CONTENTS

LIST OF ACRONYMS ................................................................. 3

EXECUTIVE SUMMARY ......................................................... 4
  Purpose and Scope of Report ............................................. 4
  Recommendations ......................................................... 5

BACKGROUND ................................................................. 6

PIPELINE BASICS AND TECHNICAL ISSUES ......................... 6
  What kinds of pipelines are in Contra Costa County? ............ 6
  Where are the pipelines in Contra Costa County? ................. 8
  Who regulates pipeline safety? ........................................ 11
  How much risk is there from the pipelines in Contra Costa County? .... 12

PIPELINE CONSTRUCTION, OPERATIONS
  AND MAINTENANCE ............................................................ 17

LAND USE PLANNING AND PIPELINES ................................. 22

DAMAGE PREVENTION AND
PUBLIC AWARENESS PROGRAMS ........................................ 22

EMERGENCY RESPONSE,
SPILL RESPONSE & PREVENTION ....................................... 23

APPENDICES ....................................................................... 26
  Agency listing and Resources for more information .............. 27
  Agenda for public meetings - video is here ....................... 28
  Easements granted to PG&E by Contra Costa County .......... 29
  All Reported Incidents in Contra Costa County .................... 32
  PG&E Transmission Incidents ........................................... 34
  Questions from Public Forums, May 29-31, 2018 ..................... 36
  Seismic Report ............................................................... 52
LIST OF ACRONYMS

AIA – Alamo Improvement Association
CAER – Community Awareness and Emergency Response
CalEPA – California Environmental Protection Agency
CAO – Corrective Action Order
CATS – Community Assistance and Technical Services, PHMSA Pipeline Safety outreach staff
CCC – Contra Costa County
CDE – California Department of Education
CPUC – California Public Utilities Commission
CUPA – Certified Unified Program Agency, as authorized under CalEPA
DCD – Contra Costa County Department of Conservation and Development
EFRD – Emergency Flow Restricting Devices
EPA – Environmental Protection Agency
FERC – Federal Energy Regulatory Commission
HCA – High Consequence Area
HL – Hazardous Liquid
HSD – Contra Costa County Health Services Department
IHC – Iron Horse Corridor
LS – Line Segment, specifying a number that identifies a specific segment of a pipeline
NTSB – National Transportation Safety Board
OSFM – California Office of the State Fire Marshal
OSPR – California Department of Wildlife, Office of Spill Prevention and Response
PHMSA – U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration
PG&E - Pacific Gas and Electric - operator of gas transmission and distribution lines
PST – Pipeline Safety Trust
SFPP – Santa Fe Pacific Pipeline system that is operated by Kinder Morgan
TAG – PHMSA Community Technical Assistance Grant
EXECUTIVE SUMMARY

Purpose and Scope of Report

The Alamo Improvement Association (AIA) contracted with the Pipeline Safety Trust to provide services intended to educate and inform the community about fuel pipelines and pipeline safety. That included presentations at three community workshops in the spring of 2018, as well as the production of this report. The Trust prepared a similar report in 2015, focused particularly on hazardous liquid pipelines and on the Kinder Morgan pipeline that runs along the Iron Horse Corridor area through Alamo. This report will draw from that report where appropriate, and will include additional information about natural gas pipelines in Alamo and Contra Costa County.

The funding for these services came from a Community Technical Assistance Grant (TAG) awarded by the Pipeline and Hazardous Materials Safety Administration (PHMSA), a division of the U.S. Department of Transportation. AIA applied for this grant to include pipeline safety public outreach and education, as well as training for local first responders, and to obtain some technical assistance relating to pipeline materials used in construction of pipelines in the area and how those materials might compare to current materials, particularly under seismic stresses. Roger Smith, President of the Alamo Improvement Association was the primary point of contact for the TAG award and contract for services with the Trust.

From December 2017 through May 2018, Pipeline Safety Trust staff participated in periodic conference calls with two representatives of the Alamo Improvement Association, a field representative in Contra Costa County District II Supervisor Anderson's office, and the Hazardous Materials Ombudsman within the Contra Costa County Health Services Department. This ad-hoc group was highly engaged with planning the three pipeline safety workshops that took place in spring 2018 and continued to be involved through the report process.

AIA asked the Trust to report broadly on pipeline issues affecting the entire county as well as the role of federal and state agencies, and in this second report to focus in on issues specific to natural gas pipelines and particularly the pipeline concerns of people in the Alamo area. Readers interested in more details about hazardous liquid pipelines in the County should refer to the 2015 report in addition to this one.

The report examines the location of natural gas lines in the county, the frequency of natural gas incidents in the county and on the PG&E system, and places those in context relative to the rest of the natural gas distribution companies of similar size, finding that PG&E has the worst incident record of similarly sized distribution companies in the country, and its record continues to worsen in recent years.

The questions that were posed at the three public meetings are included in an appendix along with responses provided by all participants except PG&E, whose responses were not made available to us by the time we finalized this report. Also included in appendices are a list of all incidents in the county, all incidents on the PG&E system, and the text of the easements granted by the County to PG&E to install pipelines on county property and rights of way.
Recommendations

RECOMMENDATION to PHMSA: Include enforcement actions against operators by state pipeline safety regulators and the U.S. Department of Justice on your webpage that currently only includes PHMSA pipeline safety enforcement actions.

RECOMMENDATION TO OFFICE OF THE STATE FIRE MARSHAL, THE CALIFORNIA PUBLIC UTILITIES COMMISSION AND PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION: Make information about a pipeline’s HCA designation easily available to the public.

RECOMMENDATION TO OFFICE OF THE STATE FIRE MARSHAL, CALIFORNIA PUBLIC UTILITIES COMMISSION AND PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION: Adopt stronger regulations that require better leak detection systems in high consequence areas, and that provide a clear performance standard for such systems.

RECOMMENDATION TO PIPELINE OPERATORS: Contract for an independent technical seismic vulnerability study on HCA pipelines affected by potentially active faults to feed into the pipeline risk analysis, and make the study available to the public.

RECOMMENDATION TO CONTRA COSTA COUNTY HEALTH SERVICES DEPARTMENT: Expand the scope of the Hazardous Materials Ombudsman and the Hazardous Materials Commission to provide an ongoing review of pipeline operators’ emergency plans and possible county efforts regarding additional coordinated technical review of pipeline integrity planning.

RECOMMENDATION TO THE STATE OF CALIFORNIA: Work with the California Department of Education (CDE) on ways to implement CDE’s suggestions for reducing the probability of a pipeline product release on schools, and reducing the consequences of pipeline releases on schools.¹

RECOMMENDATION TO DEPARTMENT OF EDUCATION: Expand School Site Pipeline Risk Analysis and the Potential Pipeline Hazard Mitigation/Management guidance in coordination with emergency response agencies to offer help for schools that already exist in close proximity to pipelines. Lead coordination efforts among the myriad of agencies that offer crisis planning assistance to schools, and suggest minimum information that should be included in these plans regarding pipelines.

RECOMMENDATION TO CONTRA COSTA COUNTY OFFICE OF PUBLIC EDUCATION AND SCHOOL DISTRICTS: Expand emergency preparedness resources to include information about pipelines and pipeline-specific risks. Assist individual schools in developing crisis plans and emergency preparedness plans that include pipelines on the emergency maps and assess how ingress/egress may be affected by a pipeline incident.

RECOMMENDATION TO PIPELINE OPERATORS: Reach out to the schools along the pipeline easement and offer to provide technical assistance assessing pipeline risks and evacuation strategies given possible incidents that could occur in close proximity to the schools.

¹ See CDE’s Potential Pipeline Hazard Mitigation/Management website at http://www.cde.ca.gov/ls/fa/sf/mitigation.asp.
BACKGROUND

Contra Costa County has over 1 million people and covers approximately 805 square miles. The city of Martinez is the county seat, and one of nineteen incorporated cities within the county. Oil refineries operate along the western and northern coastlines: Phillips 66, Chevron, Shell Oil, and Andeavor, with associated petroleum storage and transportation infrastructure. Most of the hazardous liquid pipelines in the county transport product to or from a refinery. There are also several natural gas transmission pipelines in the county and natural gas distribution lines serve large areas of the county.

A Board of Supervisors governs the county, with representatives elected from five districts; the Alamo area is part of District II, and is unincorporated with about 15,000 residents. The homeowners association – the Alamo Improvement Association – is quite active, with an elected board, and committees. In addition, the Alamo Municipal Advisory Council serves a formalized role with the county as an advisory body to the Board of Supervisors and the County planning agency, providing review and recommendations for a variety of activities that impact the Alamo area.

PIPELINE BASICS AND TECHNICAL ISSUES

What kinds of pipelines are in Contra Costa County?

There are three main types of fuel pipelines in Contra Costa County, and it is important to understand what the different types are since they have different safety considerations and are regulated by different agencies under different rules.

The three main types are:

**Hazardous Liquid Lines:** These are the lines that move crude oil to the local refineries and then move refined products (gasoline, jet fuel, diesel, etc.) from the refineries to other markets.

**Natural Gas Transmission Lines:** These are the relatively larger, higher-pressure pipelines that move gas from production or storage to where the gas is distributed to our homes and businesses. They operate at pressures in the range of 300 to over 1500 pounds per square inch.

**Natural Gas Distribution Lines:** A distribution line is a relatively small, lower pressure pipeline used to supply natural gas directly to our homes and businesses. A distribution line is located in a network of piping located downstream of a natural gas transmission line. The “city gate” is where a transmission system feeds into a lower pressure distribution system. Gas distribution pipelines comprise by far the most mileage of pipes; they carry odorized gas (with the characteristic smell of rotten eggs) throughout urban areas.

Two other important distinctions are **interstate** pipelines compared to **intra**state pipelines. Interstate pipelines are typically longer transmission pipelines that cross state lines; intrastate pipelines are transmission pipelines that lie wholly within a single state. 

The US has over 2.7 million miles of pipelines. Most of these (approximately 91%) carry gas – predominantly natural gas – and the rest (approximately 9%) carry hazardous liquids. Hazardous liquid and natural gas pipelines are governed by separate regulations. Whether and how pipelines are regulated also depends on what product is carried and where the pipeline is located.

There are over 4,000 miles of natural gas pipelines in Contra Costa County, 260 miles of which are

---

2 State lines are not the sole determiner for the inter/intrastate distinction. For details see 49 CFR 195, Appendix A.
transmission lines, and the rest are distribution lines and services. All the natural gas distribution pipelines are operated by Pacific Gas & Electric under the jurisdiction of the California Public Utility Commission.

### Pipeline Safety Initiatives – Contra Costa County

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Progress Since 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission pipeline Maximum Allowable Operating Pressure (MAOP) validation complete</td>
<td>100%</td>
</tr>
<tr>
<td>Transmission miles surveyed using high-precision GPS</td>
<td>100%</td>
</tr>
<tr>
<td>Transmission pipeline strength tested</td>
<td>46 miles</td>
</tr>
<tr>
<td>Transmission pipeline replaced (includes pipeline upgraded for in-line inspection)</td>
<td>33 miles</td>
</tr>
<tr>
<td>Valves automated on transmission pipelines</td>
<td>43 valves</td>
</tr>
<tr>
<td>PG&amp;E emergency exercises conducted</td>
<td>71 exercises</td>
</tr>
</tbody>
</table>

### Planned Initiatives

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Progress Since 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission miles to strength test</td>
<td>2.7 miles</td>
</tr>
<tr>
<td>Transmission miles to replace</td>
<td>3.1 miles</td>
</tr>
<tr>
<td>Valves to automate</td>
<td>2 valves</td>
</tr>
</tbody>
</table>

1Data valid as of 05/23/2018, unless stated otherwise. Numbers in this table are approximate.

### ALAMO OVERVIEW

- **Line:** Distribution Feeder Main (DFM) 3017-01
- **Maximum Allowable Operating Pressure (MAOP):** 365 pounds per square gage (psig)
- **Diameter:** 8 inches
- **Material:** Steel
- **Miles of Pipeline:** approx. 2 miles
- **Miles of HCA:** approx. 4,000 feet
- **Integrity Assessments:** 2012 Strength Test, Direct Assessment in progress (2018)

### Source

Source: PG&E slide from presentation at Alamo public meeting, May 29, 2018

Hazardous liquid (HL) transmission pipelines in Contra Costa County total close to 500 miles. Roughly two-thirds of the HL pipelines carry refined products, and about one-third carry crude oil.

3 Data on HL pipeline mileage in Contra Costa County from OSFM staff, and does not include empty or abandoned lines.
Pipeline Safety in Alamo, and surrounding areas within Contra Costa County, California

Where are the pipelines in Contra Costa County?

The map below from the National Pipeline Mapping System⁴ shows the general location of the hazardous liquid (red) and the natural gas (blue) transmission pipelines in Contra Costa County. These maps should not be used as a substitute for calling 811 and having utilities located before any digging, as required by law.

![Map of pipelines in Contra Costa County](https://www.npms.phmsa.dot.gov/)

### Regulated Pipeline Mileage – U.S. and California

<table>
<thead>
<tr>
<th>Miles of Pipelines*</th>
<th>U.S.</th>
<th>California</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Transmission</td>
<td>300,354</td>
<td>12,359</td>
</tr>
<tr>
<td>Gas Distribution</td>
<td>2,229,653</td>
<td>203,189</td>
</tr>
<tr>
<td>Hazardous Liquid</td>
<td>212,189</td>
<td>7,177</td>
</tr>
<tr>
<td>Regulated Gas Gathering</td>
<td>18,098</td>
<td>145</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2,760,294</strong></td>
<td><strong>222,870</strong></td>
</tr>
</tbody>
</table>

* Data from PHMSA as of 3/23/2018

### Breaddown of Commodities Shipped in California Transmission Pipelines

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Milage</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>12,368</td>
<td>63.3%</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>3,569</td>
<td>18.3%</td>
</tr>
<tr>
<td>Refined Petroleum Products</td>
<td>3,397</td>
<td>17.4%</td>
</tr>
<tr>
<td>Natural Gas Liquids HVL</td>
<td>195</td>
<td>1%</td>
</tr>
<tr>
<td>Biofuel</td>
<td>15</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>19,544</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>


⁴ [https://www.npms.phmsa.dot.gov/](https://www.npms.phmsa.dot.gov/)
Anyone can access these maps to see where hazardous liquid and gas transmission pipelines run through their community. The National Pipeline Mapping System can also tell a viewer who operates pipelines in your county.

### Who Operates Pipelines in Contra Costa County?

- PACIFIC GAS & ELECTRIC CO
- SFPP, LP (Kinder Morgan)
- STANDARD PACIFIC GAS LINE INC
- NUSTAR TERMINALS OPERATIONS PARTNERSHIP L.P.
- CHEVRON PIPE LINE CO
- BULLDOG GAS & POWER LLC
- SHELL PIPELINE CO., L.P.
- DOD DEFENSE ENERGY SUPPORT CENTER
- CPN PIPELINE COMPANY
- PHILLIPS 66 PIPELINE LLC
- TESORO LOGISTICS OPERATIONS LLC - GOLDEN EAGLE
- CRIMSON PIPELINE L.P.
- CALIFORNIA RESOURCES CENTRAL VALLEY
- VALERO REFINING COMPANY - CALIFORNIA

The map below shows the two transmission pipelines running through the Alamo area – the Kinder Morgan SFPP line in red and the PG&E natural gas line in blue. The public viewer for the maps is available online at: [https://pvnpms.phmsa.dot.gov/PublicViewer/](https://pvnpms.phmsa.dot.gov/PublicViewer/)
PG&E also maintains an interactive map system that will allow you to locate its transmission lines anywhere in its service area. The image above is an example of what you can see. [https://www.pge.com/en_US/safety/how-the-system-works/natural-gas-system-overview/gas-transmission-pipelines.page](https://www.pge.com/en_US/safety/how-the-system-works/natural-gas-system-overview/gas-transmission-pipelines.page)

Please note: These maps do not include the locations of gas distribution lines. And again, the location of pipelines in these maps is ± 500 feet, so they should not be relied on for anything other than general location. Call 811 before any digging to have utilities located and marked.

Unlike the easements granted to Kinder Morgan's predecessor for the SFPP under the Iron Horse Trail, the easements granted by the County in the 1940s to PG&E for crossing roads and other county owned property do not expire. The PG&E easements are essentially permanent unless the utility forfeits them through noncompliance with the terms, or if they are voluntarily relinquished or taken through eminent domain. This means that the County does not have the opportunity to change or renegotiate the terms of those easements. You can find the text of the PG&E easements in Appendix C to this report.
Who regulates pipeline safety?

Federal Oversight
Ultimately the U.S. Congress has responsibility for setting the framework under which pipeline safety regulations operate in the country. The U.S. Department of Transportation through the Pipeline and Hazardous Materials Safety Administration (PHMSA) is primarily responsible for issuing and enforcing the minimum pipeline safety regulations. Most of these regulations are performance-based. For example, pipeline operators are required by the federal regulations to operate and repair pipelines in a safe manner so as to prevent damage to persons or property, but the way in which they do so is generally not spelled out prescriptively. This allows pipeline operators to prioritize pipeline inspections and repairs in areas with higher populations or higher risk factors, but it also makes the regulations ambiguous and challenging to enforce.

State Oversight
The federal pipeline safety laws allow for states to accept the responsibility to regulate, inspect, and enforce safety rules over intrastate pipelines within their borders under an annual certification from PHMSA. If a state receives such intrastate authority they can set regulations that are more stringent than those PHMSA sets as long as the state rules do not conflict with the federal regulations. PHMSA also can enter into an agreement with the state pipeline regulator to carry out inspections on interstate pipelines. Local governments are not allowed to create rules to regulate the operational safety of pipelines, though they may have involvement in spill response, routing and siting issues, and franchise or easement agreements.

California has authority under a PHMSA certification for intrastate pipelines, which is carried out through the Office of the State Fire Marshal (OSFM) for hazardous liquid pipelines, and through the California Public Utilities Commission (CPUC) for natural gas pipelines.

California has adopted both hazardous liquid and natural gas pipeline regulations that are more stringent than the federal minimum regulations for the intrastate pipelines. Some of those stronger hazardous liquid rules include better information sharing, incident reporting, and planning outreach to fire departments; more frequent pipeline inspections or testing, additional pressure testing requirements in certain situations including for pipelines that have
experienced certain kinds of leaks; better protection of pipeline easements from encroachment; and an internal comprehensive database and mapping system.\textsuperscript{5}

**City and County Governmental Powers**

For the most part the federal pipeline safety law precludes local government from adopting any regulation that requires a pipeline operator to take any action regarding the safe operation of a pipeline. There is nothing in state or federal law that restricts a local government’s ability to ask for increased safety measures as part of their negotiations regarding the use of public rights-of-way or other public property. While local government may not be able to require or enforce such measures, cities nationwide have been able to obtain increased safety measures through such voluntary requests, especially when such safety measures are well thought out, supported by the public, and do not conflict with federal or state regulations. One area in which local government has considerable ability to increase pipeline safety is through their land use and zoning authority. Details of this option are discussed in the Land Use Planning section later in this report. Additional information can be found in our Local Government Guide to Pipelines.

**How much risk is there from the pipelines in Contra Costa County?**

Risk is one of those things that one person cannot really define for another, since each person thinks about risks in their own personal way. While some feel that skydiving is a risk worth taking, others won’t even go up in the airplane. In other words it is not possible for us to say whether the pipelines in Contra Costa County are safe enough. All we can do is to try to provide enough information so individuals can make that decision on their own, and then work with others in their community to pursue policies based on those beliefs.

Risk is made up of two different factors both of which need to be carefully considered when deciding how risky an activity is. Those factors are the probability that an event will occur (chance a pipeline will rupture or leak), and the possible consequences if it does.

**Probability**

First let’s take a look at some of the publicly available data to try to get a sense of the probability of a natural gas pipeline incident occurring in Contra Costa County.

PHMSA maintains a publicly accessible database of reported pipeline incidents.\textsuperscript{6} Natural gas pipeline operators are required to file an incident report when there is a release of gas that results in any of the following:

1. death or injury requiring hospitalization;
2. estimated property damage exceeding $50,000;
3. a release of 3 million cubic feet of natural gas.\textsuperscript{7}

A subset of all these reported incidents are considered ‘significant’ if they result in items 1 or 2 above. A further subset of ‘serious’ incidents are those that result in a death or injury requiring hospitalization.\textsuperscript{8}

Here are two graphs that show the numbers of significant incidents each year both throughout the U.S. and in California. As you can see in both cases the number of incidents is relatively small, but the overall trend is a slightly increasing number of incidents on both liquid and gas transmission pipelines. The trend is a slight reduction in the number of incidents on gas distribution lines.

\textsuperscript{5} California GOV Code § 51010 et. seq.


Pipeline Safety in Alamo, and surrounding areas within Contra Costa County, California

Onshore Significant Incidents

Entire U.S.

California Only

But raw numbers of incidents is a pretty rough way of looking at probability because the number of miles of pipelines changes, and the pipelines carrying different types of products have different failure rates. If we take the mileage of pipelines into consideration, and break the type of products these pipelines carry down into the two main types – hazardous liquids and natural gas – we start to get a more refined look at probabilities. For a more detailed breakdown of incidents on hazardous liquid pipelines both generally and in California, please see our 2015 report.

Over the past 10 years the probability for a gas transmission pipeline incident nationally is 1 significant incident per year per 5,128 miles of gas transmission (GT) pipeline. So with 12,358 miles of gas onshore pipeline, California could statistically expect a significant incident somewhere in the state between 2-3 times a year. The actual incident rate in California over the past ten years is 4.3 significant incidents per year, a little higher than expected by national averages. Similarly, over the past decade nationally, about 11 incidents out of the 580 GT significant incidents killed someone. That means that each year, there is nationally roughly one incident causing a death for every 270,387 miles of gas transmission pipe. With 12,358 miles of GT pipeline in California, you would expect a GT incident leading to a death every 21.9 years. California has actually had 4 incidents in the past 20 years that involved at least one death, higher than the averages would predict.

It is also possible to use these same rates to look at how individual pipeline companies compare to national averages.

In these next three charts prepared for the 2018 community meetings, we identify the operators in California and Contra Costa County by highlighting them. The operators are listed in order of the number of incidents per mile their systems have experienced, either as a 5 or 10-year average. The first chart relates to hazardous liquid incidents affecting people and the environment - that is, typically spills leaving the operator’s property or facility. The other two charts relate to natural gas pipelines, first transmission and finally distribution.
### Gas Transmission Onshore Significant Incidents per 1,000 Miles

**California Operators and others with over 6,500 miles of pipelines**  
Data Source: US DOT Pipeline and Hazardous Materials Safety Administration  
Data as of: 05/18/2018

<table>
<thead>
<tr>
<th>Operator ID</th>
<th>Operator Name</th>
<th>10 Year Average (incidents per 1,000 miles)</th>
<th>5 Year Average (incidents per 1,000 miles)</th>
<th>10 Year Incident Count</th>
<th>5 Year Incident Count</th>
<th>2017 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>15007</td>
<td>PACIFIC GAS &amp; ELECTRIC CO</td>
<td>0.36</td>
<td>0.36</td>
<td>24</td>
<td>2</td>
<td>6,535</td>
</tr>
<tr>
<td>840</td>
<td>MCHALE PIPELINE OPERATING COMPANY</td>
<td>0.34</td>
<td>0.34</td>
<td>20</td>
<td>2</td>
<td>562</td>
</tr>
<tr>
<td>18536</td>
<td>SOUTHWEST GAS CORP</td>
<td>0.31</td>
<td>0.31</td>
<td>2</td>
<td>2</td>
<td>561</td>
</tr>
<tr>
<td>31728</td>
<td>GULF SOUTH PIPELINE COMPANY, LP</td>
<td>0.30</td>
<td>0.30</td>
<td>20</td>
<td>1</td>
<td>6,550</td>
</tr>
<tr>
<td>15160</td>
<td>TENNESSEE GAS PIPELINE COMPANY</td>
<td>0.24</td>
<td>0.24</td>
<td>29</td>
<td>14</td>
<td>11,775</td>
</tr>
<tr>
<td>2016</td>
<td>COLUMBIA GAS TRANSMISSION, LLC</td>
<td>0.22</td>
<td>0.22</td>
<td>24</td>
<td>9</td>
<td>20,469</td>
</tr>
<tr>
<td>405</td>
<td>ANR PIPELINE CO</td>
<td>0.21</td>
<td>0.21</td>
<td>20</td>
<td>9</td>
<td>9,252</td>
</tr>
<tr>
<td>18570</td>
<td>TRANSCONTINENTAL GAS PIPE LINE COMPANY</td>
<td>0.21</td>
<td>0.21</td>
<td>27</td>
<td>8</td>
<td>8,292</td>
</tr>
<tr>
<td>18516</td>
<td>SOUTHERN NATURAL GAS CO</td>
<td>0.20</td>
<td>0.20</td>
<td>17</td>
<td>6</td>
<td>7,003</td>
</tr>
<tr>
<td>18484</td>
<td>SOUTHERN CALIFORNIA GAS CO</td>
<td>0.20</td>
<td>0.20</td>
<td>7</td>
<td>5</td>
<td>3,448</td>
</tr>
<tr>
<td>117</td>
<td>AIR PRODUCTS &amp; CHEMICALS INC</td>
<td>0.19</td>
<td>0.19</td>
<td>1</td>
<td>0</td>
<td>670</td>
</tr>
<tr>
<td>13750</td>
<td>NORTHERN NATURAL GAS CO</td>
<td>0.18</td>
<td>0.18</td>
<td>26</td>
<td>13</td>
<td>14,776</td>
</tr>
<tr>
<td>4330</td>
<td>EL PASO NATURAL GAS CO</td>
<td>0.13</td>
<td>0.13</td>
<td>13</td>
<td>4</td>
<td>10,062</td>
</tr>
<tr>
<td>15923</td>
<td>TEXAS EASTERN TRANSMISSION, LP (SPECTRA)</td>
<td>0.13</td>
<td>0.13</td>
<td>13</td>
<td>7</td>
<td>8,617</td>
</tr>
<tr>
<td>32009</td>
<td>ENERGY TRANSFER COMPANY</td>
<td>0.12</td>
<td>0.12</td>
<td>8</td>
<td>5</td>
<td>7,752</td>
</tr>
<tr>
<td>15033</td>
<td>PAULITE PIPELINE CO</td>
<td>0.12</td>
<td>0.12</td>
<td>1</td>
<td>1</td>
<td>894</td>
</tr>
<tr>
<td>19610</td>
<td>TRANSWESTERN PIPELINE COMPANY LLC</td>
<td>0.12</td>
<td>0.12</td>
<td>3</td>
<td>1</td>
<td>2,585</td>
</tr>
<tr>
<td>12874</td>
<td>DOMINION ENERGY QUESTAR PIPELINE, LLC</td>
<td>0.11</td>
<td>0.11</td>
<td>10</td>
<td>5</td>
<td>9,042</td>
</tr>
<tr>
<td>13120</td>
<td>NATURAL GAS PIPELINE CO OF AMERICA (NMI)</td>
<td>0.11</td>
<td>0.11</td>
<td>0</td>
<td>0</td>
<td>1,417</td>
</tr>
<tr>
<td>444</td>
<td>KERN RIVER GAS TRANSMISSION CO</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>363</td>
</tr>
<tr>
<td>2731</td>
<td>CHEVRON PIPE LINE CO</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>234</td>
</tr>
<tr>
<td>18112</td>
<td>SAN DIEGO GAS &amp; ELECTRIC CO</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>385</td>
</tr>
<tr>
<td>20044</td>
<td>PRAXAIR, INC</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>385</td>
</tr>
<tr>
<td>30838</td>
<td>TUSCARORA GAS TRANSMISSION COMPANY</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>305</td>
</tr>
<tr>
<td>21477</td>
<td>CPN PIPELINE COMPANY</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>35368</td>
<td>EASTWOOD MIDSTREAM PARTNERS LP</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>231</td>
</tr>
</tbody>
</table>

---

### Gas Distribution Significant Incidents per million Miles

**California Operators and others with over 30,000 miles of pipeline**  
Data Source: US DOT Pipeline and Hazardous Materials Safety Administration  
Data as of: 05/18/2018

<table>
<thead>
<tr>
<th>Operator ID</th>
<th>Operator Name</th>
<th>10 Year Average (Incidents per million miles)</th>
<th>5 Year Average (Incidents per million miles)</th>
<th>10 Year Incident Count</th>
<th>5 Year Incident Count</th>
<th>2017 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>15007</td>
<td>PACIFIC GAS &amp; ELECTRIC CO</td>
<td>51.82</td>
<td>72.56</td>
<td>41</td>
<td>28</td>
<td>70,777.99</td>
</tr>
<tr>
<td>31348</td>
<td>ATOMS ENERGY CORPORATION - MID-TEX</td>
<td>45.07</td>
<td>58.08</td>
<td>18</td>
<td>11</td>
<td>41,391.11</td>
</tr>
<tr>
<td>2196</td>
<td>COLUMBIA GAS OF OHIO INC</td>
<td>42.28</td>
<td>52.77</td>
<td>18</td>
<td>11</td>
<td>41,685.92</td>
</tr>
<tr>
<td>15931</td>
<td>PUBLIC SERVICE CO OF COLORADO</td>
<td>42.33</td>
<td>50.99</td>
<td>14</td>
<td>6</td>
<td>34,666.98</td>
</tr>
<tr>
<td>2748</td>
<td>CONSUMERS ENERGY CO</td>
<td>41.56</td>
<td>62.97</td>
<td>21</td>
<td>16</td>
<td>31,481.78</td>
</tr>
<tr>
<td>12408</td>
<td>DTE GAS COMPANY</td>
<td>38.55</td>
<td>50.68</td>
<td>15</td>
<td>10</td>
<td>40,006.32</td>
</tr>
<tr>
<td>15359</td>
<td>BLACK HILLS ENERGY</td>
<td>33.06</td>
<td>25.60</td>
<td>7</td>
<td>3</td>
<td>40,010.21</td>
</tr>
<tr>
<td>15952</td>
<td>PUBLIC SERVICE ELECTRIC &amp; GAS CO</td>
<td>31.76</td>
<td>28.70</td>
<td>11</td>
<td>5</td>
<td>35,081.71</td>
</tr>
<tr>
<td>782</td>
<td>ATLANTA GAS LIGHT CO</td>
<td>30.66</td>
<td>33.10</td>
<td>20</td>
<td>10</td>
<td>64,899.41</td>
</tr>
<tr>
<td>4069</td>
<td>DOMINION ENERGY OHIO</td>
<td>28.61</td>
<td>36.46</td>
<td>9</td>
<td>1</td>
<td>31,653.88</td>
</tr>
<tr>
<td>18464</td>
<td>SOUTHERN CALIFORNIA GAS CO</td>
<td>25.13</td>
<td>33.90</td>
<td>25</td>
<td>17</td>
<td>101,317.06</td>
</tr>
<tr>
<td>13710</td>
<td>NORTHERN ILLINOIS GAS CO</td>
<td>23.70</td>
<td>15.86</td>
<td>15</td>
<td>5</td>
<td>63,201.67</td>
</tr>
<tr>
<td>18536</td>
<td>SOUTHWEST GAS CORP</td>
<td>23.06</td>
<td>18.89</td>
<td>12</td>
<td>5</td>
<td>33,543.92</td>
</tr>
<tr>
<td>18112</td>
<td>SAN DIEGO GAS &amp; ELECTRIC CO</td>
<td>20.56</td>
<td>17.31</td>
<td>3</td>
<td>1</td>
<td>16,009.96</td>
</tr>
<tr>
<td>4499</td>
<td>CENTERPOINT ENERGY RESOURCES CORP</td>
<td>19.63</td>
<td>17.22</td>
<td>12</td>
<td>5</td>
<td>67,245.81</td>
</tr>
<tr>
<td>603</td>
<td>CENTERPOINT ENERGY RESOURCES CORP</td>
<td>17.56</td>
<td>19.94</td>
<td>5</td>
<td>3</td>
<td>30,882.42</td>
</tr>
<tr>
<td>13750</td>
<td>NORTHERN INDIANA PUBLIC SERVICE CO</td>
<td>16.39</td>
<td>6.07</td>
<td>5</td>
<td>1</td>
<td>34,099.96</td>
</tr>
<tr>
<td>13518</td>
<td>PIEMONTE NATURAL GAS CO INC</td>
<td>9.45</td>
<td>9.14</td>
<td>4</td>
<td>2</td>
<td>43,982.86</td>
</tr>
</tbody>
</table>

---

Operators in Contra Costa County: [Icon]
Operators in California, but not in Contra Costa County: [Icon]
Notably, the charts reflect very different incident rate performances relative to the other operators in their respective classes for the two operators of most concern to Alamo area residents, PG&E and Kinder-Morgan's SFPP. These charts take into account the operators' respective mileage of pipelines, and just compare incident rates per 1000 (or 1 million miles in the case of the distribution operators). PG&E tops both of the charts - both gas transmission and gas distribution - having the highest incident rate per mile of any of the operators in the class described in both the natural gas transmission and the natural gas distribution charts. In contrast, SFPP has the lowest incident rate per mile of the hazardous liquid operators included on the first chart.

In Appendix D is a list of all reported incidents on all three types of pipelines in Contra Costa County. These charts and graphs should provide some measure of the probability of a pipeline incident happening and some of the consequences if it does. It is fairly clear from the data that the chance of a pipeline failing in any particular spot is very, very small, but of course if you ask the families of any of the 360 people who were killed by pipeline incidents over the past twenty years in United States they would tell you that the consequences are huge. So what are the possible consequences of pipeline failures, and how can they be quantified?

**Consequences**

For natural gas pipelines it is fairly easy to predict the impact zone around a pipeline failure that explodes. There is a formula used in the federal regulations, based on the size and pressure of the pipeline that predicts the “potential impact radius,” and that radius is then used to define some elements of the regulations. The picture here shows how that radius might appear on a particular pipelines. That circle defines an area within which an unsheltered person would be killed or grievously injured if a natural gas pipeline failed and exploded at the center of the circle. The PIR may not match exactly to the actual impacts of a gas pipeline failure. In the San Bruno tragedy, for example, a much larger area than the predicted impact zone was burned because of the winds in the area that evening. In other instances, small hills, homes or other structures can act as shelter from heat, allowing people to survive a blast even if they were inside the predicted PIR at the time of the explosion.

For hazardous liquid pipelines predicting the consequence area is much more difficult because of the different products involved and because the products may flow long distances based on the terrain and whether they reach water. While each pipeline operator is required to do an analysis of whether a leak along any section of the pipeline could affect a high consequence area, that information is not shared with the public. The best that the public can do is to look at their own area and compare that with the consequences of past liquid failures. The National Transportation Safety Board investigates many of the most significant incidents and the reports of their investigations can be found at: [http://www.ntsb.gov/investigations/AccidentReports/Pages/pipeline.aspx](http://www.ntsb.gov/investigations/AccidentReports/Pages/pipeline.aspx).

Some notes on the use of information from PHMSA website:

1) The public can access information about an operator's pipeline mileage and facilities on the “Operator Information” page here: [https://primis.phmsa.dot.gov/comm/reports/operator/Operatorlist.html?nocache=9641](https://primis.phmsa.dot.gov/comm/reports/operator/Operatorlist.html?nocache=9641). Be mindful that the mileage reflected here includes only transmission line mileage, and not gas distribution mileage, which is the vast majority of PG&E's operated mileage.

2) When you check the PG&E information, be mindful of its limitations: The information on enforcement actions shows “no federal enforcement actions since 2006.” This is not exactly accurate, as PG&E was convicted of 6 federal felony criminal violations of the pipeline safety regulations and of attempting to obstruct the federal investigation of the tragic San Bruno failure by the National Transportation.
Safety Board (NTSB). These charges were brought by the US Department of Justice, rather than by PHMSA, so they are not reflected on the PHMSA website tally of enforcement actions. Also, since PG&E pipelines lines are all intrastate, the California Public Utility Commission brings most of the safety enforcement procedures. To get a full picture, you’d need to check their enforcement records as well.
https://primis.phmsa.dot.gov/comm/reports/operator/OperatorI_E_opid_15007.html?nocache=3074#EnforcementActions_tab_2

**RECOMMENDATION** to PHMSA: Include enforcement actions against operators by state pipeline safety regulators and the U.S. Department of Justice on your webpage that currently only includes PHMSA pipeline safety enforcement actions.

3) PG&E, like all operators, must annually report information about their systems, and must report incidents when they occur. However, because PG&E operates both transmission and distribution lines, some tenacity is required to find all of the information about PG&E on the PHMSA website, since incident reporting is separated by type of system.

**PIPELINE CONSTRUCTION, OPERATIONS AND MAINTENANCE**

Many of the pipelines in place today were constructed before regulations existed for pipelines. Some of the current regulations have to do with ongoing operations and maintenance, and apply to both existing and new lines. Existing ‘grandfathered’ pipelines built prior to 1979 for hazardous liquid lines, or prior to 1968 for gas pipelines, may not have been constructed according to the current regulations. What are pipeline operators required to do to maintain safe pipelines? In this section, we go through basic information, and dive more deeply into some technical issues about which the Alamo community expressed particular concern.

**Construction**

The construction phase of pipeline installation is a critically important time to ensure the long-term integrity of the pipeline. Transmission pipelines are most commonly made of steel, and the pipes are fabricated and inspected to meet industry and government safety standards. Differing soil conditions and geographic or population characteristics of the pipeline route will dictate different requirements for pipe size, strength, wall thickness and coating material. Hazardous liquid pipelines must be buried between 18 and 48 inches below the surface, depending on location and soil properties. If gas transmission lines are buried (they don’t have to be), they also must be buried to a prescribed depth at the time of construction, most commonly 30 to 36 inches. The prescribed depth must be adhered to at the time of burial, but regulations do not require it to be maintained over time.

Operators must use qualified welders, and most welds on the pipe are evaluated and inspected in the field; a proper weld can be stronger than the pipe itself.

**Corrosion Protection**

Corrosion is a serious issue for all steel pipelines. Without corrosion protection every steel pipe will eventually deteriorate, weaken, and become unsafe. With proper corrosion protection, steel pipelines can remain safely operating for many decades. Pipeline operators use three common methods to control corrosion:

- Pipeline coatings and linings defend against corrosion by protecting the bare steel from coming in direct contact with corrosive conditions.
• Corrosion inhibitors are substances that may be added to the commodity running through the pipe to decrease the rate of attack of internal corrosion.

• Cathodic protection (CP) systems use direct electrical current to counteract the normal external corrosion that occurs due to soil and moisture conditions. On new pipelines, CP can help prevent corrosion from starting; on existing pipelines, CP can stop existing corrosion from getting worse.

These corrosion control methods may all be used at the same time; pipeline engineers must carefully consider the specific operating conditions, and pipeline and commodity characteristics to maintain the necessary corrosion protection for each particular pipeline segment.

High Consequence Areas and Integrity Management
Hazardous liquid pipelines that could affect High Consequence Areas (HCAs), which include high population areas, certain drinking water sources, or some ecologically sensitive areas, must prepare integrity management plans and adhere to stricter assessment rules than pipelines that could not affect such HCAs in the event of a failure. For example, pipelines that could affect an HCA have to be physically inspected by the pipeline company on a regular basis, whereas pipelines that could not affect an HCA are not subject to the rules requiring the lines to be inspected. Currently about 41% of all hazardous liquid pipelines in the U.S. could affect HCAs and fall under these inspection and risk management requirements.

For natural gas transmission lines, HCAs are determined primarily by identifying areas of higher population density or particular sites in lower density areas where large groups of people occasionally congregate. The rules give operators two methods from which to choose in identifying the HCAs along their pipeline routes, and these methods don’t necessarily have the same results. Less than 7% of natural gas transmission lines fall under the integrity management rules – just over 20,000 miles of the roughly 300,000 total.

Operators subject to integrity management must do a risk analysis of the segments of the pipeline that could affect or are in HCAs, and then implement a plan to inspect and maintain that pipeline segment using methods appropriate to the specific risk factors impacting the pipeline. The minimum re-inspection interval for hazardous liquid pipelines is every five years; for gas lines it is every 7 years. The integrity management plan and risk analysis may indicate certain pipelines or pipeline segments need to be re-inspected more frequently. The most commonly performed inspections are done with internal in-line inspection devices referred to as ‘smart pigs’ that record problems such as corrosion, dents, and gouges as they move through the pipeline. The inspections are typically performed by a third party contractor that also interprets the inspection results, and submits both the results and their interpretation to the pipeline operator in the form of a report. Federal and state regulators may review these internal inspection reports, risk assessments and plans during their own regulatory inspections of a pipeline operator.

Information about which pipeline segments are and are not within HCAs is not easily publicly available. However, it does appear that the vast majority of hazardous liquid pipelines in Contra Costa County are covered under the stricter integrity management rules that apply to the hazardous liquid pipelines that could affect an HCA. The portion of the San Jose line within the county is operating under these rules. See PG&E slides (included at page 7) for details on their lines in Alamo.

The development and implementation of the Integrity Management Program in the last decade represented a major improvement in risk analysis and ongoing testing and maintenance of pipelines that fall under those requirements. However, with nearly a decade of performance data under the new rules numerous shortcomings in the current Integrity Management Program have been identified by a variety of groups including both PHMSA and the National Transportation Safety Board (NTSB). The

10 See 49 CFR § 195.450 and references therein for the definition of a high consequence area, and 49 CFR § 195.452 for the regulations concerning pipeline integrity management in high consequence areas.
NTSB released a report in 2015 that made numerous recommendations for improving Gas Transmission Integrity Management to make it clearer exactly what pipeline operators are required to do. PHMSA appears to be working on some of these improvements for both gas and hazardous liquid pipelines through various inquiries and rule makings, but as of this report no proposed rules have been adopted, in spite of rulemaking processes extending over nearly 8 years.

RECOMMENDATION TO OFFICE OF THE STATE FIRE MARSHAL, THE CALIFORNIA PUBLIC UTILITIES COMMISSION AND PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION: Make information about a pipeline’s HCA designation easily available to the public.

Valves
Block valves must be installed along natural gas transmission pipelines at distances established by regulations based on class locations, defined by population and development density. In rural locations, valves can be up to 20 miles apart. In the most densely developed areas, they must be no more than 5 miles apart. 49 CFR §192.179. Valves must be fully inspected and tested at least once each calendar year (not to exceed 15 months) to ensure they are functioning properly. 49 CFR §192.745.

Some valves have to be operated manually by pipeline personnel, some valves can be operated remotely from a control room, and some valves are designed to operate automatically if certain conditions occur on the pipeline. If a pipeline should fail, how quickly the valves can be closed and the distance between the valves are two of the main determinants for how much fuel is released. PHMSA has concluded that whether an operator should install automatic shutoff valves or remote control valves (operated from a far-away control room) in newly constructed or fully replaced pipelines needs to be evaluated on a case-by-case basis. Existing pipeline operators subject to integrity management rules must evaluate the type and location of valves as part of their risk assessment.

In 1994 an Edison, New Jersey natural gas incident occurred and it took two and a half hours to shut off the flow of gas that fed the fireball due to the lack of a remotely controlled shut off valve. After the 2010 San Bruno tragedy where it took the pipeline operator over an hour and a half to drive to and close a manual valve the NTSB recommended that PHMSA “Amend Title 49 Code of Federal Regulations 192.935(c) to directly require that automatic shutoff valves or remote control valves in high consequence areas and in class 3 and 4 locations be installed and spaced at intervals that consider the factors listed in that regulation.” Most recently the spill of at least 20,000 gallons of crude oil into the ocean near Santa Barbara has again reiterated the need for new rules regarding these types of valves to help limit the damage from pipeline failures. PHMSA conducted a study that in 2012 found “installing ASVs and RCVs in pipelines can be an effective strategy for mitigating potential consequences of unintended releases because decreasing the total volume of the release reduces overall impacts on the public and to the environment.” PHMSA had been working on rule makings that would have addressed issues relating to automatic and remote control valves, but as of this report no new or proposed rules have been released for public review.

In California, following the San Bruno incident, the legislature enacted a bill that requires the CPUC to issue a rule that will require (with some limitations) valves in high consequence areas and those crossing active seismic faults to be automated or made capable of remote control. (SB 216, enacted October 2011.)

Pipeline Monitoring and Leak Detection
A supervisory control and data acquisition (SCADA) system is a pipeline computer system designed to gather information such as flow rate through the pipeline, operational status, pressure, and temperature readings. This information allows operators to know what is happening along the pipeline during normal operations, and allows for quicker reactions to equipment malfunctions, failures and releases. Some SCADA systems also incorporate the ability to remotely operate certain equipment, including compressors, pump stations, and valves; allowing operators in a control center to adjust flow rates in the pipeline as well as to isolate certain sections of a pipeline. Many SCADA systems also include leak detection systems – called computational pipeline monitoring (CPM) programs – based on the pressure and mass balance in the pipelines.

In the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011, Congress asked the Secretary of Transportation to provide a report within one year on the technical limitations of current leak detection systems, the practicability of developing standards for the capabilities of leak detection systems, and the costs and benefits of requiring pipeline operators to use such systems. PHMSA completed an in-depth study\textsuperscript{14} of leak detection systems in December of 2013. That study found that for hazardous liquid pipelines:

- Emergency responders or a member of the public were currently the most likely means of discovering a pipeline release.
- “There is no technical reason why several different leak detection methods cannot be implemented at the same time. In fact, a basic engineering robustness principle calls for at least two methods that rely on entirely separate physical principles.”
- “External sensors have the potential to deliver sensitivity and time to detection far ahead of any internal system.”

PHMSA has been working on a rule making that may address this leak detection issue for more than 7 years now, but as of this report no new or proposed rules have been released for public review, and the scope of any proposed rule seems to continually shrink, so that now, public information suggests the rules will only address rupture detection, and not the far more numerous leaks.

RECOMMENDATION TO OFFICE OF THE STATE FIRE MARSHAL, CALIFORNIA PUBLIC UTILITIES COMMISSION AND PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION: Adopt stronger regulations that require better leak detection systems in high consequence areas, and that provide a clear performance standard for such systems.

Alamo Technical Pipeline Safety Concerns
Community members raised concerns about a number of specific issues related to pipeline safety on the San Jose pipeline. Pipeline Safety Trust staff also noticed some issues during their visit. This section details technical issues that warrant particular attention.

Earthquakes – In 2007, the United States Geological Survey collaborated with William Lettis & Associates on a technical report analyzing Northern Calaveras Fault data.\textsuperscript{15} This fault bisects Contra Costa County, and is not the only fault impacting ground movement in the area. Residents are concerned that hazardous liquid pipelines are properly protected in the event of an earthquake.

Pipeline operators subject to integrity management are required to consider many threats in the risk assessment that is part of their integrity management plan. A number of these pertain to earthquakes


and ground movement, though earthquake risk is not mentioned in the regulations as something that requires its own analysis and mitigation. For example, in determining the schedule to use in regularly assessing a pipeline segment, geotechnical hazards must be considered;\textsuperscript{16} and PHMSA offers further guidance on risk factors that should be considered in the frequency of assessment, including “location related to potential ground movement...”\textsuperscript{7} but the regulations do not specify how they are considered, any technical specifications to use when considering their risk, or specific ways to mitigate that risk. When PHMSA inspectors review a California operator’s risk assessment, they would expect to see seismic-related activity (ground movement, unstable soils, landslides, etc.) listed as a threat, and if not, they would dig deeper.\textsuperscript{18} In the 2011 updates to the federal pipeline safety laws, Congress specifically included “seismicity of the area” as one threat that a pipeline operator must consider when evaluating threats to a pipeline segment under Parts 192 and 195 of Title 49.\textsuperscript{19}

Pipelines worldwide have generally performed relatively well in past earthquakes,\textsuperscript{20} and ‘natural force damage’ (the cause category under which earthquake-related pipeline failures would fall) is the cause of relatively few pipeline failures nationwide (7%) and in California (2%).\textsuperscript{21} However both old and new pipelines can sustain damage from earthquakes that is “typically concentrated in areas of unstable soils with permanent ground deformation (PGD) and/or liquefaction, including at river crossings and landslides,” according to an \textit{Earthquake Risk Study for Oregon’s Critical Energy Infrastructure Hub} submitted in 2012.\textsuperscript{22} A technical handbook on seismic risk analysis stresses the importance of estimating the extent of permanent ground deformation in assessment of pipeline system vulnerability: “In particular, adequate knowledge of site-specific soil and groundwater conditions is critical to the success of the design and installation of pipelines, as well as in predicting its anticipated performance under field conditions” (page 692).\textsuperscript{23}

Both the technical handbook and the Oregon report list options for mitigation measures to improve the performance of a pipeline. The categories of mitigation measures as summarized by the handbook are: “(a) avoid the hazard by relocation; (b) isolate the pipeline from the hazard; (c) accommodate the hazard by strengthening the pipeline or increasing the flexibility; and (d) mitigate the hazard using ground improvement” (page 702). The Oregon study states mitigation options as: “soil improvement, increasing the load carrying capacity of the pipe system, reducing the friction between the pipe and soil, relocating the pipe, anchors to prevent uplift from buoyant forces, or special pipe joints or fittings that allow greater joint deflection, extension, or compression” (Page 84).

Seismic vulnerability studies can be conducted on pipelines or pipeline segments to assess pipeline performance and suggest mitigation measures appropriate to the specific situation.

A report on the seismic vulnerability of lines in the Alamo area is attached as Appendix G.

**RECOMMENDATION TO PIPELINE OPERATORS:** Contract for an independent technical seismic vulnerability study on HCA pipelines affected by potentially active faults to feed into the pipeline risk analysis, and make the study available to the public.

---

\textsuperscript{16} See 49 CFR § 195.452(e).

\textsuperscript{17} See 49 CFR § 195, Appendix C. II.A.(11)

\textsuperscript{18} Correspondence with PHMSA Pipeline Safety Western Region Office CATS staff, August 2015.

\textsuperscript{19} Section 29, Pipeline Safety, Regulatory Certainty and Job Creation Act of 2011.


\textsuperscript{21} See PHMSA data shown in graphs earlier in report entitled “Causes of HL Significant Incidents.”

\textsuperscript{22} Wang, et. al. IBID (Page 82).

Iron Horse Corridor Above-Ground Stream Crossings – In two places along the Iron Horse Corridor in Alamo, the San Jose line spans seasonal streams above-ground. Community members have raised concerns about the adequacy of the span supports, potential vulnerability of these spans and the overall safety of these crossings.

Both the above-ground pipeline spans contain a metal sleeve over the pipeline itself, and it is this sleeve that is secured to the supporting infrastructure. These types of above-ground pipeline spans are fairly common, though there are many different types of supportive infrastructure that can secure the pipeline in these situations. One additional concern with supported above-ground spans is the erosion that can occur on either side, potentially increasing the length of the unsupported portion of the span.

**LAND USE PLANNING AND PIPELINES**

Please see our [2015 report](#) for an in-depth discussion of issues relating to land use planning and pipelines.

**DAMAGE PREVENTION AND PUBLIC AWARENESS PROGRAMS**

A nationwide utility locator system is available for free in every state, to anyone planning hand or machine excavation, in order to prevent damage to pipelines and other utilities. By calling 811 at least two working days before digging, a utility locator will come identify and mark buried utilities, including cables and pipelines for fuel, water and sewer. This is a requirement by law in California (see GOV Code § 4216 et. seq.) with civil penalties associated with noncompliance, and the state recently adopted new enforcement provisions for the law that went into effect in July of this year.\(^\text{24}\) This enforcement

\(^2\text{4}\) California GOV code 4616.6.
mechanism is brand new, so there is not yet a track record from which to judge how stringent or effective it will be. Pipeline operators must participate in the One Call program. In communities that do not have other types of consultation zones or setback regulations, the “One-Call ticket” (as operators refer to the resulting notification from someone calling 811) is likely to be the first notice the pipeline operator has that someone is intending to dig close to their pipeline. Kinder Morgan and PG&E have robust damage prevention programs, with membership in the Common Ground Alliance, staff training, and staff encouraged to actively follow up on any observed violations. Both operators are supporters of, and directors of, the Gold Shovel Standard [http://goldshovelstandard.org/](http://goldshovelstandard.org/), a voluntary industry effort to improve underground utility damage prevention efforts.

Pipeline operators also are required by federal law to have a Public Awareness Program.25 This program must describe what the operator does to inform the public of the presence of the pipeline and potential hazards, and how they do it. For instance, the operator must identify and communicate with local emergency personnel, government officials, school districts, businesses, and the public, and tell them specific things such as how to recognize pipeline location markers, what kind of precautions they should take, what kind of properties the commodity being transported in the pipeline has, and how to recognize and respond to a pipeline emergency.

**EMERGENCY RESPONSE, SPILL RESPONSE & PREVENTION**

Please see our [2015 report](http://cchealth.org/hazmat/hmc/) for an in-depth discussion of spill response planning relating to hazardous liquid pipelines.

**Contra Costa County Spill and Emergency Preparations and Response**

Contra Costa County Health Services Department (HSD) is designated as a Certified Unified Program Agency (CUPA), and their Hazardous Materials Program has been involved in protecting the community from hazardous materials releases for well over two decades. The state and county rules governing hazardous materials apply very little to pipelines, as the state hazardous materials law specifically exempts the transportation of hazardous materials.26 However once hazardous materials are released from a pipeline, they are no longer considered to be part of the transportation system. In concert with these rules, the Hazardous Materials Program concerns itself with all storage and processing of hazardous materials (including at water treatment facilities, refineries, and the like), but pipelines mainly draw their attention once the hazardous materials are no longer part of the transportation system, i.e., there is an incident where oil is spilled. All releases of hazardous materials (including pipeline releases) are reported on by the Hazardous Materials Program, and available on the department’s website.27

The Health Services Department, Hazardous Materials Program has a designated staff Ombudsman whose job is to respond to questions and concerns from the public, as well as independently and impartially conduct investigations, solve problems, and make recommendations regarding the program. The Department also supports the Hazardous Materials Commission, a group consisting of 13 appointed members representing a diversity of stakeholders. The Commission is tasked with advising the Board of Supervisors on hazardous materials planning, management, and implementation, while obtaining broad public input and working to build consensus.28 The Health Services Department incorporate concerns with pipelines along with facilities as part of a broad focus on protecting the community from dangers of hazardous materials.

25 For hazardous liquid pipelines, see 49 CFR § 195.440; for gas pipelines, see 49 CFR § 192.616.
26 Specific authority given to the HSD as a CUPA is described in CA HS Code, § 25404 and § 25531 et. seq.; the Contra Costa County Industrial Safety Ordinance is found in CCC Code, Title 4, Chapter 450.
Contra Costa County is highly populated, and many people live and work and go to schools in close proximity to the pipelines in the region. The California Department of Education (CDE) offers useful guidance to Local Educational Agencies (i.e. school districts and other related entities) in siting new facilities; one piece of this guidance is their “Guidance Protocol for School Site Pipeline Risk Analysis” which is a tool to aid Local Educational Agencies and the CDE in evaluating the suitability of new school sites located near pipelines as defined in the regulations. CDE also offers guidance under their “Potential Pipeline Hazard Mitigation/Management” heading, including suggestions for reducing the probability of a pipeline product release and for reducing the severity of consequences of pipeline releases on schools.

These resources could be expanded to offer mitigation and modernization recommendations for existing schools in proximity to pipelines, looking at evacuation routes, coordination with local first responders and pipeline operators, and education of individual school staff using resources such as the School Pipeline Safety Partnership offered by the Danielle Dawn Smalley Foundation. In addition, the Contra Costa County Office of Public Education maintains online resources on emergency preparedness, and the Contra Costa County CAER has a Model Emergency Plan for Schools, both of which can be used as additional resources when developing a comprehensive emergency or crisis plan. These resources do not specifically mention the potential hazards of oil and gas pipelines as something to learn about and pay attention to, or as a potential risk for which to plan and develop mitigation measures, though they do provide helpful guidance for the important process of emergency planning.

At a minimum, those agencies who help schools develop safety plans should coordinate with one another (E.G. school districts, the CA Department of Education, county Office of Public Education, and CAER) and suggest each crisis plan include the following information about pipelines:

- Where is the pipeline? (include it in any maps, and specify distance from school facilities)
- What pipeline markers look like.
- Name of pipeline operator, product transported, and both emergency and non-emergency contact information for a pipeline operator representative.
- How and where to evacuate in a pipeline emergency, including routes that avoid pipelines and pipeline rights-of-way.
- Overview of the indications of a pipeline emergency.

There may be a timely opportunity to work with developers to address the issue of school and neighborhood connectivity in conjunction with current plans for development in this area. Every effort should be made to create publicly accessible access across these ‘dead-end’ neighborhoods that necessitate crossing the pipeline to access any services.

As mentioned earlier, resources exist for school emergency planning. In addition, assistance or funding may be available from those same agencies or the pipeline operator to receive specialized technical assistance to assess the pipeline risks and offer suggested mitigation and evacuation strategies pertinent to the specific school situation.

Two fire districts cover the central region of the county that includes the Alamo area: the Contra Costa County Fire Protection District, and the San Ramon Valley Fire Protection District. As mentioned previously, pipeline operators are required to have both an emergency response plan, and a public

31 See [http://smalleyfnd.org/services/pipeline-education/schools](http://smalleyfnd.org/services/pipeline-education/schools).
32 See [http://www.cccoe.k12.ca.us/about/resources_emergency.html](http://www.cccoe.k12.ca.us/about/resources_emergency.html).
33 See [http://www.cococaer.org/prepare_plans_school.html](http://www.cococaer.org/prepare_plans_school.html).
awareness plan, and to have a designated liaison and make information available to local first responders such as fire departments and sheriff or police departments. Because of the workload and turnover in most fire districts, it is difficult to have a single point-of-contact who is familiar with the pipeline, the operator and the emergency response plan. While pipeline operators invite district personnel to annual training events, it is up to the district to prioritize planning for a pipeline emergency.

RECOMMENDATION TO CONTRA COSTA COUNTY HEALTH SERVICES DEPARTMENT: Expand the scope of the Hazardous Materials Ombudsman and the Hazardous Materials Commission to provide an ongoing review of pipeline operators’ emergency plans and possible county efforts regarding additional coordinated technical review of pipeline integrity planning.

RECOMMENDATION TO THE STATE OF CALIFORNIA: Work with the California Department of Education (CDE) on ways to implement CDE’s suggestions for reducing the probability of a pipeline product release on schools, and reducing the consequences of pipeline releases on schools.34

RECOMMENDATION TO DEPARTMENT OF EDUCATION: Expand School Site Pipeline Risk Analysis and the Potential Pipeline Hazard Mitigation/Management guidance in coordination with emergency response agencies to offer help for schools that already exist in close proximity to pipelines. Lead coordination efforts among the myriad of agencies that offer crisis planning assistance to schools, and suggest minimum information that should be included in these plans regarding pipelines.

RECOMMENDATION TO CONTRA COSTA COUNTY OFFICE OF PUBLIC EDUCATION AND SCHOOL DISTRICTS: Expand emergency preparedness resources to include information about pipelines and pipeline-specific risks. Assist individual schools in developing crisis plans and emergency preparedness plans that include pipelines on the emergency maps and assess how ingress/egress may be affected by a pipeline incident.

RECOMMENDATION TO PIPELINE OPERATORS: Reach out to the schools along the pipeline easement and offer to provide technical assistance assessing pipeline risks and evacuation strategies given possible incidents that could occur in close proximity to the schools.

RECOMMENDATION TO FIRE DISTRICTS: Designate a single point-of-contact to coordinate with pipeline operators, familiarize themselves with the operators’ emergency response and spill response plans, know the facilities where people congregate (schools, churches, hospitals, nursing facilities, etc.) in close proximity to the pipeline, be involved with any emergency planning done by those facilities, and advise County DCD and PW on sufficiency of proposed ingress/egress for new developments.

34 See CDE’s Potential Pipeline Hazard Mitigation/Management website at http://www.cde.ca.gov/ls/fa/sf/mitigation.asp.
Appendix A. Agency listing and Resources for more information
Appendix B. 2018 Community education meetings - agendas
Appendix C. Easements granted to PG&E by Contra Costa County
Appendix D. All Reported Incidents in Contra Costa County
Appendix E. All Reported Incidents on PG&E Pipeline System
Appendix F. Questions asked at community forums and responses
Appendix G. Report: Materials review of legacy pipelines and newly built pipelines
Agency listing and Resources for more information

Alamo Improvement Association: www.alamoca.org


CA Office of the State Fire Marshal, Pipeline Safety Division: osfm.fire.ca.gov/pipeline/pipeline.php

CA Dept of Fish & Wildlife, Office of Spill Response and Prevention: www.wildlife.ca.gov/OSPR

CA Environmental Protection Agency, Unified Program: www.calepa.ca.gov/CUPA/

Contra Costa County Board of Supervisors: www.cccounty.us/193/Board-of-Supervisors

Contra Costa County Department of Conservation and Development: www.cccounty.us/dcd

Contra Costa County Health Services Department, Hazardous Materials Programs: cchealth.org/hazmat/

Contra Costa County Public Works Department, Transportation Engineering Division Iron Horse Corridor Management: www.co.contra-costa.ca.us/413/Iron-Horse-Corridor Franchise Administration: www.contracosta.ca.gov/475/Franchise-Administration

Contra Costa County Office of Education, Crisis Planning & Emergency Preparedness: www.cccoe.k12.ca.us/about/resources_emergency.html

Contra Costa County Community Awareness & Emergency Response (CAER): www.cococaer.org

Danielle Dawn Smalley Foundation, Pipeline Safety and Awareness Training for Schools: smalleyfnd.org/services/pipeline-education/schools

Federal Pipeline Safety Regulations: www.ecfr.gov/ecfrbrowse/Title49/49CIsubchapD.tpl

National Transportation Safety Board: www.ntsb.gov

Pipeline Safety Trust website: pstrust.org
  Landowner's Guide to Pipelines: pstrust.org/log
  Local Government Guide to Pipelines: pstrust.org/lgg
  Online “SafePipelines” discussion group: groups.yahoo.com/neo/groups/safepipelines


National Pipeline Mapping System: www.npms.phmsa.dot.gov/PublicViewer

Office of Pipeline Safety: phmsa.dot.gov/pipeline

Pipelines and Informed Planning Alliance: primis.phmsa.dot.gov/comm/pipa/landuseplanning.htm
Agenda for public meetings - [video is here](#)

May 29 2018, 6:30-8:30 PM, Creekside Community Church, 1350 Danville Blvd, Alamo CA 94507

May 30 2018, 7:00-9:00 PM, Bermuda Room, Convention Center, 403 Civic Center Plaza, Richmond, CA.

May 31 2018, 6:30 – 9:00 PM, Antioch Community Center, 4703 Lone Tree Way, Antioch, CA 94531

AGENDA

1) Welcome – Roger Smith, President of Alamo Improvement Association

2) Introductions – Michael Kent, Contra Costa County Hazardous Materials Ombudsman

3) Why care about pipelines? Overview of pipeline safety with focus on Contra Costa County, Carl Weimer, Pipeline Safety Trust Executive Director

4) Andy Wells, Manager, Gas Emergency Preparedness, Pacific Gas & Electric, Natural gas transmission and distribution pipeline owner/operator (Presentations for Alamo, Richmond, Antioch)

5) Kenneth Bruno, Safety and Enforcement Division (5/29 only); Paul Penney, Senior Utilities Engineer; Matthewson Epuna, Program and Project Supervisor, California Public Utilities Commission- (regulator of intrastate natural gas pipelines)

6) Scott Manley, Director of Operations, Northwest US, and Allen Fore, VP Public Affairs, Kinder Morgan, Inc., Hazardous liquid transmission pipeline owner/operator

7) Jim Hosler, Supervising Pipeline Safety Engineer, California State Fire Marshal representative (regulator of intrastate hazardous liquid pipelines)

8) Facilitated Questions & Answers – Michael Kent, facilitator

9) Short video clips of smart pigs (inline inspection tools)

10) Closing, Roger Smith
Easements granted to PG&E by Contra Costa County

ORDINANCE NO. 424
ORDINANCE GRANTING TO PACIFIC GAS AND ELECTRIC COMPANY, ITS SUCCESSORS AND ASSIGNS, THE RIGHT, PRIVILEGE AND FRANCHISE OF ERECTING, CONSTRUCTING, INSTALLING, AND MAINTAINING ELECTRIC LINES CONSISTING OF POLES, CONDUITS, AND/OR OTHER SUITABLE STRUCTURES, WITH WIRES, CABLES, AND/OR OTHER APPLIANCES INSTALLED THEREON OR THEREIN, INCLUDING COMMUNICATION CIRCUITS, IN SO MANY AND IN SUCH PARTS OF THE PUBLIC HIGHWAYS, STREETS, ROADS, AND PLACES OF THE COUNTY OF CONTRA COSTA, STATE OF CALIFORNIA, AS THE GRANTEE OF SAID RIGHT, PRIVILEGE AND FRANCHISE, ITS SUCCESSORS OR ASSIGNS, MAY FROM TIME TO TIME ELECT TO USE FOR THE AFORESAID PURPOSES, AND OF USING SUCH ELECTRIC LINES FOR TRANSMITTING, CONVEYING, DISTRIBUTING, AND SUPPLYING ELECTRICITY TO THE PUBLIC FOR ANY AND ALL PURPOSES.

THE BOARD OF SUPERVISORS OF THE COUNTY OF CONTRA COSTA DO ORDAIN AS FOLLOWS:

Section 1. The right, privilege and franchise (a) of erecting, constructing, installing, and maintaining electric lines consisting of poles, conduits, and/or other suitable structures, with wires, cables, and/or other appliances installed thereon or therein, including communication circuits, in so many and in such parts of the public highways, streets, roads and places of said county as the grantee of said right, privilege and franchise, its successors or assigns may from time to time elect to use for the aforesaid purposes, and (b) of using such electric lines for transmitting, conveying, distributing, and supplying electricity to the public for any and all purposes, are hereby granted by said County of Contra Costa, to Pacific Gas and Electric Company, its successors and assigns.

Section 2. The term of said franchise shall commence with the effective date hereof, and continue and remain in full force and effect until such time as the grantee hereof, its successors or assigns, shall surrender or abandon same or this franchise shall be forfeited for noncompliance by the possessor thereof with its terms, or the State of California, said county, or other public corporation thereunto duly authorized, shall purchase by voluntary agreement or shall condemn and take under the power of eminent domain in accordance with then existing law all property actually used and useful in the exercise of said franchise situated within the unincorporated area of said county. The franchise hereby granted shall never be given any value before any court or other public authority in any condemnation proceeding.
Resolution of Intention to Grant.

In the Matter of

Gas Franchise

STATE OF CALIFORNIA,
County of Contra Costa

Leona Marchetti

of said County, being duly sworn, deposes and says: THAT ...he is and at all times herein mentioned was a citizen of the United States of America, over the age of twenty-one years, and that ...he is not, nor was ...he at any of the times hereinafter named a party to, nor interested in the above entitled matter; that ...he is the PRINCIPAL CLERK OF THE PRINTER of the "ANTIUCH LEDGER", a newspaper of general circulation, printed and published in the City of Antioch, Contra Costa County, State of California, and which newspaper is published for the dissemination of local and telegraphic news and intelligence of a general character, and which newspaper at all times herein mentioned had and still has a bona fide subscription list of paying subscribers, and which newspaper has been established, printed and published at regular intervals in the said City of Antioch, County of Contra Costa, State of California, for a period exceeding one year next preceding the date of publication of the notice hereinafter referred to; and which newspaper is not devoted to nor published for the interests, entertainment, or instruction of a particular class, profession, trade, calling, race or denomination, or any number of same; that the notice, of which the annexed is a printed copy, has been published in each regular and existing issue of said newspaper, and that said newspaper has been published in the City of Antioch, County of Contra Costa, State of California, at the time and place of publication above mentioned.
Pipeline Safety in Alamo, and surrounding areas within Contra Costa County, California

Published January 5-6-7-8-9-12-15-16
14, 1948

(Signed) Lucea M. Burchett

Subscribed and Sworn to before me this

---

The Board of Supervisors of the County of Contra Costa, in and for the said County and the State of California, do hereby adopt the following Ordinance:

Section 1. The right, privilege and franchise of laying, constructing and maintaining gas pipes, mains and appurtenances to such in said county and in the unincorporated area of said county, for the purpose of conveying, distributing and supplying gas to the public for any and all purposes, are hereby granted by said Board of Supervisors to said contractors and assignees.

Successors and assigns.

Section 2. The term of said franchise shall commence with the effective date hereof and continue and remain in full force and effect until the time at which the grantee hereof, its successors or assigns, shall surrender, assign or sell the same. Said franchise shall be subject to the provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors. Said Board of Supervisors may, at any time, by resolution, revoke or modify any or all provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

In case of any breach of condition of said franchise, the Board of Supervisors, by resolution, may declare the same void and unenforceable, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

The Board of Supervisors of the County of Contra Costa, in and for the said County and the State of California, do hereby adopt the following Ordinance:

Section 3. The right, privilege and franchise of laying, constructing and maintaining gas pipes, mains and appurtenances to such in said county and in the unincorporated area of said county, for the purpose of conveying, distributing and supplying gas to the public for any and all purposes, are hereby granted by said Board of Supervisors to said contractors and assignees.

Successors and assigns.

Section 4. The term of said franchise shall commence with the effective date hereof and continue and remain in full force and effect until the time at which the grantee hereof, its successors or assigns, shall surrender, assign or sell the same. Said franchise shall be subject to the provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors. Said Board of Supervisors may, at any time, by resolution, revoke or modify any or all provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

In case of any breach of condition of said franchise, the Board of Supervisors, by resolution, may declare the same void and unenforceable, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

The Board of Supervisors of the County of Contra Costa, in and for the said County and the State of California, do hereby adopt the following Ordinance:

Section 5. The right, privilege and franchise of laying, constructing and maintaining gas pipes, mains and appurtenances to such in said county and in the unincorporated area of said county, for the purpose of conveying, distributing and supplying gas to the public for any and all purposes, are hereby granted by said Board of Supervisors to said contractors and assignees.

Successors and assigns.

Section 6. The term of said franchise shall commence with the effective date hereof and continue and remain in full force and effect until the time at which the grantee hereof, its successors or assigns, shall surrender, assign or sell the same. Said franchise shall be subject to the provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors. Said Board of Supervisors may, at any time, by resolution, revoke or modify any or all provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

In case of any breach of condition of said franchise, the Board of Supervisors, by resolution, may declare the same void and unenforceable, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

The Board of Supervisors of the County of Contra Costa, in and for the said County and the State of California, do hereby adopt the following Ordinance:

Section 7. The right, privilege and franchise of laying, constructing and maintaining gas pipes, mains and appurtenances to such in said county and in the unincorporated area of said county, for the purpose of conveying, distributing and supplying gas to the public for any and all purposes, are hereby granted by said Board of Supervisors to said contractors and assignees.

Successors and assigns.

Section 8. The term of said franchise shall commence with the effective date hereof and continue and remain in full force and effect until the time at which the grantee hereof, its successors or assigns, shall surrender, assign or sell the same. Said franchise shall be subject to the provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors. Said Board of Supervisors may, at any time, by resolution, revoke or modify any or all provisions hereof, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.

In case of any breach of condition of said franchise, the Board of Supervisors, by resolution, may declare the same void and unenforceable, and all rights, powers and privileges granted or authorized shall be subject to the power and control of said Board of Supervisors.
## APPENDIX D

### All Reported Incidents in Contra Costa County

All Reported Incidents in Contra Costa County - 2002 to present (as of 4/1/15)

Significant Incidents are highlighted in yellow

<table>
<thead>
<tr>
<th>Significant</th>
<th>Date</th>
<th>Name</th>
<th>City</th>
<th>Commodity spilled</th>
<th>Gallons spilled</th>
<th>Fatalities</th>
<th>Injuries</th>
<th>Property damage</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1/8/2002</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Gasoline</td>
<td>168</td>
<td>0</td>
<td>0</td>
<td>$183,180</td>
<td>Other</td>
</tr>
<tr>
<td>Yes</td>
<td>3/31/2002</td>
<td>Sfpp, lp</td>
<td>Richmond</td>
<td>Diesel fuel</td>
<td>3,360</td>
<td>0</td>
<td>0</td>
<td>$230,290</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>No</td>
<td>4/21/2002</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Diesel fuel</td>
<td>546</td>
<td>0</td>
<td>0</td>
<td>$9,639</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>Yes</td>
<td>6/21/2002</td>
<td>Pacific gas &amp; electric co</td>
<td>Concord</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$151,000</td>
<td>Damage by outside forces</td>
</tr>
<tr>
<td>No</td>
<td>7/4/2002</td>
<td>Equilon pipeline co</td>
<td>Concord</td>
<td>Crude oil</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>$7,508</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>No</td>
<td>8/14/2002</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Gasoline/diesel fuel</td>
<td>126</td>
<td>0</td>
<td>0</td>
<td>$9,119</td>
<td>Equipment</td>
</tr>
<tr>
<td>Yes</td>
<td>9/7/2002</td>
<td>Sfpp, lp</td>
<td>Richmond</td>
<td>Gasoline</td>
<td>1,260</td>
<td>0</td>
<td>0</td>
<td>$262,750</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>No</td>
<td>10/15/02</td>
<td>Venoco, Inc</td>
<td>Pittsburg</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$24,000</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>No</td>
<td>3/29/2003</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Turbine fuel</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>$10,859</td>
<td>Equipment</td>
</tr>
<tr>
<td>Yes</td>
<td>4/1/2003</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Gasoline</td>
<td>22,260</td>
<td>0</td>
<td>0</td>
<td>$162,287</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>Yes</td>
<td>4/14/2003</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Transmix</td>
<td>30,450</td>
<td>0</td>
<td>0</td>
<td>$1,390,073</td>
<td>Corrosion</td>
</tr>
<tr>
<td>No</td>
<td>5/30/2003</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Gasoline</td>
<td>60</td>
<td>0</td>
<td>0</td>
<td>$230</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>No</td>
<td>9/8/2003</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Turbine fuel</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>$667</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>Yes</td>
<td>11/11/2003</td>
<td>Pacific gas &amp; electric co</td>
<td>Walnut creek</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$750,000</td>
<td>Other</td>
</tr>
<tr>
<td>No</td>
<td>9/28/2004</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Gasoline/distillate mixture</td>
<td>126</td>
<td>0</td>
<td>0</td>
<td>$54,202</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>Yes</td>
<td>11/7/2004</td>
<td>Sfpp I.P.</td>
<td>Martinez</td>
<td>Jet fuel</td>
<td>12,558</td>
<td>0</td>
<td>0</td>
<td>$139,130</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>Yes</td>
<td>11/9/2004</td>
<td>Sfpp I.P.</td>
<td>Walnut creek</td>
<td>Gasoline</td>
<td>23,688</td>
<td>5</td>
<td>3</td>
<td>$734,449</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>Yes</td>
<td>4/30/2006</td>
<td>Sfpp I.P.</td>
<td>Concord</td>
<td>Gasoline</td>
<td>3,234</td>
<td>0</td>
<td>0</td>
<td>$499,493</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>No</td>
<td>6/5/06</td>
<td>Venoco inc.</td>
<td>Pittsburg</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$70,000</td>
<td>Corrosion</td>
</tr>
<tr>
<td>No</td>
<td>6/19/06</td>
<td>Pacific gas &amp; electric co</td>
<td>Pittsburg</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$65,200</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>Yes</td>
<td>9/8/2007</td>
<td>Pacific Atlantic terminals llc</td>
<td>Martinez</td>
<td>Gasoline/reformate</td>
<td>7,056</td>
<td>0</td>
<td>0</td>
<td>$547,084</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>No</td>
<td>3/5/2008</td>
<td>Pacific Atlantic terminals llc</td>
<td>Martinez</td>
<td>Gasoline</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>$3,908</td>
<td>Other</td>
</tr>
<tr>
<td>Yes</td>
<td>5/23/2008</td>
<td>Sfpp, lp</td>
<td>Richmond</td>
<td>Gasoline</td>
<td>168</td>
<td>0</td>
<td>0</td>
<td>$114,815</td>
<td>Corrosion</td>
</tr>
<tr>
<td>No</td>
<td>6/24/2008</td>
<td>Pacific Atlantic terminals llc</td>
<td>Martinez</td>
<td>Hydrotest water/oil mixture</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>$64,712</td>
<td>Material and/or weld failures</td>
</tr>
<tr>
<td>No</td>
<td>11/5/2009</td>
<td>Plains marketing, I.P.</td>
<td>Martinez</td>
<td>Diesel fuel</td>
<td>168</td>
<td>0</td>
<td>0</td>
<td>$34,800</td>
<td>Corrosion</td>
</tr>
<tr>
<td>Yes/No</td>
<td>Date</td>
<td>Company</td>
<td>Location</td>
<td>Type</td>
<td>Pressure</td>
<td>Length</td>
<td>Type</td>
<td>Loss</td>
<td>Cause</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>-----------------------</td>
<td>------------</td>
<td>--------------</td>
<td>----------</td>
<td>--------</td>
<td>--------------</td>
<td>------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Yes</td>
<td>8/23/2011</td>
<td>Sfpp, lp</td>
<td>Brentwood</td>
<td>Refined product</td>
<td>1,596</td>
<td>0</td>
<td>0</td>
<td>$410,000</td>
<td>Equipment failure</td>
</tr>
<tr>
<td>Yes</td>
<td>8/27/2011</td>
<td>Conocophillips</td>
<td>Byron</td>
<td>Crude oil</td>
<td>2,352</td>
<td>0</td>
<td>0</td>
<td>$1,275,040</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>Yes</td>
<td>11/7/2011</td>
<td>Conocophillips</td>
<td>Concord</td>
<td>Crude oil</td>
<td>1,890</td>
<td>0</td>
<td>0</td>
<td>$1,839,410</td>
<td>Corrosion failure</td>
</tr>
<tr>
<td>Yes</td>
<td>7/3/2012</td>
<td>Shell pipeline co., L.P.</td>
<td>Martinez</td>
<td>Refined product</td>
<td>546</td>
<td>0</td>
<td>0</td>
<td>$176,000</td>
<td>Equipment failure</td>
</tr>
<tr>
<td>No</td>
<td>10/17/2012</td>
<td>Chevron pipeline co</td>
<td>Byron</td>
<td>Refined product</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>$26,200</td>
<td>Equipment failure</td>
</tr>
<tr>
<td>Yes</td>
<td>8/8/2013</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Refined product</td>
<td>57</td>
<td>0</td>
<td>0</td>
<td>$427,913</td>
<td>Material failure of pipe or weld</td>
</tr>
<tr>
<td>No</td>
<td>6/20/2014</td>
<td>Pacific gas &amp; electric co</td>
<td>Antioch</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$70,021</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>No</td>
<td>6/21/2014</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Refined product</td>
<td>302</td>
<td>0</td>
<td>0</td>
<td>$34,453</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>No</td>
<td>6/21/2014</td>
<td>Nustar terminals</td>
<td>Crockett</td>
<td>Refined product</td>
<td>1,554</td>
<td>0</td>
<td>0</td>
<td>$52,000</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>No</td>
<td>9/14/2014</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Refined product</td>
<td>536</td>
<td>0</td>
<td>0</td>
<td>$80,967</td>
<td>Incorrect operation</td>
</tr>
<tr>
<td>Yes</td>
<td>9/15/14</td>
<td>Pacific gas &amp; electric co</td>
<td>Lafayette</td>
<td>Natural gas</td>
<td>N/a</td>
<td>0</td>
<td>0</td>
<td>$115,315</td>
<td>Excavation damage</td>
</tr>
<tr>
<td>No</td>
<td>9/17/2014</td>
<td>Phillips 66 pipeline llc</td>
<td>Richmond</td>
<td>Refined product</td>
<td>89</td>
<td>0</td>
<td>0</td>
<td>$5,000</td>
<td>Equipment failure</td>
</tr>
<tr>
<td>Yes</td>
<td>12/9/2014</td>
<td>Sfpp, lp</td>
<td>Concord</td>
<td>Refined product</td>
<td>0.42</td>
<td>0</td>
<td>0</td>
<td>$150,501</td>
<td>Equipment failure</td>
</tr>
<tr>
<td>Yes</td>
<td>1/12/2015</td>
<td>Sfpp, lp</td>
<td>Richmond</td>
<td>Refined product</td>
<td>2,474</td>
<td>0</td>
<td>0</td>
<td>$550,497</td>
<td>Equipment failure</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>116,716</td>
<td>5</td>
<td>3</td>
<td>$10,732,712</td>
<td></td>
</tr>
</tbody>
</table>
### PG&E Transmission Incidents

#### PACIFIC GAS & ELECTRIC CO

All Transmission system Incidents (2): 2006-2018

<table>
<thead>
<tr>
<th>Date</th>
<th>City</th>
<th>State</th>
<th>County</th>
<th>Cause</th>
<th>Fatalities</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/6/17</td>
<td>SUNOL</td>
<td>CA</td>
<td>ALAMEDA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10/28/17</td>
<td>PAICINES</td>
<td>CA</td>
<td>SAN BENITO</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8/22/17</td>
<td>SALINAS</td>
<td>CA</td>
<td>MONTEREY</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7/1/17</td>
<td>DUNNIGAN HILLS</td>
<td>CA</td>
<td>YOLO</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6/22/17</td>
<td>PAICINES</td>
<td>CA</td>
<td>SAN BENITO</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2/28/17</td>
<td>REDWOOD VALLEY</td>
<td>CA</td>
<td>MENDOCINO</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2/27/17</td>
<td>FOLSOM</td>
<td>CA</td>
<td>SACRAMENTO</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1/8/17</td>
<td>PITTSBURG</td>
<td>CA</td>
<td>CONTRA COSTA</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12/3/16</td>
<td>CHOWCHILLA</td>
<td>CA</td>
<td>MADERA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8/27/16</td>
<td>WATSONVILLE</td>
<td>CA</td>
<td>SANTA CRUZ</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7/16/16</td>
<td>DIXON</td>
<td>CA</td>
<td>SOLANO</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6/5/16</td>
<td>PATTERSON</td>
<td>CA</td>
<td>STANISLAUS</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5/13/16</td>
<td>ARVIN</td>
<td>CA</td>
<td>KERN COUNTY</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1/7/16</td>
<td>Not Within a Municipality</td>
<td>CA</td>
<td>SAN BERNARDINO</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11/13/15</td>
<td>BAKERSFIELD</td>
<td>CA</td>
<td>KERN</td>
<td>EXCAVATION DAMAGE</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10/23/15</td>
<td>DIXON</td>
<td>CA</td>
<td>SOLANO</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5/6/15</td>
<td>YUBA CITY</td>
<td>CA</td>
<td>SUTTER COUNTY</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4/17/15</td>
<td>FRESNO</td>
<td>CA</td>
<td>FRESNO COUNTY</td>
<td>EXCAVATION DAMAGE</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>4/13/15</td>
<td>DIXON</td>
<td>CA</td>
<td>SOLANO COUNTY</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2/28/15</td>
<td>CARMEL</td>
<td>CA</td>
<td>MONTEREY</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1/28/15</td>
<td>ARVIN</td>
<td>CA</td>
<td>KERN COUNTY</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1/7/15</td>
<td>ARVIN</td>
<td>CA</td>
<td>KERN COUNTY</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12/23/14</td>
<td>OROVILLE</td>
<td>CA</td>
<td>BUTTE</td>
<td>CORROSION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12/10/14</td>
<td>HINKLEY</td>
<td>CA</td>
<td>SAN BERNARDINO COUNTY</td>
<td>ALL OTHER CAUSES</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11/22/14</td>
<td>ARVIN</td>
<td>CA</td>
<td>KERN COUNTY</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10/24/14</td>
<td>BAKERSFIELD</td>
<td>CA</td>
<td>KERN</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10/15/14</td>
<td>SANTA CLARA</td>
<td>CA</td>
<td>SANTA CLARA</td>
<td>CORROSION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8/24/14</td>
<td>MULTIPLE</td>
<td>CA</td>
<td>MULTIPLE</td>
<td>NATURAL FORCE DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8/19/14</td>
<td>AUBURN</td>
<td>CA</td>
<td>PLACER</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3/25/14</td>
<td>WEST SACRAMENTO</td>
<td>CA</td>
<td>YOLO</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3/14/14</td>
<td>REDWOOD CITY</td>
<td>CA</td>
<td>SAN MATEO COUNTY</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11/22/13</td>
<td>SAN ARDO</td>
<td>CA</td>
<td>MONTEREY</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10/23/13</td>
<td>WHEATLAND</td>
<td>CA</td>
<td>YUBA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8/29/13</td>
<td>FIREBAUGH</td>
<td>CA</td>
<td>FRESNO</td>
<td>OTHER OUTSIDE FORCE DAMAGE</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Date</td>
<td>Location</td>
<td>County</td>
<td>Reason</td>
<td>Count</td>
<td>Incidents</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>-------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>6/30/13</td>
<td>ARVIN</td>
<td>CA</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>12/1/12</td>
<td>STOCKTON</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11/30/12</td>
<td>MADERA</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11/10/12</td>
<td>MODESTO</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10/4/12</td>
<td>SUNNYVALE</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9/19/11</td>
<td>NOVATO</td>
<td>CA</td>
<td>CORROSION</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9/9/11</td>
<td>SALINAS</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6/13/11</td>
<td>RIO VISTA</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5/25/11</td>
<td>MOUNTAIN VIEW</td>
<td>CA</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5/25/11</td>
<td>NEEDLES</td>
<td>CA</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11/29/10</td>
<td>20 MILES EAST OF LOS BANOS &amp; F</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10/2/10</td>
<td>SALINAS</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9/9/10</td>
<td>SAN BRUNO</td>
<td>CA</td>
<td>MATERIAl/WELD/EQUIP FAILURE</td>
<td>8</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>3/5/10</td>
<td>RIO VISTA</td>
<td>CA</td>
<td>OTHER OUTSIDE FORCE DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>12/9/09</td>
<td>ELK GROVE</td>
<td>CA</td>
<td>CORROSION</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11/11/09</td>
<td>SAN FRANCISCO</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10/22/09</td>
<td>SALINAS</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4/3/09</td>
<td>SALINAS</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3/19/09</td>
<td>ARBUCKLE</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7/21/08</td>
<td>EUREKA</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3/31/08</td>
<td>GLENN</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9/13/07</td>
<td>AVENAL</td>
<td>CA</td>
<td>INCORRECT OPERATION</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8/28/07</td>
<td>CHOWCHILLA</td>
<td>CA</td>
<td>EXCAVATION DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1/16/07</td>
<td>HEALDSBURG</td>
<td>CA</td>
<td>CORROSION</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11/20/06</td>
<td>STOCKTON</td>
<td>CA</td>
<td>MATERIAL/WELD/EQUIP FAILURE</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8/19/06</td>
<td>MAD RIVER</td>
<td>CA</td>
<td>NATURAL FORCE DAMAGE</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Totals**: 10 incidents, 68 incidents reported.
Questions from Public Forums, May 29-31, 2018

1. **CPUC**: What triggers an audit from the CPUC?
2. **PG&E**: Why are there still so many dig-in incidents where there are valid 811 tickets on PG&E lines?
3. **PG&E**: What is PG&E’s explanation for rising significant incident rate in most recent 5 years?
4. **PG&E**: Why does PG&E have the worst gas transmission pipeline accident record? Why is it getting worse?
5. **PG&E**: Would a modern smart pig have been able to detect the type of defect that caused the San Bruno incident? If so, please provide detail about what the pig would pick up.
6. **PG&E**: On PG&E transmission lines, what is percentage of repairs made without depressurizing the line? When this occurs, what considerations drive the choice?
7. **CPUC**: How does the CPUC evaluate the effectiveness of a pipeline operator’s integrity management program (e.g. metrics, other performance indicators)? Can the public get access to these evaluations for individual operators?
8. **PG&E**: How does PG&E divide financial resources between the six “layers of protection” mentioned? Could the $500 million for the CPSA have been better spent on valve automation, pipeline testing and 811 education?
9. **PG&E and K-M**: What is the maximum interval between transmission pipeline markers? What is regarded as industry best practice in this regard?
10. **PG&E**: How does PG&E decide where to place an automatic shut-off valve, or to replace an existing valve with an automated one?
11. **PG&E**: How does PG&E set MAOP when they do not have recent testing or a verifiable historic record?
12. **CPUC**: Why are gas transmission pipelines that come across state lines from Oregon and Arizona considered intrastate pipelines once they come into California?
13. **PG&E**: What is the PIR of PG&E’s transmission line in Alamo?
14. **PG&E**: Does PG&E have plans to remove more trees in the region?
15. **PG&E**: When was the last inline inspection on PG&E’s line along Miranda Avenue? What were the results? Given the location of the middle school and the new fire house, would this qualify the line under AB 1420 for more frequent inspections (Two years, rather than 7)? If not, how would our community request this?
16. **K-M**: Are there any automatic shut-off valves along the Iron Horse trail? If not, why not, and what are the criteria you (Kinder- Morgan) use to decide?
17. **K-M**: What can be done to reinforce and protect the section of Kinder Morgan pipe over the San Ramon Creek between LaSerena and Hemme along the Iron Horse trail? I am concerned as it appears to be vulnerable to earthquake movement.
18. **OSFM/CPUC**: Do local planning departments know how and who to go to for information to make sure projects are reviewed for pipeline proximity before approval? What does the Fire Marshal/CPUC do to inform them?
19. **All**: How is the public notified of a leak or pipeline failure? How will information be broadcast?

20. **OSFM/CPUC**: Do operators have to keep the information on their pipeline markers current? Does any regulator ever inspect markers, or just inspect the operators’ records relating to the markers?

21. **All**: How can we get our city government to take an interest in land use around pipelines?

22. **K-M**: What is the easiest way to report a problem on the Kinder Morgan line in the Iron Horse trail? For example, I reported a tree hanging over the pipe, took a photo and reported it, but it was 6 months before the tree was removed. Is there something else I should do next time to speed up the response?

23. **OSFM/CPUC**: How often do the state agencies require emergency drills, and what kind? Tabletop or full scale, unannounced drills?

24. **PG&E**: How often is the transmission line in Brentwood inspected? Is it piggable? Does it have automatic shutoff valves?

25. **PG&E and K-M**: Do any of your pipelines in the area intersect with Superfund sites? What precautions do you take in those areas in the event of an incident?

26. **PG&E and K-M**: What makes your unpiggable lines in this area non-piggable? Do you have a goal of making them all piggable? If not all, why not? By when?

27. **K-M**: Are all of your pipelines included fully (threat assessments, pigging, repair schedules, etc.) in your integrity management program or are the lines outside high consequence areas treated differently? If different, in what ways?

28. **K-M**: What’s the life expectancy of the Iron Horse trail line?

29. **K-M**: How much of Contra Costa County is considered a high consequence area?

30. **K-M**: Does Kinder Morgan rely on the outdated identification of environmentally sensitive areas done by PHMSA when you identify HCAs or do you do your own analysis to identify them?

31. **PG&E**: When you refer to automatic shutoff valves, do they still require an operator to initiate? How many of PG&E’s automatic valves in this area are automatic and how many are switched remotely?

32. **CPUC/OSFM**: Do the things operators report to you (age, piggability, frequency of incidents) influence how often you inspect companies, or what goes into your decisions about inspection frequency?

33. **K-M and PG&E**: How many miles of new or replacement pipelines do you expect in the next 10 years in this area?

34. **OSFM**: Is a comprehensive inspection required every year by the new state law? or specifically, what kind of inspection does it require?

*Not all of the responses to these questions were available at the time we completed this report. When we have received them all, we will update this appendix.*
SEISMIC REVIEW REPORT

Pipelines:
Kinder Morgan San Jose Liquid Fuel Pipeline
PG&E Natural Gas Pipeline

Original Release Date:
MAY 25, 2018

Presented to:
Alamo Improvement Association

By:
The VMC Group

Report: VMA-52036-01
Revision: 1

The Power of Together™
Table of Contents

Introduction ........................................................................................................................................ 4
Pipelines and Fault Lines .................................................................................................................... 4
Geological Surveys ............................................................................................................................. 5
Historical Earthquakes .......................................................................................................................... 6
Building Code Evolution ..................................................................................................................... 9
Pipe Span Analysis ............................................................................................................................. 9
Recommended Actions ....................................................................................................................... 11
References ........................................................................................................................................... 11
Appendices .......................................................................................................................................... 12

Revision Table

<table>
<thead>
<tr>
<th>Rev</th>
<th>Date</th>
<th>Description</th>
<th>By</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5/25/18</td>
<td>Initial Customer Release</td>
<td>LOE</td>
</tr>
<tr>
<td>1</td>
<td>8/24/18</td>
<td>Updated Analysis</td>
<td>TAF</td>
</tr>
</tbody>
</table>
Legal Disclaimer

Seller warrants that the services proved hereunder will be performed in a professional and workmanlike manner consistent with applicable industry standards. This warranty will be in effect for a period of one (1) year from the completion of the applicable services (the “Warranty Period”). If during the Warranty Period, Seller receives written notice from buyer of non-conformity with the performance of the services or work product provided hereunder, Seller will, as buyer’s sole and exclusive remedy and Seller’s entire liability for any breach of the foregoing warranty, at its sole option and expense, promptly re-perform any services and re-deliver the work product provided hereunder that fail to meet this limited warranty or refund to buyer the fees paid for the non-conforming services or work product. THE FOREGOING STATES BUYER’S SOLE AND EXCLUSIVE REMEDY FOR WARRANTY CLAIMS RELATED TO THE SERVICES. EXCEPT AS EXPRESSLY SET FORTH IN THIS AGREEMENT, SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS AND REPRESENTATIONS, EXPRESS OR IMPLIED OR STATUTORY, INCLUDING THOSE RELATED TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, SATISFACTORY QUALITY, ACCURACY OR COMPLETENESS OF RESULTS, CONFORMANCE WITH DESCRIPTION, AND NONINFRINGEMENT. SELLER SPECIFICALLY DISCLAIMS ALL IMPLIED WARRANTIES, CONDITIONS AND REPRESENTATIONS ARISING OUT OF COURSE OF DEALING, USAGE OR TRADE. IN NO EVENT SHALL SELLER, BE LIABLE TO BUYER OR TO ANY THIRD PARTY FOR ANY SPECIAL, INCIDENTAL, PUNITIVE, INDIRECT OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF USE, DATA, BUSINESS OR PROFITS, REVENUE, GOODWILL, ANTICIPATED SAVINGS) OR FOR COSTS OF PROCURING SUBSTITUTE SERVICES, ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT OR THE SERVICES OR ANY WORK PRODUCT PROVIDED HEREUNDER, WHETHER BASED UPON CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE), FAILURE OF A REMEDY TO ACCOMPLISH ITS PURPOSE, STRICT LIABILITY OR OTHERWISE, AND EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Claims under this warranty must be made in writing immediately after the defect is discovered, and all such claims are subject to substantiation by seller’s inspection department.

Calculations, Analysis, and Report by:
Laura Ostar-Exel, IBC Project Engineer, The VMC Group
Tyler Feingold, IBC Project Engineer, The VMC Group
Introduction

The Alamo Improvement Association tasked The VMC Group with assessing the sections of the Kinder Morgan Hazardous Liquid Pipeline and the Pacific Gas & Electric Natural Gas Transmission Pipeline that run through Alamo for their capacity to survive the seismic events that are so powerful and profuse in this part of the world. Details about the risks associated with these pipelines in Alamo are discussed in the Pipeline Safety Report to the Alamo Improvement Association in September 2015, including previous failures in the nearby area. This report

1. Investigates the intersections between the pipelines and known fault lines
2. Explains how and why our understanding of the geology and seismology of the area has changed since the building of these pipelines
3. Lists the earthquakes that the pipelines have survived since installation
4. Evaluates how the building codes have applied and evolved
5. Analyzes the high-risk lengths of above-ground pipe that span creek beds

Additional action recommendations are made at the end of the report based on the contents described above.

Pipelines and Fault Lines

The map above is an overlay of two publically available maps: The USGS Quaternary Faults and Folds Database1 and the DOT National Pipeline Mapping System. Within Alamo, the pipelines run close to parallel to the known fault lines, meaning that any displacement caused by a seismic event in these faults should not cause direct shear on the pipelines. There is a crossing between the gas transmission pipeline and an undifferentiated, inferred fault, but it should be noted that at the location of crossing the two are oriented in the same direction. Therefore, within Alamo, pipelines should not be damaged due to displacement along faults from seismic events.

However, it should be noted that there are crossings within the greater Contra Costa County area, which may pose a risk to Alamo depending on the severity of the damage and on the local geography. A more comprehensive study of the fault lines and the shear risk posed to the gas transmission and hazardous liquid pipelines is recommended.

1https://doi.org/10.5066/F7S75FJM
2https://pvnpms.phmsa.dot.gov/PublicViewer/
Geological Surveys

The building code requirements for all structures and non-structural components have changed over the decades as the geological understanding of our country has evolved. Building codes use the geological surveys to define requirements for resistance to seismic events. The first comprehensive geological survey of the United States was published by the U.S. Costal Geodetic Survey in 1948, and adopted into the Uniform Building Code in 1949. The Uniform Building Code defined Seismic Zones 0 through 3, and required structures to be able to withstand accelerations based on those zones. Later geological surveys were conducted by the U.S. Geological Survey, and provided estimated seismic accelerations for more precise locations. The UBC added a Seismic Zone 4 in 1976, which increased the expected seismic event acceleration magnitudes in all of coastal California by 33%.

The most recent published survey from the USGS was completed in 2016, and defines the level of seismic activity that structures and non-structural components must be expected to withstand, with design levels defined by applicable building code factors of safety. The results of the survey conducted can be seen using the USGS database to the precision level of street addresses. The greatest expected horizontal ground acceleration in to withstand the actual seismic activity expected given our more modern understanding of seismic activity.

<table>
<thead>
<tr>
<th>Geologic Data</th>
<th>Acceleration</th>
<th>Seismic Design Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>USCGS 1948</td>
<td>0.3g</td>
<td>UBC Zone 3</td>
</tr>
<tr>
<td>USGS 1976</td>
<td>0.57g</td>
<td>UBC Zone 4</td>
</tr>
<tr>
<td>USGS 1990</td>
<td>0.80g</td>
<td>UBC Zone 4</td>
</tr>
<tr>
<td>USGS 2002</td>
<td>1.063g</td>
<td>CBC 2007/2010</td>
</tr>
<tr>
<td>USGS 2008</td>
<td>1.348g</td>
<td>CBC 2016</td>
</tr>
<tr>
<td>USGS 2016</td>
<td>1.485g</td>
<td>CBC 2019 / IBC 2018</td>
</tr>
</tbody>
</table>

Source: U.S. Coast and Geodetic Survey, 1948

Historical Earthquakes

Since the pipelines were built in Alamo in 1955 (Est), they have survived numerous earthquakes that shook the San Francisco Bay Area. The USGS earthquake database, accessible to the public, lists the number of earthquakes above a 2.5 magnitude on the Richter Scale as 2232, with 19 earthquakes being above a 4.5 on the Richter Scale. The Richter Scale is a useful measure of earthquake intensity, but it does not define the accelerations seen at any specific locations or take into account soil conditions. It is these accelerations that cause local damage to structures and non-structural components, and these accelerations that the pipelines must survive.

Data from accelerometers and local reports for four of the more relevant earthquakes are shown in the images on the following pages. Three are the highest magnitude earthquakes to occur in the area, while the fourth had it epicenter very close to Alamo. In each, the peak ground accelerations seen were less than 7% of a single g, where one g is equivalent to the acceleration due to gravity. It was estimated that no or only light damage would have been caused by these earthquakes, and only to massive structures high off the ground. On the one hand, the existing pipelines have survived these historic earthquakes without catastrophic failure. On the other hand, the pipelines and their supports may have experienced shifting, fatigue, or other minor damage that may add up over time.

*https://earthquake.usgs.gov/earthquakes/search/*
Bay Area Earthquakes

Source: USGS Earthquake Catalog
Alamo Improvement Association
Gas and Hazardous Liquid Pipeline
Seismic Review Report

Date: 8/24/2018
Report # VMA-52036-01
Rev 01

Source: https://earthquake.usgs.gov/earthquakes/eventpage/nc17204
Building Code Evolution

The pipelines in Alamo were built between 1950 and 1970. At the time, there were no building code requirements for pipelines to be designed with environmental considerations in mind. Later building codes required the design to consider the environment in which it was being installed, although did not specify seismic activity or soil type as conditions to be designed for, nor were there any specifics on how a pipeline’s design should be evaluated. Finally, the International Building Code and the California Building Code include seismic capacity to be designed for before pipelines can be installed in any area. This is done by ASCE7, which is a document referenced by both applicable building codes.

This means that there was no legal or published industry standard requirement to take into consideration the seismic activity and soil type of a location at the time that the pipelines through Alamo were built. In addition, later building codes did not apply retroactively to previously installed pipelines. Therefore the Alamo pipelines were never legally required to be designed or tested to withstand the high seismic activity seen in the Bay Area.

Pipe Span Analysis

The greatest areas of concern when it comes to the seismic capacity of the pipelines in Alamo are that there are long above ground lengths of pipe that span creek beds. Without the damping or additional supports seen by buried or above ground pipes, exposed spans of pipes may have a low natural frequency within the range produced by seismic events. During an earthquake, the pipe may experience resonance and catastrophic failure. This would be especially troubling, given the location of the above ground pipe spans over a creek.

Therefore, analysis has been performed on two of the spans of the Kinder Morgan pipeline to determine their natural frequencies. The circumference of each pipe sheath was measured to be 50 inches. As the company has not confirmed what the filler between the inner pipe and the outer pipe casing is, two cases will be tested: steel and concrete. It is reasonable to assume that the filler has a density similar to one of these cases.

The equation for natural frequency \( f_n \) of a beam fixed at both ends is as follows:

\[
f_n \approx \frac{K_n}{2\pi} \sqrt{\frac{E I g}{w L^4}}
\]

Where second moment of area \( I \), natural frequency constant \( K_n \), and modulus of elasticity \( E \) of the beams are:

\[I \approx \frac{\pi}{2} (r_0^4 - r_i^4)\]
\[K_n \approx 22.4\]
\[E \approx \sum \frac{E_i A_i}{A_{total}}\]

\[E_{\text{steel filler}} \approx 19 \times 10^6 \text{ psi}\]
\[E_{\text{concrete filler}} \approx 3.4 \times 10^6 \text{ psi}\]
According to the 2007 PEER Spectrum Analysis report, as well as the shake test requirements set forth in ICC-ES AC-156:2015 and used by IBC, CBC, and UBC, the majority of content created by an earthquake is released in the frequency range of 0.5 Hz and 8 Hz, with some variation depending on the location of a distance from the epicenter. As the frequencies calculated in the table below show, the pipe spans have natural frequencies within the peak earthquake content range, and therefore may experience resonance during a seismic event.

<table>
<thead>
<tr>
<th>Location</th>
<th>Outer Diameter</th>
<th>Inner Diameter</th>
<th>Span Distance</th>
<th>Jacket Filler</th>
<th>Estimated Weight</th>
<th>First Natural Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemme Ave</td>
<td>16”</td>
<td>8”</td>
<td>49'</td>
<td>Steel</td>
<td>27,000 lbs</td>
<td>7.9 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concrete</td>
<td>10,000 lbs</td>
<td>5.4 Hz</td>
</tr>
<tr>
<td>Wayne Ave</td>
<td>16”</td>
<td>8”</td>
<td>42’</td>
<td>Steel</td>
<td>23,000 lbs</td>
<td>10.7 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concrete</td>
<td>8,000 lbs</td>
<td>7.3 Hz</td>
</tr>
</tbody>
</table>

The way to determine if a pipe will fail during resonance is to perform a stress analysis. The worst case pipe is the Hemme Ave pipe span, and as such will be analyzed for failure. AC-156 determines the accelerations seen and designed for using a Shock Response Spectrum with 5% damping, which describes the accelerations seen in seismic events as a function of the frequency the acceleration is transmitted by. For the natural frequencies calculated above, the horizontal acceleration the pipe would need to survive would be 1.485g, according to USGS 2016 data. Using the previously calculated values of E, I, ρ, weight, length, and diameter of the pipe, the maximum stress seen by the perimeter of the midpoint of the pipe is calculated and shown in the table below. In addition, the yield and tensile stress for steel and concrete are shown for reference. If the pipe stress exceeds these values, failure may occur.

<table>
<thead>
<tr>
<th>Pipe Jacket Fill Material</th>
<th>Maximum Stress</th>
<th>Yield Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>σ = 1958 psi</td>
<td>σ_{concrete} = 300 - 700 psi</td>
</tr>
<tr>
<td>Steel</td>
<td>σ = 4930 psi</td>
<td>σ_{steel} = 36,000 psi</td>
</tr>
</tbody>
</table>

As shown in the table above, the steel components of these pipe spans should not yield, even vibrating at resonance with the greatest seismic event expected in the Alamo area with an epicenter nearby the Hemme Ave pipe span. However, if the jacket supporting the pipe is filled with concrete, which is less flexible and performs poorly in tension, the concrete may crack experiencing such a seismic event. Cracked concrete has an even lower maximum tensile stress and modulus of elasticity, and will be unable to provide structural support to the pipe inside. With more specific information about the pipe and jacket materials and dimensions, a more accurate analysis of the pipe spans could be performed. This information would need to be provided by Kinder Morgan.
Recommended Actions

In general, this analysis reveals that there is likely a low risk for most of the pipeline except in the instances of simply supported and over-creek pipe spans. Based on reasonable assumptions, the pipeline spanning the creek located at Hemme Ave shows a possible catastrophic situation whereby we know it will resonate with seismic ground motion content. We highly recommend at a minimum, this particular location be analyzed using FEA analysis with the addition of soil-type testing and non-destructive pipe thickness evaluation. A remedy for that particular site can be additional supports or better-behaving mechanisms of damping, all of which can be designed, fabricated, and installed on-site.

The VMC Group recommends the following actions to more accurately analyze specific risks that were identified in this report:

1. Non-destructive Pipeline Thickness Testing to exactly measure wear-and-tear and exact composite material thicknesses; In addition, soil-type tests can be conducted to determine the exact soil amplification factor that is occurring near all of the pipe earth-to-air interfaces which are the most critical circumstances in the county
2. Pipeline-Stream Finite Element Analysis of the location directly passing over streams which, based on the calculations performed shown in this report, theoretically should resonate with earthquake input spectra between 1-8 Hz
3. Computational Fluid Dynamics analysis to determine exact pipe failure flow paths and its interaction with fresh water sources

As pipeline failures nearby may affect Alamo, a detailed analysis should be performed for both the hazardous liquid and natural gas pipeline systems across Contra Costa County. In addition, with the cooperation of Kinder Morgan and PG&E, a more in-depth analysis of the pipes could be completed with more detailed information about the pipes themselves.

References

FEMA 233
IBC 2000 – IBC 2018
ASA B31.1-1955
USCGS 1948
PST Alamo Report
CBC 1981 - CBC 2016
ASME B31.4, B31.6
NPMS
UBC 1949 – UBC 1994
ASCE 7
USGS
PEER Report 2004/07
American Concrete Institute
Appendices

4/10/2019

Design Maps Summary Report

User-Specified Input


Site Coordinates 37.84486°N, 122.03585°W

Site Soil Classification Site Class D - "Stiff Soil"

Occupancy Category I/II/III

USGS-Provided Output

\[ S_a = 1.595 \, \text{g} \quad S_{ns} = 1.595 \, \text{g} \quad S_{os} = 1.063 \, \text{g} \]

\[ S_t = 0.600 \, \text{g} \quad S_{nt} = 0.900 \, \text{g} \quad S_{ot} = 0.600 \, \text{g} \]

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.
4/10/2018

Design Maps Summary Report

User-Specified Input

(which utilizes USGS hazard data available in 2008)

Site Coordinates 37.84486°N, 122.03585°W

Site Soil Classification Site Class D - "Stiff Soil"

Risk Category I/II/III

USGS-Provided Output

\[ S_g = 2.023 \text{ g} \quad S_{50} = 2.023 \text{ g} \quad S_{50} = 1.348 \text{ g} \]
\[ S_I = 0.697 \text{ g} \quad S_{AI} = 1.046 \text{ g} \quad S_{AI} = 0.697 \text{ g} \]

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.