public safety.

The NTSB report addressed the following safety issues:

- The vulnerability of plastic pipe to premature failures due to brittle-like cracking;
- The adequacy of available guidance relating to the installation and protection of plastic pipe connections to steel mains; and
- Performance monitoring of plastic pipeline systems as a way of detecting unacceptable performance in piping systems.

Copies of this report may be obtained by calling NTSB's Public Inquiry Office at 202-314-6551.

The phenomenon of brittle-like cracking in plastic pipe as described in the NTSB report and generally understood within the plastic pipeline industry relates to a part-through crack initiation in the pipe wall followed by stable crack growth at stress levels much lower than the stress required for yielding, resulting in a very tight slit-like opening and gas leak. Although significant cracking may occur at points of stress concentration and near improperly designed or installed fittings, small brittle-like cracks may be difficult to detect until a significant amount of gas leaks out of the pipe, and potentially migrates into an enclosed space such as a basement. Premature brittle-like cracking requires relatively high localized stress intensification that may be a result from geometrical discontinuities, excessive bending, improper fitting assemblies, and/or dents and gouges. Because this failure mode exhibits no evidence of gross yielding at the failure location, the term brittle-like cracking is used. This phenomenon is different from brittle fracture, in which the failure results in fragmentation of the pipe.

The report suggests that the combination of more durable plastic pipe materials and more realistic strength testing has improved the reliability of estimates of the long-term hydrostatic strength of modern plastic pipe and fittings. The report also documents that older polyethylene pipe, manufactured from the 1960s through the early 1980s, may fail at lower stresses and after less time than was originally projected. NTSB alleges that past standards used to rate the long-term strength of plastic pipe may have overrated the strength and resistance to brittle-like cracking of much of the plastic pipe manufactured and used for gas service from the 1960s through the early 1980s.

In 1998, NTSB made several recommendations to trade organizations and to the Research and Special Programs Administration (RSPA) on the need for a better understanding of the susceptibility of plastic pipe to brittle-like cracking. NTSB

recommended that RSPA "[d]etermine the extent of the susceptibility to premature brittle-like cracking of older plastic piping (beyond that marketed by Century Utilities Products Inc.) that remains in use for gas service nationwide."

II. Advisory Bulletin (ADB-99-02)

To: Owners and Operators of and Natural Gas Distribution Pipeline Systems

Subject: Potential susceptibility of plastic pipe installed between the 1960 and the early 1980s to premature failure due to brittle-like cracking.

Purpose: To inform natural gas distribution pipeline operators of the need to determine the extent of susceptibility to brittle-like cracking of plastic pipe installed between the years 1960 and early 1980s.

Advisory: A review of Office of Pipeline Safety (OPS) reportable natural gas pipeline incidents and the findings of NTSB Special Investigation Report (NTSB/SIR-98/01) indicates that certain plastic pipe used in natural gas distribution service may be susceptible to brittle-like cracking. The standards used to rate the long-term strength of plastic pipe may have overrated the strength and resistance to brittle-like cracking of much of the plastic pipe manufactured and used for gas service from the 1960s through the early 1980s.

It is recommended that all owners and operators of natural gas distribution systems identify all pre-1982 plastic pipe installations, analyze leak histories, and evaluate any conditions that may impose high stresses on the pipe. Appropriate remedial action, including replacement, should be taken to mitigate any risks to public safety.

Authority: 49 U.S.C. Chapter 601; 49 CFR 1.53.
Issued in Washington, D.C. on March 3, 1999.
Richard B. Felder,
Associate Administrator for Pipeline Safety.

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