Increasing Pipeline Construction Tie-In Safety - *The Truth*

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Pipeline tie-ins are difficult to assess, because each one is different. In addition to the difference in the field aspects that create different working environments, energy companies also differ in their design and best construction practices contractors adhere to. While tie-ins are difficult to address, there are proactive measures that can be taken during the design and construction phases of a pipeline project. Here I discuss some common cost-effective approaches to safe construction practices that also reflect better damage prevention practices.

Energy Companies Can Improve Pipeline Tie-Ins

1. Safe tie-ins begin at the planning stages of the right-of-way itself for midstream/transmission construction.

Two main factors impact how safe a tie-in will be: one is depth, and the other is underground utilities. These two factors directly affect the width of the trench which affects the safe width of a travel lane. To proactively address this ahead of time, the energy company can do two things to help lessen risk on the front end and help the contractor better plan their work and materials on the back end. One is to have the project engineer (PE) walk the proposed right-of-way he/she is designing the project for. Two is to involve the project superintendent of the contractor chosen to construct the project or equal subject matter expert. This feedback and collaboration will provide critical information on hazards that will accompany the project relative to equipment, and available specialty pipe, such as abrasive resistant overcoat (ARO), bottle neck risks, etc. This input from the superintendent might be able to assist in centerline conversations, high risks areas and a walk down of the project before the as-builts are officially released to contracting parties. This can dramatically increase productivity, lower costs and tremendously lessen risk to workers who will be involved in the construction of the pipeline down the road.

2. Build in contingencies to the state 811 one-call system.

Each state is slightly different in their specific 811 damage prevention programs—aka ground disturbance programs. Even soil classifications can be different and exceed OSHA requirements in 1926 Subpart P. These differences can cause problems in the project planning process because utility locators only locate publicly owned utilities and what they are given from the operating companies pipeline integrity records. This poses many problems for a pipeline contractor because there is currently no national certification for utility locators, and this can create inconsistencies in a locator's competence.

A nationally recognized training and certification is needed to improve locators' understanding of underground utilities. This would help the accuracy of locates for contractors to plan their work around. It would also help locators identify additional utilities that might not be on the documents supplied to them by the energy company to reference. These unknown utilities create dangerous working conditions to pipeline contractors, especially during the tie-in practice of sections. However, unknown utilities can be found during the initial locates called in to the 811 state systems.

Abandoned or unknown utilities owned by energy companies or private firms impact the safe trench excavation and bell hole design where the tie-in will occur. This in return affects the available working space on a travel lane which jeopardizes the equipment stability and reduces needed working space for the tie-in crew to affectively do their job. Abandoned utilities can be found by pairing a 3rd party survey contractor with the planning stages of the project. This 3rd party locator should have vacuum excavation equipment available to them to validate positive identification. This will also give you your depth which can help in future tie location planning.

Often safe pipeline contractors do this when they get to the right-of-way, however it should be done before the contractor kicks off stringing pipe. Why you ask? Because identifying unknown lines, abandoned lines, and close-proximity lines can dramatically reduce hazards to utilities by excavators before the contractor breaks ground. It allows utility owning companies to assess their own hazards, assists engineering in wall thickness needs, and provides enough time for companies to potentially relocate, reduce flow or shut off products before construction begins.

3. Technologies to solve problems and improve pipeline integrity.

There are several technologies that can be easily implemented during the planning phases of a project and throughout the pipeline construction process. The Safe Excavator app by The National Excavator Initiative allows pipeline workers to very quickly research state specific 811 laws and checklists. For example, Michigan is different than Illinois in call-in request time. All Patriot Pipeline Safety pipeline consultants are required to utilize this app in the field to help facilitate safe excavations. This helps the site foreman proactivity plan for a tie-in.

Additional survey systems such as Pipetrak IT by Petro IT can help energy companies create a much-needed record of utilities that cross their right-of-way. This record is created during the 3rd party survey sweeps by walking and utility sweeping the entire right-of-way before construction takes place. These records can be handed over to the client upon completion to support decades of safe excavations and sell off's regarding the asset constructed to another company who will then have a complete record of assets crossing their right-of-way. 811 laws can also be modified to require locators to locate even without ground disturbance. This would help the contractor plan their work more safely and efficiently and would further reduce cost to the client.

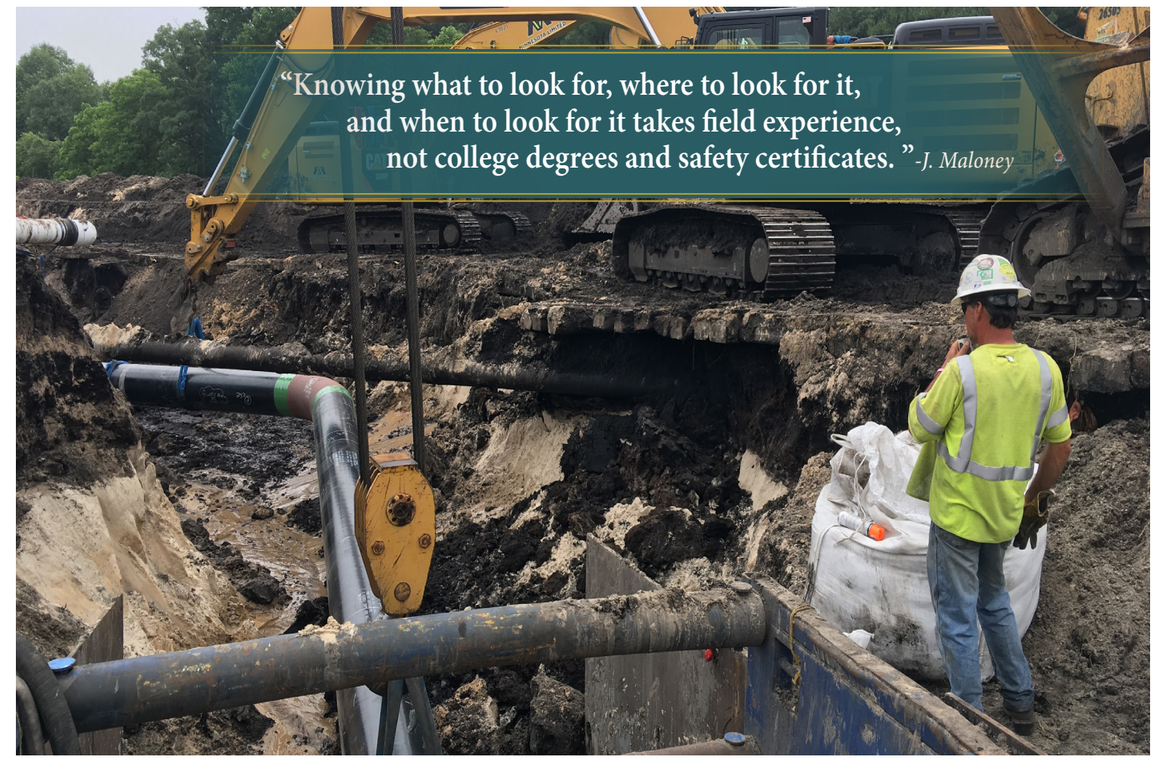
4. Support the recommendation for dewatering practices.

Often construction takes place in wetlands, an environment not desirable to horizontal directional drilling (HDD) for multiple reasons. When this occurs, its important for both the contractor and client to discuss dewatering by well points. Dewatering an area before an excavation takes place helps sustain a stable trench wall. This helps keep workers safe, lessens unexpected sloughing of trench walls, and reduces material from potentially contacting the pipe and causing a fatal pinch point within the trench box or bell hole. Dewatering can also speed up construction and prevent slow digging often required in wetlands when dewatering isn't available. Contractors dig slow in swamps to allow for the water to fill the trench and hold the trench banks until the pipe is lowered and tied in. This makes achieving depth difficult for the contractor. Promoting dewatering practices in the scope of work and project budget will often reap back end safety and cost savings.

The implementation of these best practices helps reduce depth of trenches and exposure to underground utilities which lessons the risk for the contractor and client. These practices also help pipeline contractors better plan their project and often increase working space on the right-of-way which increases the safety of the workers. It's a proactive approach to provide the pipeline contractor with the best working environment possible.

5. Realistic conversations regarding safe bell holes.

It is important for a utility owning company to take responsibility for their right-of-way design, especially when they carry it out without the input of the pipeline contractor or equal subject matter expert in the field of pipeline construction. It damages working relationships when the client forces bell hole compliance using OSHA Subpart P standards when it is the client who has not provided enough room in their right-of-way design to dig a compli-



Difficult tie-in carried out in sandy soil that poses significant challenges for holding a trench. Point of intersect (PI) tie-in was near an exiting line with residuals and was successfully carried out with little right-of-way to work with. Great example of how restricted and congested right-of-way provided can pose significant challenges during construction practices.

ant bell hole. Often a compliant bell hole leaves little safe operating room for sidebooms and excavators to maneuver and actuate. This makes bringing in a section of pipe or manipulating existing sections difficult. This also often brings equipment closure to the edge of excavations and increases harm to workers that may be in the bell hole or trench box.

Anyone can say "implement a trench box or dig a safe bell hole" on the job site, however it's important to have an honest, in-depth conversation on exactly what type of equipment and activity is going to be permitted. Difficulty can arise in identifying the hazards of trench box pinch points and installation, along with bell hole hazards from sloughing dirt and soil, when you have existing live pipelines or low hanging overhead power, either distribution and transmission, that the contractor and their operators must manipulate safely around.

Therefore, it's important to walk your right-of-way with a pipeline contractor during the design phases. As a pipeliner who has served in the field, and hopefully in many different disciplines, a right-of-way will tell you a lot about future challenges, as well as opportunities to save time and productivity—if you know what to look for. A right-of-way will also tell you what and where many of your safety challenges will be during the construction phases so that you may plan proactively.

6. The best interpretation for double block and bleed (DBB) relative to safe tie-ins.

Finally, for the energy companies' portion of this article, we discuss what has been argued for years. What is the best double block and bleed system? This question is rarely discussed between energy utility companies and contractors before work begins and can lead to dangerous tie-in working conditions for tie-in crews working for the pipeline contractor. The details of these interpreted definitions and expectations need to be established on the front end because:

- *The American Petroleum Institute (API) and The Occupational Safety & Health Administration (OSHA) have different definitions for what double block and bleed is. API's definition satisfies DBB with the use of one valve with a body bleed and two seals each representing a block "double block," while OSHA defines DBB as the use of two valves with a bleed in the middle. To aid to this confusion, valve companies have also issued their own definition version on double block and bleed in their in-house handbooks.*
- *Often there are little to no records on valves installed decades ago, and they haven't been actuated in decades due to flow changes or preferred manipulation practices by the pipeline technician or operator. This leaves a question of valve seat integrity.*
- *Without an available valve maintenance record, there is no way of determining if the valve has a high probability of seating well, the condition of the valve grease buttons that deliver grease to the seats, correct type of grease used in different seasons, or if the valve and body bleeds have ever been exercised to promote good seating and isolation.*
- *A company that currently owns the assets may not be the original owner. Often there is missing data on valve locations, operational maintenance and manufacturers' specifications. Some valves need line pressure to help seal, while others do not. It's difficult to determine if a valve seats/seals when it is manufactured with no body bleed and there is no blow down installed before the tie-in point.*

The answer to which system is best really comes down to a case by case scenario. For construction and tie-ins during pipeline construction, modernization, or maintenance, the utility owning company should ask the following:

- **What do we know about the system we are asking the pipeline contractor to tie-in to?**
- **What types of valves are existing?**
- **What is the environment the valves have been operating under (underground, underwater, corrosive products, external corrosive environment, locked open, etc.)?**
- **Most importantly, has there been an existing valve maintenance program?**

If the answers to the questions are unknown or perhaps unavailable due to the tie-in occurring with another company, I would highly recommend choosing the OSHA definition over the API definition and here's why.

Many valves experience different operating conditions that impact the integrity of the valve's seats and body bleeds. Some valves cannot be truly manipulated/actuated to test them, because it would interrupt expected flow, and if they fail to open again, may cause unexpected over pressuring of a system in operation. Often, it's not known if the valve will even close, let alone seal, until the time of the tie-in is upon the project. At this point, it's too late and too costly. When pipeline contractors tie into an existing meter station, compressor station, lateral, loop line, city gate, etc., the contractor needs to worry about their employees first and foremost. Utilizing OSHA's definition of double block and bleed doubles the seal protection from upstream products and provides a physical test point—"the middle bleed"—to continuously monitor for vapors or product during welding or bolt up operations. Simply put, no matter the type of valve installed in the past, more times than not, two valves are better then one and four seals are better than two.

If a project cannot achieve the OSHA definition of double block and bleed due to the nature of the tie-in and current design, and must practice the API's version of DBB, it is recommended to always open your valve body bleeds on your closed valve and utilize air movers on the blown down side of the valves to remove any vapors that may sneak past a closed valve that may leak. This will increase the safety of your tie-in crew during tie-in operations on a live system.

Handing off of section during night tie-in of a creek bed. The Foreman works closely with survey to assure proper depth in difficult environmental conditions consisting of running ground water and sloughing of the trench wall.

Pipeline Contractors Can Improve Pipeline Tie-ins

People differ on what pipeline safety actually means. Many think it's hard hat compliance or what type of work boots you have on. I think success in pipeline safety lives in the technical shadows of information you learn from field experience. Where should a worker be standing on a pipe bending crew when traveling with pipe? How much travel room do we have in our travel lane? Will that deadman hold on that suspended road boar and is the cable in good condition?

Don't get me wrong, debris in an eye and a twisted ankle are important. However, it's the things that can kill a worker, not injure them, that I have found the best pipeline safety and construction supervisors focus on. This approach makes a true difference for the safety of the workers. Knowing what to look for, where to look for it, and when to look for it takes field experience, not college degrees and safety certificates.

Every pipeline tie-in is different on every project. The best practices below are often affected by the above proactive best practices. What is not addressed on the front end of the planning of a project will adversely impact the pipeline contractor during the construction process. Nevertheless, proactive planning on behalf of the contractor can still mitigate high risk hazards and pinch points during tie-ins. These practices might take seconds longer, although should always be supported by the superintendent, assistant superintendents and foremen. There is proven truth in "Slow is fast, and steady is safe." Let's take a look at a few safe practices below.

1. Plan accordingly to prepare your tie in location when given little right-of-way.

The lack of planning for a safe right-of-way is getting more and more common as engineers rely on technology instead of visiting the right-of-way with the contractor project managers and superintendents before the project begins. As a result, the contractor is often left with little right-of-way to work safely. Even so, the contractor should attempt to move spoil piles, or reduce them to widen the travel lane. This provides safe travel of machinery, reduces blind spots for operators, and increases the distance of the equipment's tracks and wooden matts from the edge of the excavation. It also helps stabilize your trench banks in frozen conditions and reduces vibration near your excavation.

Superintendents and assistant superintendents should also work with their foremen to discuss the height of your travel lane when it is used to store spoil, because there is no room on the right-of-way to place it without jeopardizing your environmental control devises (ECDs). A high travel lane can increase equipment boom exposure to overhead power and decrease strength and control the equipment needs to hold the pipe. The further you actuate down or out with materials and pipe, the less effective the equipment counterweights are in stabilizing the equipment for safe handling.

2. Do not walk under arms of equipment when under load.

Do not permit workers and swampers to walk under a boom or arm of a sideboom or excavator while holding the pipe. This is a pinch point and considered a suspended load. While it does take a few seconds longer to walk around the equipment, contractors should establish communication practices in loud construction environments. The use of air horns, whistles, and radios are helpful in getting an operator's attention that a worker will be walking around the equipment, so the operator is aware the worker is there. Walking under a boom while the equipment is under load exposes the worker to falling in a trench or pinning the worker between the trench and the equipment if the equipment loses ground as a result of being too close to an excavation edge due to lack of right-of-way space.

3. Reduce stress on pipe when putting into clamps.

Often its right-of-way etiquette to help the foremen behind you on a Spread. In doing so, its important to encourage the lower-in crew to leave a portion of the section lowered in for the tie-in crew behind him. How much to leave exposed should be discussed, because pipe manipulation will vary with pipe diameter, wall thickness, atmospheric temperature and sunlight exposure. The trench may fill with water as well, and this should be discussed in a case by case scenario in the field. More pipe exposed will lessen the stress on the pipe when putting the two ends of the section in the pipe clamps. Less stress on the pipe increase safety of workers involved with tie-in responsibilities. A pipeline contractor should never push on the pipe or overly force the sections to align to fit into pipe clamps. It also lessons the stress on a weld. Only essential workers needed to tie-in the pipe should be around the pipe during pipe clamp install and welding operations. The less the better.

4. Monitor pinch point possibilities rather than working in a bell hole or trench box.

When you have exposed sections of pipe during tie-ins, it is because the foreman needs what is called "Breakover". Additional hazards need to be monitored outside of the immediate working area, especially when tie-ins take place in wetlands or sloughing conditions from recent rains. Always keep a close eye on your trench banks outside of the bell holes and trench boxes. While the foreman or welder is concentrated on lining up the pipe in the pipe clamps, soil and dirt may break away from the trench wall outside of the bell hole or trench box and hit the exposed pipe. If the pipe is suspended in a roller or belt, it can sway from the impact of the soil, especially if the section that caves in is large and heavy with moisture such as peat bog. If this occurs, the pipe may sway, hitting a worker and knocking a pipeline worker into the trench box wall or bell hole bank, creating a potentially lethal pinch point. To mitigate this, use skids when applicable, and stack them away from the worker between the trench box or trench bank to serve as a barrier for the pipe to contact. This minimizes the potential crush impact on the body if the pipe moves unexpectedly while lining up for pipe clamps, or while in the pipe clamps although not yet secured.

5. Utilizing road plates, sheet pile and matts to aid trench safety.

Have a proactive discussion with the energy company on what acceptable methods can be used to isolate workers from trench hazards. It is effective and can be OSHA compliant to utilize certain matts and road plates with engineering data when working in deep and congested bell holes. Create open dialog with the client regarding best practices for using wooden matts and steel plates to protect against exposed trench in road boar tie-ins, PI tie-ins, and deep tie-ins. Employ competent pipeline safety professionals who can effectively explain the benefits of road plates and matts to protect employees. Why? Because often it's more dangerous to use staked trench boxes and aluminum trench boxes due to external pressures and changing conditions during rain season and winter months where soil conditions change with frequent freeze and thaw cycles.

Understand the pros and cons of driving sheet pile in to increase safety. Watch your seams when using ball and socket sheeting in hard clay and frozen soil to make sure they do not come out of track. Watch your bowing-in to see if you need a wedding band inside or whalers to support from toeing in at the top. Make sure all underground utilities are identified before driving sheet pile in the work area. Make sure to set your dewatering well points before driving sheet pile to proactively manage or remove water from the future excavation. Weigh the acceptable level of risk in these discussions. Even with OSHA standards, there are many working conditions OSHA standards do not aid in addressing such complex risk with this unique type of construction.

Conclusion

Tie-Ins during pipeline construction and maintenance can be safe and successful. Creating safe tie-ins starts way before the tie-in ever occurs, long before crews ever set excavating equipment on the right-of-way. Safe tie-ins begin in the engineering and design phases of a project. It helps to consider the person that will be involved in that tie-in and what he or she will be exposed to. Take a close look at project planning, walk your right-of-way's, and collaborate with multiple parties throughout the planning and construction process. Doing so will no doubt provide safe tie-ins, cost efficient operations and increased productivity. Plan your work and work your plan. ★

Here is a tie-in being prepared of a 36". This tie-in illustrates a joining of the mainline to a recently completed road bore. This was a two joint section spooled in between the road bore abrasive resistant overcoat (ARO) pipe and the mainline section. Welder helper begin prepping the bevels for welders to enter the bell hole and begin welding the two sections together. (Notice the install of the flat bar (sissy bar) on the excavators bucket teeth! This install practice dramatically increases safe digging around existing underground utilities during construction.)