Managing Aldyl-A Polyethylene Pipe in Avista’s Distribution System

By Dr. Gene Palermo, Palermo Plastics Consulting and Kristen Busko, Avista Utilities

There have recently been a number of incidents involving DuPont Aldyl-A medium-density polyethylene (MDPE) pipe. This article will first review the history of Aldyl-A pipe and the various resins used in its production, and then review the Avista Utilities program to systematically remove selected portions of Aldyl A pipe from its natural gas distribution system in Washington, Oregon and Idaho.

Physical Properties

The first thermoplastic resin the DuPont Company used to manufacture plastic pipe for the industry was polyacetal, with the trade name Delrin®. Manufacturing began at the plant in Tulsa, OK in 1960. Because the polyacetal material was brittle, DuPont made a co-extruded pipe with a polyacetal core and an outer layer of polyethylene (PE).

The trade name was Alathon®, with DelPont taking the “al” from Alathon and “del” from Delrin to arrive at the trade name “Aldel.” Apparently, this was too close to an existing trade name, so they changed the “e” to a “y” and came up with Aldyl® as the new trade name for its co-extruded thermoplastic gas pipe.

In 1965, DuPont eliminated the polyacetal layer and began to make gas pipe as a solid wall PE pipe. The name of this PE pipe was Aldyl-A pipe.

The PE resin DuPont initially used for the production of Aldyl-A pipe from 1965-70 was Alathon 5040. This PE resin used a butene comonomer and had a base resin density of 0.935 g/cc and a melt index (MI) of 2 g/10 min.

These two properties of melt index and density control many of the other physical properties for PE materials. Most of the other PE materials used for the gas industry at that time had an MI of about 0.2 g/10 min, so Aldyl-A was not fusion-compatible with these other materials. With this relatively low molecular weight (high MI), the recommended butt fusion temperature for Aldyl-A pipe was 310°F (154°C), compared to 400°F (204°C) to 500°F (260°C) for the other PE materials.

Because some of the small tubing sizes made from the Alathon 5040 resin did not consistently meet the ASTM D1599 quick burst minimum stress requirement of 2520 psi, DuPont decided to use a higher density PE resin. DuPont changed to Alathon 5043 resin in 1970.

This was also a butene comonomer, but with a higher base resin density of 0.939 g/cc to increase the yield strength and more consistently meet quick burst stress requirements. In order to maintain a balance of molecular parameters, the molecular weight was increased when the density was increased, and the corresponding melt index was 1.2 g/10 min. With this higher molecular weight (lower MI), the butt fusion joining temperature was increased to 340°F (171°C).

Alathon 5043 was the primary PE resin that DuPont used for Aldyl-A pipe from 1970-83. It was also during this time that the LD1W (low-ductile inner wall) phenomenon occurred.

In the late 1970-71 era, DuPont had a manufacturing issue that resulted in a brittle inside surface. This was detected during some elevated-temperature, stress-rupture testing, resulting in premature failures in which multiple slits were observed as opposed to the normal single slit failure.

It was also noted that the spherulites on the inside surface were extremely large (30-40 microns). Because of these large spherulites on the inside surface, this pipe was called “large-bore spherulite” pipe, or the term more commonly used is LD1W.

The brittle inside surface resulted from the manufacturing process that degraded the inner surface. The premature failures were due to an oxidized inner surface that dramatically reduced the initiation time and thus the overall failure time.

The effect of this LD1W surface on long-term pipe performance has been determined using the rate process method (RPM). In early 1972, DuPont changed the manufacturing process to prevent these large spherulites from forming. DuPont estimated about 30-40% of the pipe it produced in 1970-71 had an LD1W inner surface, and it was primarily in pipe sizes 1½-inch to 4-inch IPS.

Alathon 5043 was a good PE resin at the time it was manufactured. However, by today’s standards, the slow crack growth (SCG) resistance of Alathon 5043 resin was relatively low. For the past several years, SCG has been measured with the Pennsylvania notch test (PENT), which is described in ASTM F1473.

When PENT was introduced in the PE gas pipe standard ASTM D2513, the requirement was 100 hours at 80°C/2.4 MPa. The current D2513 minimum requirement is 500 hours PENT. Today’s high-performance bimodal PE materials have PENT values over 10,000 hours. In comparison, the PENT value for the Alathon 5043 PE material was one hour.

Another measure of SCG resistance is elevated temperature sustained pressure testing in accordance with ASTM D1598. This is a single-point test but it can be correlated with long-term performance, since the failure mode in the laboratory test is the same as the failure mode in field failures for PE gas pipe.

At typical test conditions of 80°C and 120 pounds per square inch gage (psig) – 600 pounds per square inch (psi) hoop stress – the failure time for Aldyl-A pipe made from Alathon 5043 resin was about 100 hours. This using the standard bidirectional shift factors, 80°C/600 psi/100 hours, shifts to 21°C/1,200 psi/7 years.

That means at an average annual ground temperature of 21°C (70°F) and a hoop stress of 1,200 psi (240 psig), the average failure time is about seven years. A pressure of 240 psig is about four times higher than the standard operating pressure of 60 psig typically used for gas distribution. (Information on bidirectional shift Factors is in Reference 1, which is a White Paper that I wrote for the American Gas Association.)

In 1983, DuPont made a significant change in the PE resin, switching from a butene comonomer to an octene comonomer. The original octene resin was called Alathon 5046-C, and it had a melt index of 1.1 g/10 min and a base resin density of 0.939 g/cc.
The change to octene resulted in a significant improvement in SCG resistance and in long-term performance. The octene comonomer has longer side branches than butene (six carbons instead of two carbons), and this improved the efficiency of the tie molecules, which control long-term performance. This increased efficiency of the tie molecules resulted in a significantly longer time for the crack to grow, and thus for a failure to occur, as shown in a typical 80ºC/600 psi stress rupture test for Aldyl-A pipe, using test method ASTM D1598:
- Alathon 5043 resin (butene comonomer) 100 hours
- Alathon 5046C resin (octene comonomer) 1,000 hours

Using the standard bidirectional shift factors, 80ºC/600 psi/1,000 hours shifts to 21ºC/1,200 psi/710 years. This means that at an average annual ground temperature of 21ºC (70ºF) and a hoop stress of 1,200 psi (240 psig), average failure time is about 710 years.

An advantage of the lower density was increased flexibility for the pipe. This made the pipe easier to bend, as well as easier to coil, uncoil and squeeze-off – especially in cold weather. These installation advantages, coupled with the improved SCG resistance, made Alathon 5056-U one of the best PE materials available for the natural gas distribution market.

The last change in the resin for Aldyl-A pipe came in 1992 with the introduction of Alathon 5046-O. DuPont developed technology making it possible to selectively place the octene comonomer on the high molecular weight molecules. Since the tie molecules are a very high molecular weight, much of the octene comonomer was added to the molecules that directly affect long-term performance.

Since the amount of comonomer remained the same, the density was still 0.933 g/cc and the melt index was still 1.1 g/10 min. This final change in the PE resin resulted in another improvement in SCG resistance, as evidenced by 80ºC/600 psi stress rupture testing for Aldyl-A pipe:
- Alathon 5043 resin 100 hours
- Alathon 5046-C resin 1,000 hours
- Alathon 5046-U resin 10,000 hours
- Alathon 5046-O resin >30,000 hours

Using the standard bidirectional shift factors, 80ºC/600 psi/30,000 hours shifts to 21ºC/1,200 psi/2,100 years. This means that at an average annual ground temperature of 21ºC (70ºF) and a hoop stress of 1,200 psi (240 psig), the average failure time is about 2,100 years.
Dr. Carl Popelar introduced bidirectional shift factors in the early 1990s. He used stress rupture data from several unimodal medium-density PE materials, unimodal high-density PE materials and also bimodal high-density materials, and found stress rupture data for all these PE materials could be shifted into one master curve.

He also determined the equations for shifting data from one temperature to another. There is a corresponding bidirectional shift in both the hoop stress and the time when the temperature is shifted. The equations were based on about 50 different stress rupture datasets for a variety of PE materials.

\[ a = \exp \left[ -0.109 \left( T - T_R \right) \right] \]
\[ b = \exp \left[ 0.0116 \left( T - T_R \right) \right] \]

Where the temperature \( T \) and the arbitrary reference temperature \( T_R \) are in degrees Celsius.

When the coefficients “\( a \)” and “\( b \)” are known, the hoop stress \( S \) and the failure time \( t \) are calculated from the following equations.

\[ S \left( T_R \right) = S \left( T \right) x b \]
\[ t \left( T_R \right) = t \left( T \right) / a \]

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Density</th>
<th>Melt Index</th>
<th>Co-monomer</th>
<th>Resin</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldyl-A</td>
<td>1966 – 1970</td>
<td>0.935</td>
<td>2.0</td>
<td>Butene</td>
<td>Alathon 5040</td>
<td>Original Alathon resin</td>
</tr>
<tr>
<td>Aldyl-A</td>
<td>1970 – 1983</td>
<td>0.939</td>
<td>1.2</td>
<td>Butene</td>
<td>Alathon 5043</td>
<td>Increased density due to quick burst test</td>
</tr>
<tr>
<td>LDIW Aldyl-A</td>
<td>1971 – 1972</td>
<td>0.939</td>
<td>1.2</td>
<td>Butene</td>
<td>Alathon 5043</td>
<td>Manufacturing issue</td>
</tr>
<tr>
<td>Improved Aldyl-A</td>
<td>1983 – 1988</td>
<td>0.939</td>
<td>1.1</td>
<td>Octene</td>
<td>Alathon 5046-C</td>
<td>Changed comonomer</td>
</tr>
<tr>
<td>Improved Aldyl-A</td>
<td>1988 – 1992</td>
<td>0.933</td>
<td>1.1</td>
<td>Octene</td>
<td>Alathon 5046-U</td>
<td>Added more comonomer</td>
</tr>
<tr>
<td>Improved Aldyl-A</td>
<td>1992 -</td>
<td>0.933</td>
<td>1.1</td>
<td>Octene</td>
<td>Alathon 5046-O</td>
<td>Placed comonomer on high molecular weight molecules</td>
</tr>
</tbody>
</table>

Table 1: DuPont Aldyl-A PE pipe and Alathon PE resins.

**Bidirectional Shift**

Bidirectional shift factors in the early 1990s. Used stress rupture data from several unimodal medium-density PE materials, unimodal high-density PE materials and also bimodal high-density materials, and found stress rupture data for all these PE materials could be shifted into one master curve.

He also determined the equations for shifting data from one temperature to another. There is a corresponding bidirectional shift in both the hoop stress and the time when the temperature is shifted. The equations were based on about 50 different stress rupture datasets for a variety of PE materials.

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\[ S \left( T_R \right) = S \left( T \right) x b \]
\[ t \left( T_R \right) = t \left( T \right) / a \]
As an example, we have determined that at a test temperature of 80°C and test hoop stress of 600 psi, the failure time (or running time) is 1,000 hours. We would like to know the corresponding hoop stress and time at 20°C.

In calculation 1, the test conditions shift from a stress of 600 psi to a stress of 1,203 psi and from a time of 1,000 hours to a time of 79 years, when the temperature is shifted from 80°C to 20°C.

**Example Calculation 1: Shift from 80°C to 20°C.**

Example Calculation 2: Shift from 23°C to 80°C.

Note when shifting from a high temperature to a lower temperature that the stress is shifted to a higher stress and the time is shifted to a higher time. Since both stress and time are shifted, the method is referred to as a bidirectional shift.

Of course, shifts can be made from a lower temperature to a higher temperature (Figure 2), when the shift was from 23°C to 80°C.

### RPM/Popelar Correlation

In Table 1, the DuPont raw data for our RPM program for 2-inch Aldyl-A control pipe is displayed. Note that this was low ductile inner wall (LDIW) Aldyl-A pipe. The first column is the file number – in this case file Number 691. The second column is the failure mode – in this case all are 1, which denotes a slit failure. The third column is the temperature in degrees Celsius; the fourth column is the internal pressure in psig, while the fifth column is the failure time in hours.

RPM equation for that data set:

\[
\text{Data File FILE691.DAT}
\]

\[
\log_{10}(t) = A(0) + A(1)/T + A(2)*P
\]

\[
\begin{align*}
A(0) &= -15.955 \\
A(1) &= 8,563.6 \\
A(2) &= -1,167.3
\end{align*}
\]

### Table: RPM/Popelar Correlation

<table>
<thead>
<tr>
<th>Reference Conditions</th>
<th>Shifted Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (T) = C</td>
<td>23</td>
</tr>
<tr>
<td>Stress (Sr) = psi</td>
<td>1600</td>
</tr>
<tr>
<td>Failure time (t) = hr</td>
<td>100,000</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\log_{10}(t) &= A(0) + A(1)/T + A(2)*P \\
A(0) &= -15.955 \\
A(1) &= 8,563.6 \\
A(2) &= -1,167.3
\end{align*}
\]

Example Calculation 1: Shift from 80°C to 20°C.

<table>
<thead>
<tr>
<th>Popelar Shift Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Conditions</td>
</tr>
<tr>
<td>Temperature (T) = C</td>
</tr>
<tr>
<td>Stress (Sr) = psi</td>
</tr>
<tr>
<td>Failure time (t) = hr</td>
</tr>
</tbody>
</table>

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Note when shifting from a high temperature to a lower temperature that the stress is shifted to a higher stress and the time is shifted to a higher time. Since both stress and time are shifted, the method is referred to as a bidirectional shift.

Of course, shifts can be made from a lower temperature to a higher temperature (Figure 2), when the shift was from 23°C to 80°C.
RPM projection can be correlated for this way, the Popelar shift projection and the temperature and corresponding pressure. In this, the projected time at the same 20°C temperature from the RPM program was determined. The Popelar shift function was used to bidirectionally shift each test condition to 20°C. This would be the Popelar shift projection based on each single point test condition.

The RPM program determined the RPM projected time at the same 20°C temperature and corresponding pressure. In this way, the Popelar shift projection and the RPM projection can be correlated.

It can be seen that as the test temperature decreased, the correlation between the Popelar shift projection and the RPM projection improved. Also, from these calculations, we can see that as the test pressure decreases, the correlation between the Popelar shift projection and the RPM projection improves.

The correlation at 90°C/60 psig is 19 years vs. 7 years, which is a factor of 2.71, or a 171% higher projection for Popelar shift, compared to the RPM projection. The correlation at 70°C/30 psig is 251 years vs. 270 years, which is a factor of 0.93 or a 7% lower projection for Popelar shift, compared to the RPM projection. This is quite good.

**RPM/Popelar Correlation**

Table 2 shows the DuPont raw data for the RPM program for 2-inch Aldyl-A indented pipe. This was the same LD IW Aldyl-A pipe lot used for the control RPM program.

Here is the RPM equation for that data set:

<table>
<thead>
<tr>
<th>Test Condition</th>
<th>20°C BSF Projection</th>
<th>20°C RPM Projection</th>
<th>BSF/RPM Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°C 30 psig/756 h</td>
<td>67.5 psig/178 yrs</td>
<td>67.5 psig/107 yrs</td>
<td>66% higher</td>
</tr>
<tr>
<td>80°C 60 psig/261 h</td>
<td>120 psig/20.6 yrs</td>
<td>120 psig/11 yrs</td>
<td>87% higher</td>
</tr>
<tr>
<td>80°C 30 psig/2582</td>
<td>60 psig/204 yrs</td>
<td>60 psig/171 yrs</td>
<td>19% higher</td>
</tr>
<tr>
<td>70°C 60 psig/896 h</td>
<td>107 psig/23.8 yrs</td>
<td>107 psig/17 yrs</td>
<td>40% higher</td>
</tr>
<tr>
<td>70°C 30 psig/9472</td>
<td>53.5 psig/251 yrs</td>
<td>53.5 psig/270 yrs</td>
<td>7% lower</td>
</tr>
</tbody>
</table>

The table summarizes these projections for File 693 (indented pipe).

The test temperature decreases, and the correlation between the Popelar shift projection and the RPM projection improves. Also, from these calculations, we can see again that as the test pressure decreases, the correlation between the Popelar shift projection and the RPM projection improves, with the exception of the 70°C comparison, which is very good at both pressures.

The correlation at 90°C 60 psig is 8.9 years vs. 5.4 years, which is a factor of 1.65 or a 65% higher projection for Popelar shift, compared to the RPM projection. The correlation at 70°C 30 psig is 14.8 years 16.4 years, which is a factor of 0.90, or a 10% lower projection for Popelar shift, compared to the RPM projection.

These are quite good. With the exception of the highest temperature and highest pressure condition, they are all within the 30-50% assumed error between Popelar shift and RPM.
Several years ago after the collapse of a bridge in the Minneapolis-St. Paul area, a cartoon was published showing two people standing on a sidewalk acknowledging the news and bemoaning what else could go wrong. Shown only as can best be done in cartoons, was a mish-mash of pipes underneath their very feet, totally out of sight, in various contortions and in varying levels of disrepair and decay.

The message of the cartoonist was to demonstrate that the state of today’s infrastructure is not only what you can see, i.e., roads and bridges, but also what cannot be seen. At the Plastic Pipe Institute, that “underground infrastructure” is what mainly concerns us.

The success of any municipality (one could easily say, state, country or even civilization) must necessarily depend on its ability to provide basic services to a greater civilization or even society. Clean water, electricity and gas are essential building blocks for a prosperous and thriving populace.

As a country grows and technology expands over time, various pipe solutions are created and employed; each promoting improved performance or economics—sometimes both—as a reason to design a distribution system using a particular type of pipe. Pipe systems are created and employed; each promoting improved performance or economics—sometimes both—as a reason to design a distribution system using a particular type of pipe.

**Identifying Pipe Systems**

If one looks at the United States, a relatively newcomer in terms of developed countries, as an incubator of developing technologies, it becomes apparent that what is underfoot is a veritable cacophony of pipe systems. For example, in 1815, clay pipe was first installed for water in Washington, DC. Since that time, cast iron, concrete, corrugated steel, concrete pressure, asbestos concrete, ductile iron, polyvinyl chloride and polyethylene pipe have been used in various applications for underground distribution systems.

Is it any wonder that 200 years later, many municipalities are challenged to know what is underground, where it is, when it was installed and who made it?

To go back in time and identify who, what, where and when pipe systems were installed may be one of the most difficult tasks a municipality or utility can be tasked with. However, going forward and taking advantage of newer technology, the ability to track and trace new installations may allow future generations to completely identify their underground assets.

In the early 2000s, the federal Pipeline and Hazardous Materials Safety Administration (PHMSA), recognized that the lack of adequate traceability information and tracking of pipe locations prevented operators from having enough information to identify system issues related to incidents. Furthermore, the inability to locate affected sections of pipe or fittings could result in excessive and unnecessary pipe excavations, adding to lack of service and additional costs.

**New Regulations**

In an effort to resolve this shortcoming, PHMSA has proposed regulations (for example, NPRM 2014-0098) that require tracking and traceability in accordance with ASTM F2897-11a. It’s evident that PHMSA’s intent is to ensure that all operators have methods to identify the location of pipe, the people who joined the pipe and components in the pipeline system.

This standard, along with the proposed regulations, would require a 16-character code and barcode along with corresponding record retention practices to provide all the pertinent data necessary to identify the who, what, when and how records for every gas distribution installation throughout the life of the asset.

**Tracking/Traceability Program**

The Plastics Pipe Institute, Inc. (PPI) is a trade association that has worked closely with federal agencies for over 50 years and assists PHMSA in developing and implementing a tracking and traceability program for the benefit and safety of the public. To that end, PPI hosts the registry for gas pipe and component manufacturers, known as Component ID.org, which registers manufacturers of gas pipeline assets, enabling utilities to fully identify what they have in their gas distribution system.

There are 25 manufacturers registered in ComponentID.org, with many more expected when F2897 is fully incorporated. In the past few years, PPI member companies have invested significant dollars to lead in the development and implementation by marking over 90% of their gas distribution products with a 16-character code and bar code (in accordance with ASTM F2897), well in advance of regulations, to demonstrate their commitment and support of PHMSA’s initiative.

As this program continues to develop, PPI has also been working with the American Gas Association (AGA) and PHMSA on a reasonable implementation approach for rolling out the full tracking and traceability program and participated in the AGA tracking and traceability workshop that took place in November.

One can quickly surmise that this tracking and traceability program can be quite extensive when considering all the various components that go into a modern gas distribution system. Pipes, fittings, valves, risers and meters are just a few of the pieces that must be catalogued. One major technical challenge

By Tony Radziszewski, President, Plastics Pipe Institute, Inc. (PPI)
facing this endeavor is to develop a scanning technology and record retention procedures that can be used across multiple platforms.

Leveraging the vast intellectual property of our members developed during decades of working within the gas industry, we joined forces with another close ally, the Gas Technology Institute (GTI), to help develop marking solutions that can be effectively used throughout the system.

One has to consider not only the multiple components mentioned earlier, but the multiple materials as well, including metals, plastics, alloys and composites. This collaborative effort with GTI and others will ultimately deliver a standardized coding system able to cross all pipelines and appurtenances.

Polyethylene Pipe

Polyethylene pipe constitutes nearly 60% of the nation’s gas distribution system and over 95% of all newly installed gas distribution piping. Without question, the integrity and safety of the hundreds of thousands of miles of our members’ pipe and fittings is of great concern not only to PPI, but to other committed organizations as well.

To that end, in the early 2000s a group of representatives of federal and state regulatory agencies and the natural gas and plastic pipe industries formed The Plastic Pipe Data Collection Initiative (PPDC). The goal of the PPDC has been to create a national voluntary database of information related to the in-service performance of plastic piping materials.

Working with congressional leaders and staff, our members can provide critical information and insight regarding developments in materials and technology used in gas distribution and transmission systems.

In another example, the Department of Energy is announcing several new initiatives and enhancing existing programs to modernize infrastructure and reduce methane emissions through common-sense standards, smart investments, and innovative research to advance the state of the art in natural gas system performance. This stems in part from President Obama’s Climate Action Plan calling for a comprehensive, interagency strategy for reducing methane emissions from gas transmission and distribution systems.

Working with the Federal Energy Regulatory Commission, PPI is actively engaged to provide insight regarding replacement of leak-prone pipes and other infrastructure improvements and upgrades to enhance the safe and reliable operation of natural gas pipelines.

Since 1950, PPI has been a resource to the gas industry to promote the acceptance and responsible use of plastic pressure pipe and systems in the energy markets by providing research, education, and code/standard development with a focus on delivering safe and sustainable plastic system solutions.

For further information, visit www.plasticpipe.org.

Author: Tony Radoszewski is president of the Plastics Pipe Institute, Inc., the trade association representing all segments of the plastic pipe industry. He is a veteran of the plastics industry with nearly 35 years of experience including leadership positions in sales, marketing and business development at Phillips 66 Company/Phillips Driscopipe. Radoszewski earned a bachelor’s degree in chemistry in 1980 from St. Mary’s University in San Antonio, TX.
STEEL VS. PLASTIC PIPE: Some Thoughts to Consider

With oil prices hovering near $50 a barrel for the first time since the crash of 2008, oil and gas producers are watching to see if this is a temporary blip from the $80-100 range or closer to a “new normal” in which prices stay below $60.

For some, this price uncertainty has meant scaling back production, exploration and drilling with the looming possibility of halting some activities all together. Traditional oil and gas companies are not the only ones feeling the squeeze. The Wall Street Journal recently reported that the U.S. Steel Corporation, which depends heavily on oil and gas companies to buy its steel pipe and tubes, might have to stall its Lorain, OH plant in March and lay off 614 of the plant’s 700 workers. The company also said it could temporarily end work at a plant in Houston, affecting 142 workers.

Examples like this will be a hard hit for many workers across the country. While methods vary from company to company, one thing holds true for oil and gas well operators: production needs to occur. Price pressures are causing companies to look for steps in the process that can be reworked to save time and money.

One area for improvement is the installation of gathering lines that connect wells to production facilities. Because every day that a well is not producing is a day that a company is missing out on revenue, it is important that gathering lines are fast, easy and safe to install.

While gathering lines are traditionally made of steel, companies have been using plastic pipe as an alternative for years. With price uncertainty and the push for immediate revenue, the time is right to re-examine the question of steel or plastic to see if the oil and gas industry should change its status quo.

Though the core functionalities of each of the respective pipes are the same, their history and makeup are not. Before the invention of pipe bending for oil pipelines, oil was transported from wells to railway stations by horse in converted wooden whiskey barrels. According to Pipeline Equities, it is because of these that we still measure oil by the barrel.

With wood and metal pipelines replacing barrels in 1865, the steel pipeline has deep roots in the U.S. oil and gas industry. Of the more than 385,000 miles of liquid petroleum pipelines, nearly 320,000 miles of gas transmission pipelines, and over 2 million miles of gas distribution pipelines, the overwhelming majority are made of steel.

Steel pipe may still be the go-to choice for oil field operators but plastic pipe is growing in popularity. Initially developed in the early 1990s, reinforced thermoplastic pipe (RTP) is a generic term referring to a pipe constructed of plastic polymers and reinforced with Aramid, polyester, or glass.

It was developed to replace medium-pressure steel pipe in response to growing demand for non-corrosive conduits for application in the onshore oil and gas industry, particularly in the Middle East. The combination provides a corrosive-resistant pipe for oil and gas applications with the strength to replace steel pipes in low- and medium-pressure situations.

While both get the job done, there are several benefits to both plastic and steel pipe for oil and gas production. RTP is lightweight and flexible, whereas steel is heavy, requiring much more manpower, equipment and energy to transport and install.

Unlike RTP, the strength of steel makes it difficult to bend and manipulate. RTP is also more cost-effective than steel pipe and can save companies from spending unnecessary dollars, allowing companies to cut costs instead of cutting activity.

Arguably, one of the most significant advantages to RTP is its highly corrosion-resistant components. Plastic pipe is low maintenance and will never fail due to rust-like steel pipe can. In fact, corrosion inhibitors are never needed as they are with traditional steel pipelines.

While steel can deliver unmatched temperature and pressure service levels, RTP has made advances in this area that make it usable in a majority of use cases.

There are several prominent players in the plastic pipe space that are making major headway against the steel industry with RTP and composite pipe. While ultimately it’s up to each field operator to determine whether plastic or steel pipe works best for their business plan, it’s easy to see the benefits in using RTP piping: speed to get wells flowing and producing for its operators, lower operating costs, increased corrosion resistance, and easier to work with and transport.

With the uncertainty in the oil and gas industry as well as related industries (like steel), it’s a smart to consider plastic pipe for gathering lines and other applications in the oilfield to keep production flowing at a lower cost.