The petroleum pipeline industry has undertaken a voluntary environmental performance tracking initiative, recording detailed information about spills and releases, their causes and consequences.

The pipeline members of the American Petroleum Institute and the Association of Oil Pipe Lines believe that tracking and learning from spills will improve performance, thus demonstrating the industry's firm commitment to safety and environmental protection by its results.

This is one of a series of Advisories about the Pipeline Performance Tracking System, "PPTS," its evolution and its lessons.

PPTS OPERATOR ADVISORY: MORE TO DO ON EXCAVATION DAMAGE

Summary: Key Findings

- Over the eight-year period 1999 through 2006, PPTS participants reported 280 excavation damage incidents involving a release, which is 7 percent of all reported incidents. While relatively small in number, excavation damage release incidents produce more fatalities than other incidents and larger barrel losses. Almost 90 percent occur along the right-of-way.
- Farmers and homeowners accounted for 30 percent of the incidents; those involved with one-call programs ("One-Call Partners" for this Advisory) for 23 percent; operators and operator contractors for 16 percent; and road work, land development, and waterway, railway and other activity for the remaining 31 percent.[1]
- Incidents declined 50 percent for the period 2004-2006 compared with 1999-2001. For the nearly 70 percent of excavation damage incidents involving *an immediate release*, the decline was 66 percent.
- A fall in third-party excavation damage release incidents drove the overall decline, masking an increase in first- and second-party incidents (operators and their contractors) of 42 percent from 1999-2001 to 2004-2006. However, the actual increase in first- and second-party incident numbers was small.
- The primary cause of 53 percent of the incidents was failure to use the one-call system.

See additional detailed data analysis beginning on page 3.

Considerations for Operators

The data demonstrate that the frequency of excavation damage incidents is low, and has declined in recent years. However, while the frequency is low, release volumes tend to be large and result in greater consequences. In addition, to drive incidents down further, operators and One-Call Partners – entities that together accounted for 50% of the incidents in the 3-year averages ending in 2004, 2005, and 2006 – must improve their record. Some considerations are listed below.

Vigorously apply industry standards and company policies.

- ❖ Revisit the company's mapping, excavation, damage prevention, and surveillance processes and procedures to ensure they are sufficient and understood, and that employees are trained in their use.

[1] These findings are based on 195 incidents occurring along the right-of-way, where failure occurred at the time of damage, and where the release was five barrels or more or it involved death, injury, fire or explosion.

- Focus particularly on how your company manages contractor excavations, as two-thirds of all incidents reported as operator excavation involved contractors.
- Ensure aerial and ground patrol procedures and training include specifics on how to spot and report signs of trenching, grading, or backfilling near the pipeline ROW.
- Establish and follow a strong ROW maintenance and surveillance program that addresses vegetation control, signage, depth of cover, encroachment, and other issues.

Integrate information across your company and across the industry.

- After investigating incidents for root causes, share the results company-wide and apply lessons learned to other parts of the system. Use company-wide data to spot trends. Determine if lessons learned from incident investigations provide any leading indications of the effectiveness of the damage prevention and public awareness programs.
- Learn from and share with other operators by attending workshops and participating in forums. This is particularly important when it comes to excavation damage, because the number of incidents for each operator, typically, is low.
- Continue to learn from and share with contractors and others involved in construction and excavation.
- Understand industry incident data to help you spot trends that may not be apparent in a few company incidents. Advisories posted on API's website (www.api.org/ppts) summarize and analyze the data to help operators. Share the Advisories' findings across the company. Additional excavation damage Advisories are planned to address specific aspects of excavation damage in more detail.

Know your right-of-way neighbors.

- Employ GIS to better understand the locations where your pipeline intersects farms, and focus your Public Awareness, surveillance, and ROW maintenance efforts on those farmers.
- Survey your ROW to identify where other pipelines and other underground facilities co-exist with your assets. Share the information developed from PPTS with those operators.
- Track rapidly growing areas near your pipeline particularly carefully. Become involved in local/county land use planning and permitting for new construction or development in these areas. Not only do the construction activities around new homes and businesses create a potential for a hit, there is an ongoing potential for a hit from the utilities that service them on a routine basis, and from related activities and services such as landscaping, fence-building and other site maintenance and improvements.

Engage in policy- making decisions for stakeholder prevention programs.

- Support or become involved in industry groups and research efforts.
- Support continued development and use of One-Call systems. PPTS operators have reported that failure to use One-Call was the primary cause of failure in more than half of the releases caused by third parties.
- Proactively participate in damage prevention and One-Call programs in the states in which your system operates. Help shape reforms of regulations and statutes to eliminate unnecessary exemptions and enhance enforcement options. Support aggressive enforcement of One-Call statutes, including legal redress of violations.
- Continue to educate the public regarding safety around pipeline facilities.

Excavation Damage Incidents: Low Frequency, but High Consequence

Releases from excavation damage caused by third parties account for 6% of the number of all incidents occurring on all commodity systems over the 1999-2006 period. In addition, excavation damage by first or second parties accounts for 1% of the incidents.[2] Why concentrate on excavation damage if it only accounts for some 7% of the incidents? Because this same 7% is responsible for:

- 77% of fatalities,
- 49% of injuries,
- 49% of incidents involving evacuations,
- 41% of barrels released in right-of-way (ROW) incidents, and
- 27% of incidents involving a release of 50 barrels or more.

Thus, the consequences of excavation damage incidents are disproportionately high when compared to their relatively low overall rate of occurrence. Almost 90% of these incidents occur along the ROW, where the public is likely to be in proximity, they tend to be large, and result in significant impacts (i.e., injury, death, fire, explosion, evacuation, and significant property damage).

There's More to Do

Pipeline operators have good reason to prevent excavation damage. Any hit – even one that doesn't result in an immediate release – must be investigated and addressed. Assessing the damage from a hit may require that the pipeline be shut down while it is being examined, imposing both a business cost and a direct outlay. Furthermore, while releases are relatively rare, they have involved high consequences in terms of pollution, deaths, injuries and burden on the local community's emergency responders and infrastructure. Thus, each pipeline operator has an interest in understanding the causes of and preventing excavation damage. The "Considerations for Operators" in this document provide some strategies and tactics that operators have found effective.

It is important to clarify that PPTS does not collect information on hits that do not result in a release. The Common Ground Alliance's Damage Information Reporting Tool (aka DIRT) does collect information on these non-release hits, and in future years, this information may provide additional insights. For now, this Advisory utilizes only release data reported to PPTS.

The Pipeline Performance Tracking System data demonstrate that excavation damage is more than just "others" hitting "us" (third party damage). The pipeline operator or its contractor can also cause hits and releases. The data also underscore the fact that outreach for prevention must be tailored for the appropriate audience because the various parties who may damage the pipeline – first, second, or third party – may be using different equipment to perform a variety of different tasks.

Excavation Incidents Reduced, but First/Second Party Trend is a Concern

Over the 1999-2006 period, there were 280 releases reported to PPTS that were attributable to mechanical or excavation damage from a first, second, or a third party. Excavation damage

[2]Incidents where the operator (the "first party") or its contractor (the "second party") damages the line are classified in PPTS as operator error. Operator error incidents are only specified as operator excavation versus another type of operator error for releases of 5 barrels or more or releases involving a death, injury, fire or explosion. (Beginning in 2007, all incident reports will include this detail.)

releases have declined significantly, showing a reduction of about 50% in the number of incidents per year from the first three-year period of PPTS data, 1999-2001, to the most recent three years, 2004-2006. While the downward trend is commendable – even impressive – the drive to 0 spills requires that the industry continue and enhance its prevention efforts.

The graph on the next page (*Immediate Failure Incidents Drive the Decline*) shows third party damage split into two sub-categories, and also shows first/second party damage incidents. The data include only those incidents qualifying for the detailed long form (see box below) and only those incidents occurring along the ROW, where almost all excavation damage incidents occur. This subset of incidents covers 195 incidents out of the 280 total incidents previously under discussion.

For damage by third parties, the long form differentiates between mechanical or excavation damage that immediately results in a pipeline release (”immediate failure”) and failures caused from prior damage (“latent” damage or delayed failure). In the case of latent damage, the damage may weaken the pipeline or the coating making it vulnerable to corrosion failure over time. For first/second party releases, PPTS does not specify whether the incidents involved immediate failure versus failure from prior damage because it is assumed that an operator would repair the damage to a hit line, eliminating the vulnerability to later failure. PPTS also records intentional damage to the pipeline such as vandalism or sabotage, or damage from motor vehicles unrelated to excavation/construction.

Damage resulting in an immediate release at the time of the pipeline hit is the most common incident type, and the record for this type of damage has improved the most, registering a 66% decline from the 3-year average of the first period, 1999-2001, to the most recent period, 2004-2006. (See graph on the next page, “Immediate Failure Incidents Drive the Decline.”) Thus, these immediate failures from third party damage went from 70% of excavation damage incidents in the first period to a 49% share in the most recent period. Releases due to latent damage

Excavation Damage Basics

What: Excavation encompasses a range of types of damage resulting from a range of activities, not all of which may strictly be considered to be “excavation.” The damage is generally caused by a foreign object such as a backhoe, auger, or plow hitting and damaging the pipeline. It does not include damage caused by earth movement such as subsidence or a landslide.

Who: As used in PPTS, excavation damage can be caused by first, second, or third parties. PPTS defines them as the following:

First Party – Employee(s) of the operator.

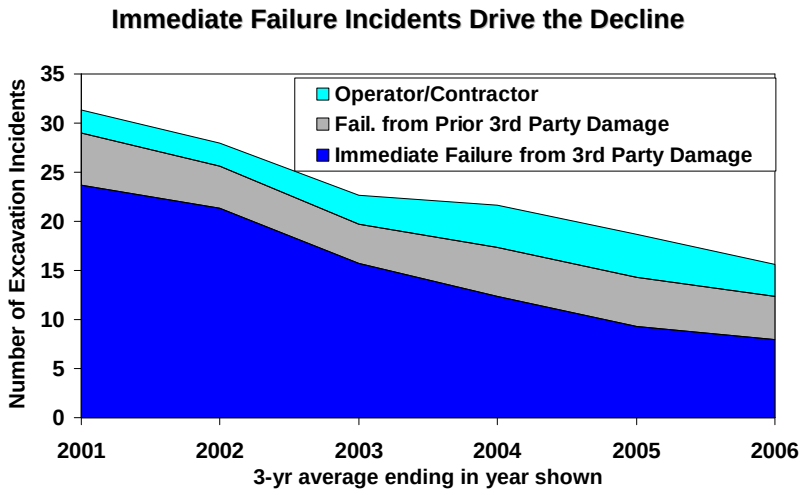
Second Party – The operator’s contractor.

Third Party – Person or persons not involved with operating or maintaining the pipeline. Third parties can be farmers, landowners, developers, excavators, road crews, other pipeline operators, or utility workers not related to the pipeline, among other types of entities.

“Long Form” versus “Short Form”: Until 2007, releases of less than 5 barrels or ones that did not involve a death, injury, fire or explosion were reported on the short form, which provided very limited information to PPTS. The detailed information was only required on larger and/or more consequential incidents. This was changed in 2007. Now operators provide full detail on all incidents.

Of the 280 excavation damage releases, 208 qualified for the long form and 195 occurred on the ROW. This is a further illustration that these incidents tend to be of higher consequence.

declined by 18%. (Not shown in the graph below are incidents involving intentional or vehicle damage. These incidents, which are not related to excavation, never registered a 3-year average higher than 3 incidents, and have been less than 1 incident per year in recent periods.)



Includes onshore pipeline incidents >=5 barrels or death, injury, fire or explosion.
Excludes incidents caused by intentional damage or motor vehicles unrelated to excavation.

In contrast to the record for third party damage, first/second party damage rose over the period. The record of 2.3 incidents per year from 1999-2001 showed a 42% increase in moving to 3.3 per year from 2004-2006. The number of incidents has remained low, but the trend could reflect the need for additional review of operator practices relating to their excavation activities. In fact, the level of incidents was higher in the three-year periods ending in 2004 and 2005. On a positive note, the level has fallen in the latest 3-year average because there were no operator excavation incidents in 2006; however, it remains to be seen whether this improvement will be sustained and reverse the upward trend.

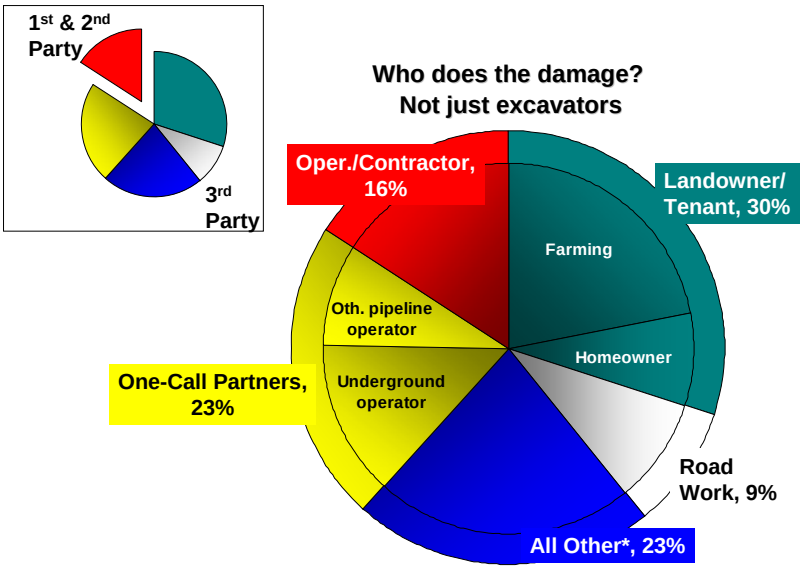
Different Activity + Different Party = Different Strategies

PPTS records information on what type of entity or activity was involved in incidents resulting in immediate failure. The detail on the "damaging party" is critical to developing prevention strategies. Outreach efforts for one group will not necessarily be effective with all groups and excavation practices and equipment -- for instance, backhoe, auger, tilling discs, or boring equipment for directional drilling -- will differ between groups.

The pie chart on the next page divides the damaging parties into five broad categories. (A table of this information is available in the Appendix.) The Data Mining Team chose these groupings to reflect logical targets for common prevention strategies.

One of the most important distinctions between these parties is whether they are involved in operating underground facilities such as pipelines, gas and electric utilities, telecommunications and cable providers, or not operating underground facilities, such as farmers, homeowners, road construction crews and building contractors.

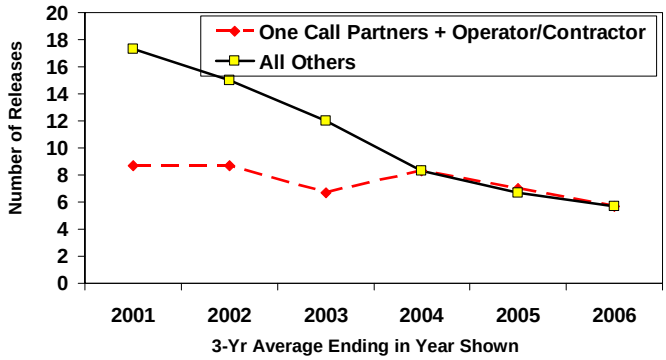
The distinction is useful because those operating underground facilities would be assumed to be particularly attuned to the potential for mechanical/excavation damage. This group includes the One-Call Partners (see text box) and operator/contractor excavation. The One-Call Partners, operators, and their contractors accounted for 50% of the incidents in the 3-year averages ending in 2004, 2005, and 2006.



Onshore pipeline spills where: release occurred at the time of damage, and involving 5 barrels or more, or death, injury, fire or explosion.
*"All Other" includes resid'l/comm'l dev., waterway, railroad and other party or activity.

As noted previously, incidents caused by operator/contractor excavation have increased. Though the number of incidents is low, the trend indicates a possible need for review of internal excavation-related safety practices by pipeline operators. These may include procedures, one-call response, mapping accuracy and outreach to contractors. For further data related to excavation damage incidents involving the PPTS operator or its contractor, see PPTS Advisory 2008-5 (in preparation). Additional data analysis presented there may help operators target their damage prevention strategies and preventive measures.

The People Who Should Know the Most Have As Many Hits As All Others



Includes 1999-2006 onshore pipeline incidents >=5 barrels or death, injury, fire or explosion

"One-Call" and "One-Call Partners"

Each state has at least one organization that is a central communications link allowing individuals/entities who intend to dig to notify operators who have underground assets that could be damaged. The potential excavator makes "one call" to the one-call center, which in turn informs all of the underground facilities operators in the area. These operators include oil and gas transmission pipelines, gas and electric utilities, cable TV and other telecommunications providers, water suppliers and sewer systems. The operators then mark the position of their pipelines, conduits, cables, etc. following well-established practices. The operators – grouped together as "One-Call Partners" in this discussion -- are required to be members of the one-call organization and thus fund its activities. For more on the one-call process, see Anatomy of a One-Call, in the liquids pipeline's newsletter *In the Pipe*.

Additional Detail on Third Party Damage Releases[3]

As noted above, participants in PPTS provide information on the type of activity or party that caused the damage and on the "apparent primary cause" of the third party incident. The table below consolidates some of the categories of damaging parties to enhance understanding and to simplify the presentation of the data. An important take-away is that prevention of excavation damage is a process, not a single act as the name "one-call" might suggest. Understanding what went wrong in the process is key for assessing hazards and targeting prevention efforts.

Apparent Primary Cause of Third Party Damage Incidents Occurring on the Right-of-Way, by Damaging Party Category, 1999-2006

	Total Number	Failure to utilize One-Call System	Failure to take reasonable care to protect facilities	Failure to respect pipeline company directions	Failure to wait the proper time	Failure of pipeline operator to respond or to mark the line	Other
	Number	% of Total Number					
Landowner/Tenant	44	73%	11%	2%	0%	5%	9%
One-Call Partners	33	33%	21%	15%	15%	3%	12%
All Other Parties	33	42%	30%	9%	9%	6%	3%
Road Constr/Maint	13	62%	8%	0%	8%	8%	15%
Total	123	53%	19%	7%	7%	5%	9%

Includes releases of 5 barrels or more, or involving death, injury, fire or explosion where the failure occurred immediately. There is no analogous question for incidents involving operator/contractor excavation, or for other types of third party damage.

- Farming activities account for the largest share of the third party incidents. Taken together with homeowner activities, they form a "landowner/tenant" category which accounts for 36% of the third party damage incidents meeting the criteria for detailed reporting. Failure to use one-call was the apparent primary cause of almost three-quarters of the incidents in this category.
- "One-Call Partners" accounted for 27% of the third party incidents. Failure to use the one call system was named as the primary cause of one-third of these incidents. In addition, failure to take reasonable care, to respect the instructions of the pipeline personnel, and to wait the proper time accounted for another 50% of the incidents; each of these items is part of the best practices for excavation established by the Common

[3] All numbers presented in this section include only third party damage incidents resulting in immediate failure. The information reported in this section is not collected for failures due to prior third party damage or for first and second party damage incidents.

Ground Alliance[4] and industry groups. (These data cover only third party damage, not damage by the operator or its contractor.)

- "All Other Parties" accounts for 27% of the third party damage incidents occurring on the pipeline ROW. The category includes a variety of industrial/commercial activities such as residential/commercial development, onshore waterway activity, and rail construction. It also includes the miscellaneous incidents that PPTS respondents reported as "other" damaging parties or activities. Further examination of these incidents confirms that they are various types of industrial/commercial activity. For this category, 42% of these incidents were ascribed to the failure to use one-call, and another 30% were ascribed to the failure to take reasonable care.
- Road construction and maintenance activities account for 11% of the third party incidents. This work is often undertaken by counties and municipalities (or their contractors) and is often exempt from one-call requirements. PPTS operators ascribed 62% of these incidents to the failure to use one-call.

For further data related to third party damage incidents, see PPTS Advisory 2008-4, "Details on Third Party Damage." Additional data analyses presented in this Advisory may help operators target their damage prevention strategies and preventive measures.

The oil pipeline industry has developed a variety of programs and strategies or participated in the compilation of best practices to reduce excavation damage in recent years. Among them:

- Damage Prevention and Operator Error Advisories drawn from PPTS (www.api.org/ppts)
- API Guideline for Property Development
- API April 2006 Pipeline Performance Improvement Advisory – "Key Practices for Damage Prevention"
- API Recommended Practices (RP) such as
  - API RP 1166, Excavation Monitoring and Observation
  - API RP 1162, Public Awareness Programs for Pipeline Operators
  - API RP 1109, Marking Liquid Petroleum Pipeline Facilities
  - API RP 1161, Guidance Document for Qualification of Liquid Pipeline Personnel
- Damage Prevention Workshops, 2003, 2006 and 2008
- Common Ground Alliance Best Practices (www.commongroundalliance.com)

Understanding the detailed data is central to developing appropriate strategies for prevention. Hence, we have developed additional detailed advisories to address different aspects of excavation damage incidents. You may find these Advisories at www.api.org/ppts/. Click on the "documents" link in the left frame to see these and other Operator Advisories.

NOTE; The "Considerations for Operators" represent the experience of a limited number of subject matter experts from a variety of liquids pipelines operators. They were not developed under the process prescribed by the American National Standards Institute and do not represent a Standard or a Recommended Practice of the API or its member companies.

[4] Common Ground Alliance (www.commongroundalliance.com) is an organization of excavators, pipeline operators and other operators of underground assets, regulators and other stakeholders in protecting underground facilities.

Appendix

Excavation Incidents along the Right of Way, by Category of Damaging Party Category, 1999 – 2006

	3 Yr Average Ending	2001	2002	2003	2004	2005	2006
Total	All Incidents	26.0	23.7	18.7	16.7	13.7	11.3
Public/One-Call Users	Landowner/Tenant	8.7	.7	6.0	4.3	3.0	2.0
	All Other Parties	5.7	4.3	3.7	3.3	2.3	3.0
	Road Construction	3.0	2.0	2.3	0.7	1.3	0.7
Operators and One-Call Partners	One-Call Partners	6.3	6.3	3.7	4.0	2.7	2.3
	Operator Excavation	2.3	2.3	3.0	4.3	4.3	3.3

"One-Call Partners" includes parties that participate in – and thus pay for – one-call programs: utilities, gas distribution companies, telecommunications companies, and other pipeline operators. "Operator Excavation" is the PPTS participant reporting the incident to its own line, whether caused by the participant's direct employees or its contractors.

Third Party Excavation Incidents involving Immediate Failure and Occurring on the Right-of-Way											
	Damaging Party Category	Damaging Party or Activity	1999	2000	2001	2002	2003	2004	2005	2006	Total, 1999-2006
Number	Landowner/Tenant	Farming or agricultural business	7	10	3	3	4	1	2	2	32
		Homeowner or other activity related to homeowner residence		3	3	4	1		1		12
		Subtotal	7	13	6	7	5	1	3	2	44
	Road Constr/Maint	Road construction or maintenance, including ditch grading, traffic light construction, etc.	3	1	5		2		2		13
		Subtotal	3	1	5		2		2		13
	All Other Parties	Other damaging party or activity	4	3	4	2	3	3	1	3	23
		Railroad construction, maintenance, or repair	1								1
		Residential or commercial development	2	2		1				2	7
		Some type of inland waterway oil production, maritime, shipping, or fishing activity	1			1					2
		Subtotal	8	5	4	4	3	3	1	5	33
	One-Call Partners	Other liquid or gas transmission pipeline operator or their contractor	3	6		1	1	1	1		13
		Other underground facility operator or their contractor	2	4	4	4	1	4		1	20
		Subtotal	5	10	4	5	2	5	1	1	33
	Grand Total		23	29	19	16	12	9	7	8	123

Third Party Excavation Incidents involving Immediate Failure and Occurring on the Right-of-Way											
	Damaging Party Category	Damaging Party or Activity	1999	2000	2001	2002	2003	2004	2005	2006	Total, 1999-2006
Share of Annual Total	Landowner/Tenant	Farming or agricultural business	30.4%	34.5%	15.8%	18.8%	33.3%	11.1%	28.6%	25.0%	26.0%
		Homeowner or other activity related to homeowner residence	0.0%	10.3%	15.8%	25.0%	8.3%	0.0%	14.3%	0.0%	9.8%
		Subtotal	30.4%	44.8%	31.6%	43.8%	41.7%	11.1%	42.9%	25.0%	35.8%
	Road Constr/Maint	Road construction or maintenance, including ditch grading, traffic light construction, etc.	13.0%	3.4%	26.3%	0.0%	16.7%	0.0%	28.6%	0.0%	10.6%
		Subtotal	13.0%	3.4%	26.3%	0.0%	16.7%	0.0%	28.6%	0.0%	10.6%
	All Other Parties	Other damaging party or activity	17.4%	10.3%	21.1%	12.5%	25.0%	33.3%	14.3%	37.5%	18.7%
		Railroad construction, maintenance, or repair	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%
		Residential or commercial development	8.7%	6.9%	0.0%	6.3%	0.0%	0.0%	0.0%	25.0%	5.7%
		Some type of inland waterway oil production, maritime, shipping, or fishing activity	4.3%	0.0%	0.0%	6.3%	0.0%	0.0%	0.0%	0.0%	1.6%
		Subtotal	34.8%	17.2%	21.1%	25.0%	25.0%	33.3%	14.3%	62.5%	26.8%
	One-Call Partners	Other liquid or gas transmission pipeline operator or their contractor	13.0%	20.7%	0.0%	6.3%	8.3%	11.1%	14.3%	0.0%	10.6%
		Other underground facility operator or their contractor	8.7%	13.8%	21.1%	25.0%	8.3%	44.4%	0.0%	12.5%	16.3%
		Subtotal	21.7%	34.5%	21.1%	31.3%	16.7%	55.6%	14.3%	12.5%	26.8%
	Grand Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Includes incidents of 5 barrels or more, or those involving death, injury, fire or explosion											