

What Is the Safety Risk of Trees Above PG&E's Transmission Pipelines?

The research and analysis in this report is based on a combination of publicly available information and interviews with safety experts. The report was prepared by Save Lafayette Trees, a nonprofit association located in Lafayette, California. Save Lafayette Trees has a twofold mission: preserve Lafayette's rural California character by identifying and preventing unnecessary tree destruction; and improve the safety of the natural gas pipelines in our area by focusing safety improvement attention on the primary safety risks. For more information, go to savelafayettetrees.org.

The Claim

PG&E says that it must remove thousands of trees in California that are located above its buried natural gas transmission pipelines because the trees pose an unacceptable safety risk.

Our Conclusion

- Contrary to PG&E's claim, trees pose no significant safety risk to buried gas transmission pipelines.
- PG&E's current allocation of hundreds of millions of dollars for tree removal in its pipeline rights-of-way is a grave misallocation of organizational attention and financial resources that urgently needs to be redirected. There are significant PG&E transmission pipeline safety vulnerabilities that are not receiving effective attention, as described in our separate analysis describing PG&E's disappointing safety performance relative to its industry peers.

The Basis of Our Conclusion

Save Lafayette Trees has conducted an extensive investigation of PG&E's tree risk claim, including:

- A review of assigned causes for every reported gas transmission pipeline safety incident in the U.S. over the past 20 years. Out of a total of 2,076 incidents associated with more than 300,000 miles of gas transmission pipeline, *there were zero in which a tree was found to be the cause of damage to an underground gas transmission pipeline—not only none in California but none anywhere in the United States!* (details below)
- A review of the findings from PG&E's 2014 "Tree Root Interference Assessment" (conducted in partnership with the consulting firm Dynamic Risk), which found no direct evidence that tree roots in contact with buried gas transmission pipelines cause pipeline damage. (details below)
- A review of the federal Pipeline and Hazardous Materials Safety Administration's (PHMSA) multiple responses over the past 40+ years to property owners' requests for federal policy clarification regarding gas utilities attempts to remove trees above their pipelines. Throughout this period, PHMSA has consistently and repeatedly stated that (1) it is not a federal requirement to keep a pipeline right-of-way clear of trees/other vegetation; (2) federal regulations do not give operators a right to cut down trees on their pipeline easements. (details below)
- Interviews with experienced Bay Area first responders and a PHMSA senior inspector. We sought their opinion about PG&E's frequent claim that one of the risks trees pose is that they can delay pipeline access during an emergency. The first responders we consulted uniformly rejected this idea. They said that when dealing with a significant incident on a transmission pipeline, the priorities are to evacuate the area, shut down the line, and wait for the gas to dissipate. At that point, there will be plenty of time to clear any vegetation that might be affecting access.

Attempting to work on a significant leak in a gas transmission line (characterized by their large diameter and high operating pressure) before it is shut down is simply foolish. The PHMSA senior inspector we consulted said that he completely agreed with the first responders' perspective as stated above.

Analysis of U.S. Gas Transmission Pipeline Safety Incidents

U.S. gas utilities are subject to regulations issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA). PHMSA is an agency within the U.S. Department of Transportation, and it is responsible for ensuring (among other things) the safe and environmentally sound operation of the country's gas pipeline system. The regulations include a requirement that pipeline operators (such as PG&E) submit a very detailed report within 30 days of any "significant" safety incident that occurs on a gas transmission line. Significant has a precise regulatory definition, but briefly it includes an event involving an emergency system shutdown, a sizeable gas release, a personal injury, or sizeable property damage. The reports are available to the public in spreadsheet format, and each report covers more than 400 data fields. Most of these fields concern the incident's cause, and they are designed to uncover the incident's "root cause." Failure to submit an incident report subjects the operator to a fine of up to \$100,000; failure to submit multiple incident reports can result in a \$1,000,000 fine. Compliance with this reporting requirement is an item that is routinely examined during PHMSA audits of pipeline operators.

Save Lafayette Trees chose PHMSA's incident reports covering all U.S. gas transmission pipelines because it offers a very complete and easy-to-analyze source of information about the cause associated with each incident. We were seeking objective evidence to clarify how often trees above a buried transmission pipeline have been the cause of a safety incident. In the interest of time, we limited the scope of our study to the past 20 years (1998-2017).

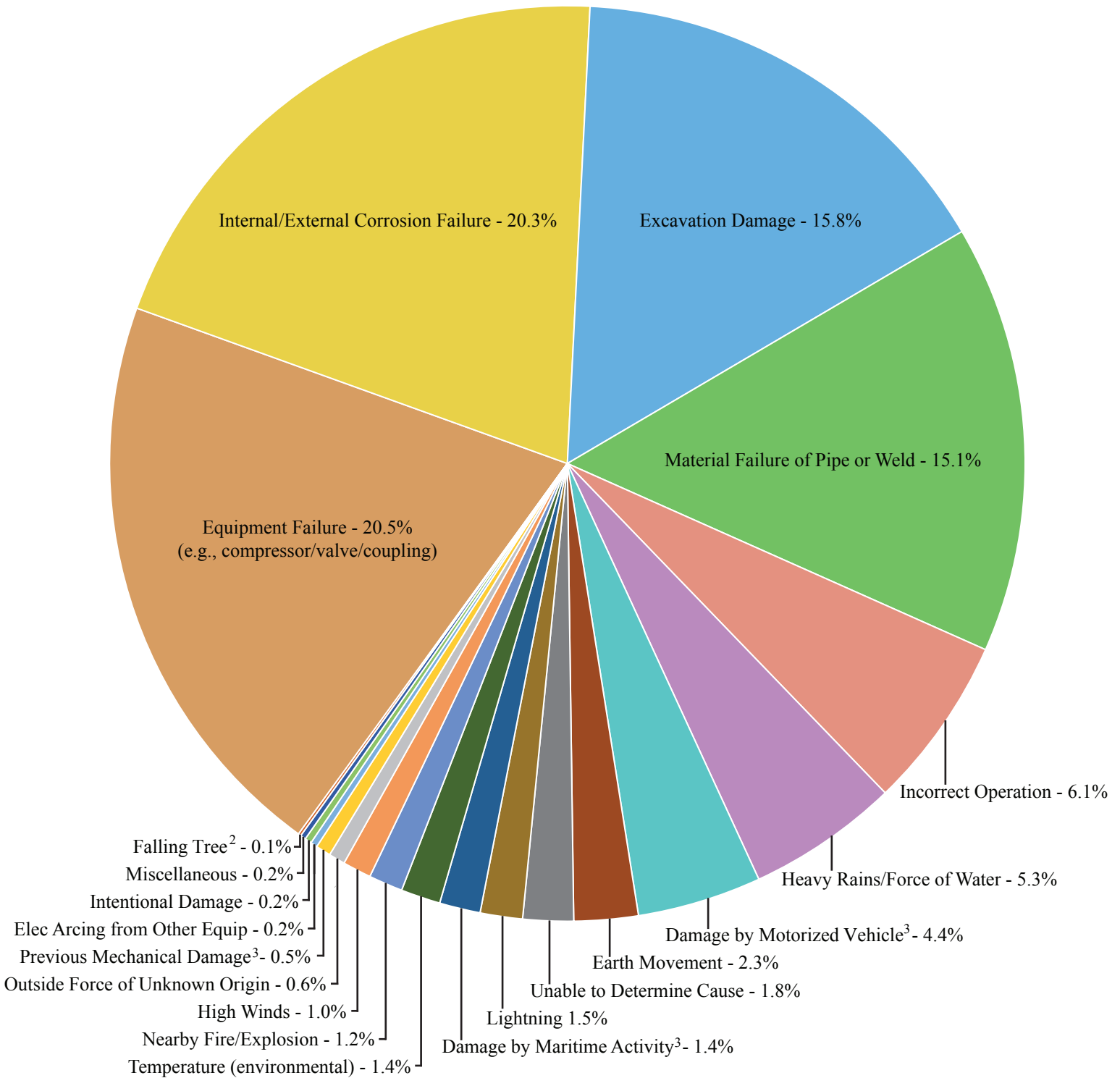
After many hours of careful review of every 1998-2017 gas transmission incident in the PHMSA database (total of 2,076 incidents), we were frankly surprised to discover that *there are zero incidents of trees determined as causing damage to underground gas transmission pipelines*. A falling tree was, however, identified as the cause in two incidents not connected to underground pipelines: (1) in Louisiana, a dead tree fell over and struck an underwater pipeline (the pipe was exposed without any protective soil/mud on top); (2) in Texas, a live tree fell and struck an above-ground component of the pipeline control system. These two are the only examples of trees causing an incident in these pipelines (which extend over more than 300,000 miles) in the past 20 years. In summary: 0.0% causing damage to underground gas transmission pipelines; 0.1% causing damage of any type to gas transmission pipeline systems over the past 20 years.

PG&E has also claimed that trees close to their transmission pipelines often need to be removed because they have the potential to delay quick access to the pipeline in the event of an emergency. We therefore searched the incident records described above for any mention of trees delaying quick access to transmission pipelines. There is no record of this problem occurring anywhere in the U.S. over the past 20 years. See also the fourth bullet in the Our Conclusion section on page 1.

The pie chart on the next page shows the various incident cause categories, as extracted from the 2,067 incident records described above.

U.S. Gas Transmission Pipeline Safety Incidents 1998-2017 Analysis of Causes¹

(2,076 Incidents)



¹Based on pipeline incident reports submitted to PHMSA, an agency of the U.S. Dept of Transportation, and analyzed by Save Lafayette Trees

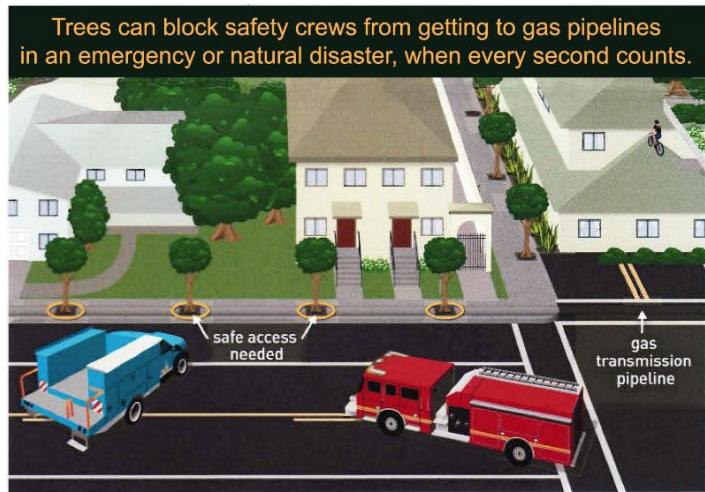
²No trees, however, caused damage to a buried gas pipeline

³Damage not associated with excavation activity

PG&E's Inconsistencies on Need for Immediate Pipeline Access

In May 2017, PG&E delivered a flyer titled Community Pipeline Safety Initiative to the homes of many Lafayette residents living near their Lafayette transmission pipelines. The flyer explained the importance of immediate access for first responders to their gas transmission pipelines. It stated, "Trees can block safety crews from getting to gas pipelines in an emergency or natural disaster, when every second counts."

When PG&E was asked to explain the rationale for classifying 272 Lafayette trees as unacceptable risk and requiring removal, it turned out that a substantial portion of these trees are classified "unacceptable risk" because of PG&E's concern about emergency access.



However, when PG&E chose to replace 6,000 ft of transmission pipeline running between Lafayette and Moraga in the summer of 2018, it considered two options: follow the existing route beneath the St Mary's Rd asphalt, or install the new line along the Lamorinda Trail, which closely parallels St Mary's Rd but would greatly expand the opportunity for immediate pipeline access in an emergency. Which did they choose? They placed the pipeline under the St Mary's asphalt for its full length, and as a result created 10 weeks of major traffic delays on the detour routes and inconvenience for residents living near the closed section of St Mary's (12 hours/day, Mon-Sat). If emergency access (where every second



counts) was truly an important safety consideration, PG&E would have routed this capacity expansion pipeline along Lamorinda Trail.

In case there is doubt about access delays for transmission pipelines under a roadway, here is an excerpt from PG&E's 2011 report to PHMSA about a leak discovered in a transmission line running perpendicular to the roadway:

"9/19/11—PG&E personnel discovered gas readings at the casing vents for a 20-inch casing surrounding 16-inch steel gas transmission line under Redwood Blvd in Novato. PG&E crews excavated the pipe and casing on both sides of the roadway in an attempt to identify the location of the leak. Unfortunately, the source of the leak was not at either side of the roadway but appears to be located somewhere under the roadway. Due to the location of the leak it is not feasible to attempt to repair the leak. A new pipe will be installed under the roadway to replace the leaking pipe. Construction is scheduled to begin 10/19/11." [one month after discovery of the leak]

In pointing out the potential emergency access delays associated with gas transmission pipelines located beneath a roadway, we want to be clear about our beliefs:

1. Gas transmission pipelines operate under substantially higher pressure than distribution and service lines. Transmission lines are also significantly larger in diameter. Because of both factors, when a pipeline failure occurs transmission lines are more likely to explode than distribution or service lines. (PHMSA shares this opinion)
2. Because of the higher pressure and larger diameter, when a transmission line explodes the damage radius can be quite large. (The San Bruno explosion created a crater 167 ft long X 26 ft wide X 40 ft deep. The blast leveled 35 homes and damaged many more.)
3. Because of the damage potential in the event of an explosion, we believe that if a transmission line leak is confirmed the standard procedure should be to de-pressurize the line and evacuate the area until the pipeline no longer represents an immediate threat. If this were PG&E's standard operating procedure there would not be a need for emergency access. (PHMSA and the local emergency response experts we spoke to agree that this should be the standard procedure. PG&E, however, has expressed multiple conflicting opinions on this point over the past year.)
4. In general, it will take longer to access a buried transmission line located under a roadway than one located under a tree. Therefore, since PG&E is electing to install a capacity expansion transmission line (St Mary's Rd) during the summer of 2018 beneath 6,000 ft of roadway, we believe that the trees that have been targeted in Lafayette principally due to emergency access concerns should be removed from the "unacceptable risk" list.
5. We do not believe that locating gas pipelines beneath roadways is inherently unsafe. It is a common practice in the industry, and there are always pros and cons associated with any pipeline siting decision.

PG&E's claim to need immediate access at all points of the pipeline is further called into question when we consider the status of Lafayette's

Plaza Park trellis which stands in front of the Way Side Inn Thrift Shop. PG&E designated this large, heavy wood and stone structure for removal as part of the original Pipeline Pathways program because it sits directly above a gas transmission line. Unlike trees, structures are explicitly required to be removed from gas pipeline pathways. According to the email documents obtained from our PRA request, however, PG&E and the City of Lafayette negotiated in early 2017 to relocate the pipeline around the trellis. More recently, PG&E has decided to not relocate the pipeline and to allow this structure to remain in place, blocking emergency access to the pipeline. Preposterously, and further illustrating its inconsistency, PG&E is nonetheless proceeding with its plans to remove young, small-diameter ornamental trees on either side of the trellis.



This decision makes two issues perfectly clear: 1) the City of Lafayette benefited by negotiating with PG&E before the Tree Cutting Agreement was signed, unlike residents with trees or structures on their property, and 2) PG&E's claims for needing immediate access is bogus or, at best, erratically inconsistent, as the trellis structure would take days to dismantle and move.

PG&E's 2014 Tree Root Assessment Study

In 2011 (following the 2010 San Bruno explosion), PG&E launched a comprehensive safety improvement program focused on its 6500+ miles of natural gas transmission lines in Northern and Central California. Some of the program initially addressed surveying pipeline locations and improved pipeline marking, but most of effort (which actively continues in 2018) has been devoted to removal of trees in the gas transmission rights-of-way that PG&E regards as an unacceptable safety risk. The utility uses an algorithm involving multiple parameters to establish which trees fall into their “unacceptable risk” category, but despite repeated requests to make their algorithm public, to date they have refused to do this.

In 2013, the transmission pipeline safety improvement program evolved into PG&E's Pipeline Pathways program. The announced program budget was \$500 million. However, after developing a reputation in many communities for its coercive, heavy-handed tactics in pursuing tree removal from private and public property, the program was rebranded as the Community Pipeline Safety Initiative.

Also in 2013 (after the launch of their Pipeline Pathways program), PG&E commissioned the consulting/engineering firm Dynamic Risk to investigate the ways that trees could affect buried pipelines. Fifty-three targeted excavations were conducted as part of this study, and the excavations included 30 species of trees and pipeline installation date that ranged from 1931 to 1987. PG&E employees participated in both the data collection and report writing phases of this project, so the study is not an independent, third-party assessment.

The study's final report, issued in January 2014 and called “Final Report—Tree Root Interference Assessment” can be downloaded from [this location](#). In summary, this is what the study concluded:

1. The study found no direct evidence that tree roots in contact with the pipe increased the susceptibility to the initiation of stress corrosion cracking.
2. At locations where pipelines and tree root systems co-exist, it is common for the roots to degrade the external coating on the steel pipe (extent varies with the type of coating used). However, the functioning of the cathodic protection system that PG&E routinely uses on its buried transmission lines does not appear to be adversely affected by tree roots. (Cathodic protection involves placing an electric charge on steel pipelines to control corrosion of the metal surface, and it is used on all PG&E transmission lines. The company sends corrosion management specialists to monitor proper operation of this equipment six times per year, and it has begun installing devices that permit continuous remote monitoring of its cathodic protection systems.)
3. Some external corrosion was noted in a minority of the surveyed sites where the roots damaged the pipeline's external coating. However, the study was unable to verify a causal link between the presence of tree roots and the initiation of external corrosion.
4. Above ground pipeline surveys are not significantly affected by the presence of tree roots.
5. The effectiveness of External Corrosion Direction Assessment does not appear to be adversely affected by the presence of tree roots.

PG&E's 2013 Tree Root Assessment Study

We recently found (on CPUC's website) an earlier “[Final Report—Tree Root Interference Threat Analysis](#)” that was prepared by Dynamic Risk for PG&E and approved by Dynamic Risk for distribution in August 2013. Curiously, this version differs substantially in overall report length (23 pages for the 2013 version vs 39 pages for the 2014 version), and the individuals from Dynamic Risk

who “signed off” on the approval lines are quite different for the two report versions: different Prepared By individual; different Contributing Authors; different Approved By/Reviewed By individuals. The 2014 report’s Executive Summary mentions the 2013 report (second paragraph) as “an earlier report on tree root interactions” that served as the basis for PG&E’s adoption of tree removal standards (utility standard TD-4490S, published June 2013). The References section of the 2014 report lists the 2013 report and describes it as a “Final Report.” The existence of two reports covering what appears to be largely the same topic and with nearly identical titles has been confusing to both Save Lafayette Trees and multiple members of PG&E. When we asked detailed questions about some of the differences between the reports during the PG&E information “Open House” in Lafayette on 5/9/18, everyone we asked responded in the same way: they had no knowledge of the 2013 report, and it certainly must be a draft version of the 2014 report, so they believe it has no particular relevance.

Here are some of the significant differences between the two reports.

1. The 2013 version mentions that the study team reviewed PHMSA gas transmission incident data from 2002-2013 and found that tree roots were not identified as a direct or contributing cause of pipeline failure in any of those incidents. The 2014 version is silent on this finding.
2. The 2013 version (in Section 8.3, Threat-Based Risk Assessment) includes this caution:

This threat-based risk assessment has assumed that the tree roots are alive and in proximity to the buried pipeline. One factor not considered in this assessment, and that also requires consideration as part of the development of a tree root removal program, is the effect of tree roots that are not alive and have the potential to decompose. It is recognized that the decomposition of organic matter will produce carbon dioxide (CO₂) and this has the potential to increase the susceptibility to cracking of the outside diameter pipe surface. *Further study, assessment and consideration for this phenomenon is required.* [emphasis added]

And in Section 10, Recommendations:

- Decomposition and CO₂ production could increase susceptibility to cracking. Further study, assessment and consideration for this phenomenon is required.
- The effects of leaving tree root systems in place and how they could affect future pipeline integrity and/or future integrity surveys that may be required.

The 2014 version omits the above cautions and recommendations. However, the 2014 report’s Summary of Findings (p iv) says, without further elaboration:

There was insufficient data collected in this study to draw any conclusions as to whether the presence of dead tree roots in contact with the pipe has any impact on pipeline integrity.

3. The 2013 version (in Section 10, Recommendations) proposes:

Identify all mitigative actions and their effect on the threat susceptibility, ability to monitor, and ability to respond (e.g., root barrier systems). on the threat susceptibility, ability to monitor, and ability to respond (e.g., root barrier systems).

The 2014 version is silent on the topic of root barrier systems for threat mitigation.

4. The 2013 version includes “Table 2 – Examples of Monitoring and/or Mitigation Actions and Effect on the Risk Profile.” That table rates tree removal *along with root removal* as clearly reducing the threat of external corrosion cracking. Importantly, the table indicates

that the impact of tree removal *without accompanying root removal* is uncertain with respect to external corrosion cracking.

The 2014 version omits Table 2 entirely. Apart from the “insufficient data collected” statement cited above, the 2014 version is silent on the concern suggested in the 2013 report that removing a tree while leaving the roots in place appears to represent an increased risk of external corrosion cracking. External corrosion of gas pipelines is an important issue and has been studied extensively. See, for example, [External Corrosion of Oil and Natural Gas Pipelines](#) by Beavers and Thompson (2006).

5. In Section 10 – Recommendations, the 2013 report states that tree removal as follows “will reduce the risk profile”
 - All trees within 5 ft of the pipeline centerline
 - Trees 8” or more in diameter and within 10 ft of the pipeline centerline
 - Trees greater than 36” in diameter and within 14 ft of the pipeline centerline

PG&E’s standard on gas pipeline rights-of-way ([TD 4490S](#), published 6/19/13) provides essentially the same tree removal standards. The standard also says that the timing on specific tree removals will be subject to decisions made by PG&E Integrity Management personnel.

The 2014 report does not recommend specific tree removal criteria, but as mentioned above it refers to the 2013 PG&E standard, TD-4490S.

In May, as follow-up to their open house communication, we asked PG&E to explain the differences between the 2013 and 2014 versions of the Dynamic Risk reports. They have not yet responded. But PG&E has confirmed that when removing trees in pipeline rights of way they have been and will continue to leave the tree roots in place.

PHMSA’s Position on Removing Trees from Pipeline Rights-of-Way

As the federal agency charged with regulating and insuring the safety of the nation’s gas pipelines, PHMSA has been asked many times in the past to clarify the right of a pipeline operator to remove trees growing in pipeline rights-of-way that sit on private or public property. This comes up frequently because PHMSA requires the operators to patrol their rights-of-way as often as every three months and observe surface conditions including indications of leaks, construction activity, erosion, and other factors affecting safe operation. The lowest cost method of doing this is generally aerial surveillance (an approved method), but the presence of trees often makes aerial surveillance impractical. Acceptable surveillance alternatives include walking and driving along the right-of-way.

Shown on the next page is an extract from a September 2000 regulatory interpretation¹ that PHMSA sent to the mayor of Piscataway, N.J. The city was contesting Duke Energy’s plan to remove all street trees along its natural gas pipeline right-of-way in a section of the city. PHMSA has been repeatedly providing essentially this same interpretation for more than 40 years.

“Pipelines operated by Duke Energy are subject to the safety regulations of Title 49 CFR Parts 190-199. These regulations require operators to patrol their pipeline easements for signs of leaks and construction activity. However, *the regulations do not require operators to keep their easements free of trees to make patrolling easier or to minimize the possibility of damage by tree roots, nor do the regulations give pipeline operators a right to remove trees on their pipeline easements.* The authority of an operator to remove trees is subject to private agreements with landowners and to any local land use controls. Although aerial surveillance is usually the most practical method of patrolling, in areas where an easement is concealed by trees or large bushes, a pipeline operator may observe conditions on the easement by walking or driving along the easement.”¹

¹ <https://www.phmsa.dot.gov/regulations/title49/interp/PI-00-0102>