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The San Bruno, California Natural Gas Pipeline Explosion: *Response, Investigation and Regulatory Actions*

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Introduction





In the early evening of September 9, 2010 in the Glenview neighborhood of San Bruno, California—a typical California suburb—a malevolent force was about to be unleashed. Its source was 30-inch diameter, high-pressure natural gas pipeline.[1] The tragedy about to be unleashed stemmed from gross human errors made 54 years ago, and completely undetected by the utility company that installed and operated the pipeline, Pacific Gas & Electric Company ("PG&E"), one of the largest and oldest public utilities in the United States. When the pipeline failed and ruptured on that quiet summer evening, it released 47.6 millions of cubic feet of flammable natural gas—enough gas to meet the needs of the entire City of San Bruno ("City") for a month.[2]

Within seconds, the gas ignited with incredible force and violence. The roaring fireball soared 100-feet into the air and its sound was deafening. As the 2,000-degree flames overtook the neighborhood, people ran for their lives with just the clothes on their backs. Some, however, did not escape the inferno. Eight people lost their lives and 66 were burned and injured, including four firefighters who suffered smoke inhalation. At least four survivors suffered severe burns and are facing long and difficult recoveries. The explosion also destroyed 38 homes and severely damaged 70 others, leaving 17 homes still uninhabitable. An additional 53 homes were also impacted. A large crater, 72 feet long by 26 feet wide and surrounded by burned trees, now cuts through the Glenview neighborhood. Vacant lots stand were a children's playground and family homes once stood.

Emergency Response

The first 911 call was received within seconds although the San Bruno Fire Department fire fighters saw the explosion from their station. More than 900 first-responders, including mutual aid responders and San Bruno's Fire, Police, Public Works, and citywide departments, responded to the explosion—

1 Referred to as Line 132 in the subsequent investigations. Line 132 supplies natural gas to the San Francisco Peninsula and the City of San Francisco.

2 A documentary on the explosion can be found at: http://www.km2communications.com/order

setting a new standard for emergency response for cities in California and across the country.

Still, locating the cause was difficult. Firefighters and residents alike did not know that a high pressure natural gas line ran through a populated neighborhood. Initially, many believed the explosion was due to an airplane crash since San Bruno is located in the take-off pattern of the San Francisco International Airport and the roar of the escaping gas sounded like a jet turbine. Others mistook the explosion for a massive earthquake on the nearby San Andreas fault.

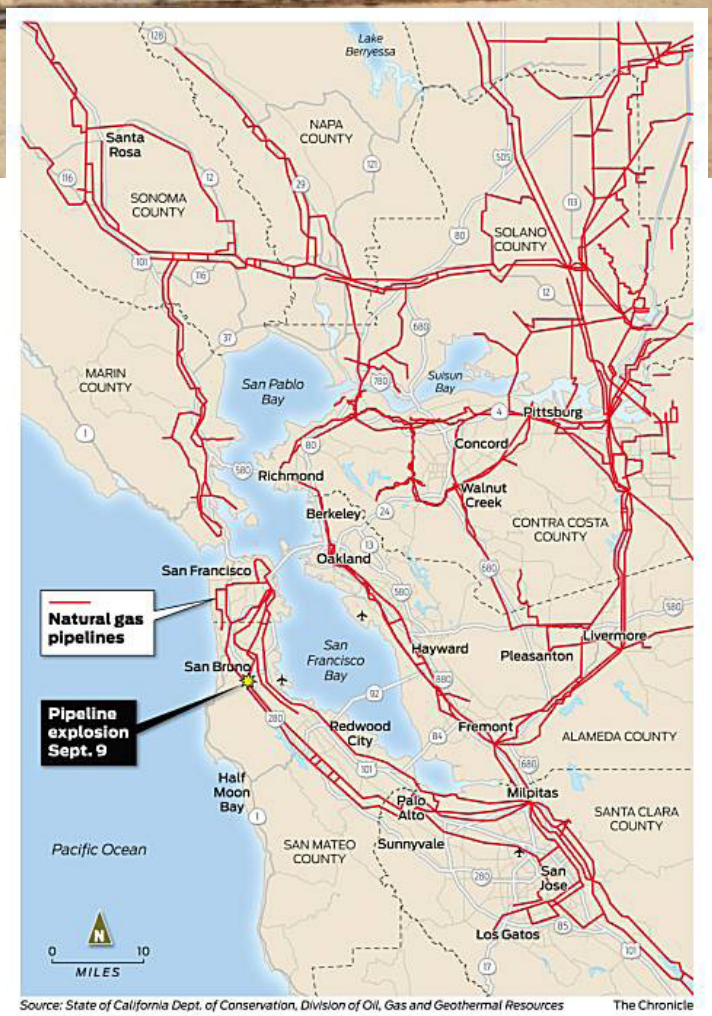
In hindsight, PG&E's public awareness program was profoundly ineffective and did nothing to prepare the community or emergency response personnel for a pipeline emergency.

PG&E had not previously provided the San Bruno Fire Department with detailed maps showing the location of Line 132 nor important information about the pipeline, such as the size, operating pressure and expected consequences if it ruptured. PG&E did not provide coordination and training to the Fire Department before the accident. Therefore, on-scene emergency personnel were unable to quickly recognize that the pipeline had ruptured and were not in a position to immediately contact to PG&E to confirm the cause of the explosion. Nor did PG&E have an emergency response plan in place to contact San Bruno and regional emergency response personnel. Although federal pipeline safety regulations require operators to have public awareness programs, many San Bruno residents were also unaware of the pipeline near their homes nor of its size and pressure. Consequently, the public was also unable to confirm the location and intensity of the failure after the explosion. While this was a catastrophic pipeline failure, odors from small leaks, such as corrosion "pin holes," would have prompted residents to proactively report safety problems to address before a catastrophic failure occurs.

Once it was apparent that this major gas transmission line had failed, PG&E took more than 95 minutes to stop the flow of gas and isolate the rupture site. This delay put the emergency responders in defensive mode instead of offensive







mode to control the fire. As a result, the situation worsened, contributing to the extent and severity of property damage and increasing the life-threatening risks to the residents and emergency responders.

Locating the Cause

PG&E's supervisory control and data acquisition center (SCADA) is the electronic nerve center for the gas system in the Bay Area. The major intersection for gas transmission lines in the Bay Area is located at the Milpitas station which is linked electronically to SCADA. The loss of pressure control at this station minutes before the explosion spiked the pressure in Line 132, ultimately precipitating the final catastrophic failure. In fact, just minutes before the explosion, a PG&E control room operator told a PG&E co-worker, "We've got a major, major problem in Milpitas, and we've over-pressurized the whole Peninsula."[3] The NTSB investigation later

3 San Francisco Peninsula includes the City of San Bruno

found that inadequate maintenance and control room coordination, protocols and/or procedures during maintenance activities at the control station (upstream of the accident site) likely resulted in inadequate management of Line 132 and acted as contributing cause that triggered the pipeline rupture. PG&E control room operators were not properly alerted to the pressure increase and/or the loss of pressure. Consequently, the controllers did not take the necessary action to prevent or to mitigate the conditions that triggered the rupture.

The section of the ruptured pipe was eventually found 100 feet south of the crater in the Glenview neighborhood. It was 28 feet long and weighed 3,000 pounds.

By law, the National Transportation Safety Board (NTSB) has jurisdiction over pipeline accidents[4]. When the NTSB started its investigation, it reviewed PG&E's records. These records indicated that the ruptured pipe was part of a 1,742-foot-long segment installed in 1956 as part of a relocation of the pipeline originally installed in 1948. It reportedly had a .375-inch thick wall and was "seamless." However, a closer look revealed that the ruptured section of the pipe was not seamless, but had a longitudinal seam. Maintenance and safety inspections on gas pipelines are dependent upon accurate "as built" records. PG&E's records were wrong. Even more troublesome is the fact that PG&E's gas system contains over 42,000 miles of natural gas distribution pipelines and over 5,700 miles of natural gas transmission pipelines. PG&E is one of the largest gas and electric utility companies in the United States. Like a ticking time bomb, what other pipelines could result in the same fate?

Aftermath of the Tragedy

Even now, a year and a half later, the San Bruno community continues to cope with the irreparable losses it has experienced. As the victims work to rebuild their homes and their lives, they and other residents are acutely aware of the long and difficult road to full recovery still ahead. That recovery includes a commitment by the City of San Bruno and the San Bruno community to do what they can to ensure this tragedy does not happen anywhere ever again.

Acronyms and Abbreviations

ANPRM	advance notice of proposed rulemaking
ASV	automatic shutoff valve
COF	consequence of failure
CPSD	Consumer Protection and Safety Division
CPUC	California Public Utilities Commission
DOT	U.S. Department of Transportation
DSAW	double submerged arc welded
ECDA	external corrosion direct assessment
ERW	electric resistance welded
GIS	geographic information system
HCA	high consequence area
HV	Vickers hardness number
INGAA	Interstate Natural Gas Association of America
KSI	1,000 pounds per square inch
LOF	likelihood of failure
MAOP	maximum allowable operating pressure
MOP	maximum operating pressure
NPRM	notice of proposed rulemaking
OII	Order Instituting Investigation
OIR	Order Instituting Rulemaking
PG&E	Pacific Gas & Electric Company
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSI	pounds per square inch
PSIG	pound per square inch, gauge
RCV	remote control valve
RMP	risk management procedure
SCADA	supervisory control and data acquisition
SMLS	seamless
SMYS	specified minimum yield strength
UPS	uninterruptible power supply

4 49 U.S.C. 1131

To this end, San Bruno participated in NTSB's investigation into the explosion and is currently participating the California Public Utilities Commission's (CPUC) investigations and Rulemaking procedures.

Relevance to Municipalities

The City of San Bruno today recognizes that threats continue within its infrastructure; it is still vulnerable to another explosion, and it is not alone. Though all cities and counties have utilities, their operations usually go unnoticed, are old systems, and are not being regularly maintained and repaired. San Bruno is not an exception. In fact, PG&E blew up two other high-pressure gas lines in its system when it conducted mandated hydro-testing of pipelines after the San Bruno explosion.

Another disconnect is that this is a homeland security issue. Accurate maps, pressures, and control stations are not in the public domain for reasons of security. San Bruno was not aware of the size, nature, age, and pressurization of Line 132. While we hope municipalities will never face a crisis like San Bruno and be involved in NTSB proceedings, they should have a role with their utilities commission to ensure that their commission implements recent NTSB recommendations involving increased pipeline safety. Most utilities are investor-owned utilities like PG&E that operate under franchise agreements—agreements entered into between the City and utilities in perpetuity. Every state has a commission, like the CPUC, that regulates these monopolies and sets rates and safety regulations. The utilities commissions must enforce the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) federally mandated rules while cities and counties must understand what is in the ground in their communities.

In sum, local governments need to understand what role they have in regulating their utilities and also in promoting public awareness of what is in the ground within their cities' boundaries.

National Transportation Safety Board Process

NTSB Initial Investigation

The NTSB is responsible for investigating pipeline accidents when a fatality, significant injury to the environment, or substantial property damage occurs[5]. In order to prevent similar outcomes, the NTSB conducts accident and incident investigations to determine the facts, conditions, and circumstances relating to an accident or incident in order to determine its probable cause[6]. The investigation includes the field investigation, report preparation, and, where ordered, a public hearing. *Id.* The result of the investigation is a conclusion issued in the form of a report or brief. *Id.*

Immediately after the accident, NTSB Board Member Christopher Hart and his special assistant travelled from Washington DC to San Bruno and assisted investigators at the scene of the explosion. Twelve NTSB investigators were on scene for nine days and additional investigators were added to the team throughout the investigation. Over the period of a year, the NTSB investigation team reviewed thousands of pages of documents and conducted several interviews.

The accident investigation is a fact-finding proceeding with no formal issues and no adverse parties[7]. The investigation begins by the designation of the investigator-in-charge (hereinafter, the "IIC")[8]. The IIC organizes, conducts, controls, and manages the field phase of the investigation. *Id.* The IIC also designates the parties to the investigation[9]. Parties must be limited to persons, government agencies, companies, and associations whose employees, functions, activities, or products were involved in the accident and who can provide suitable qualified technical personnel actively to assist the investigation. Id. The IIC designated the following parties to the investigation: City of San Bruno, the Pipeline and Hazardous Materials Safety Administration, the

5 49 CFR § 831.2(b)
6 49 CFR § 831.4
7 49 CFR § 831.4
8 49 CFR § 831.8
9 49 CFR § 831.11(a)

California Public Utilities Commission, PG&E, and the Engineers and Scientists of California and the International Brotherhood of Electrical workers (unions that represent PG&E workers).

On January 3, 2011, the NTSB issued urgent and interim safety recommendations to PHMSA, CPUC, and PG&E. Three of these recommendations were directed to PG&E, three were directed to the CPUC, and one was directed to the Pipeline and Hazardous Materials Safety Administration. Specifically, the NTSB directed PG&E to "aggressively and diligently search" for all pipelines in densely populated areas or "high consequence areas" (HCAs)[10] that have not reached a maximum allowable operating pressure established through hydrostatic testing.[11] The NTSB then directed PG&E to use this data to determine the maximum allowable operating pressure based on the "weakest section of the pipeline to ensure the safe operation of natural gas transmission lines in HCAs that have not been hydrostatically pressure tested. *Id.* The NTSB also required PG&E's control room operators to "notify, immediately and directly, the 911 emergency call centers" of any possible pipeline rupture.

First NTSB Hearing - Accident Hearing & Initial Procedures

Following NTSB's initial investigation after a transportation accident, the agency decides whether to hold a public hearing.[12] If the NTSB holds a public hearing, then a Board of Inquiry (hereinafter, the "Board") is assembled, which consists of a Chairman of the Board of Inquiry (hereinafter, the "Chairman") and other employees designated by the Chairman. [13]The Board's charge is to examine all witnesses and gather all known facts pertaining to the accident in order to determine its probable cause and formulate a corrective action.[14]

The Chairman also designates the parties to the hearing.[15] Designation as a "party" is important to the process, since, besides NTSB staff, only parties can examine witnesses. Parties can be persons, agencies, companies, and associations whose participation in the hearing is deemed necessary if the Chairman believes their special knowledge will contribute to the fact-finding proceedings. *Id.* Each party shall designate a spokesperson, who must be a qualified technical employee or member. *Id.* This spokesperson cannot occupy a legal position[16]. Further, the spokesperson must not be a person who also represents an insurer or claimant. *Id.* The NTSB also assembles a technical panel of dozens of people, consisting of NTSB's technical staff.[17] The technical panel may participate in the hearing and initially develop witness testimony.

Unless the hearing is deemed an "expedited hearing," the Chairman is required to hold a prehearing conference.[18] During this conference, the parties are advised of (1) the witnesses who will be called at the hearing, (2) the areas in which they will be examined, and (3) the exhibits that will be offered into evidence. Id. The prehearing conference is held at a convenient time and place. *Id.* Furthermore, each party must submit any exhibits to be entered as evidence for the hearing during the preliminary conference. [19] If a party fails to produce such exhibits, the Chairman may preclude the party from introducing the evidence at the hearing. *Id.*

San Bruno spent a significant amount of time and effort compiling the documentary evidence for its March 2011 public hearing. The City even hired consultants to assist with the investigation's technical issues and the NTSB process. The City also spent a considerable amount of staff time and resources answering numerous questions from the NTSB's IIC and staff over a year-long period.

Purpose of Hearing

The federal regulations for NTSB address two related investigatory procedures used by the agency. The first step is basic investigations, including witness interviews and essentially gather information from the parties. The procedures are set forth in 49 CFR

10 Highly populated areas
11 http://www.ntsb.gov/investigations/summary/PAR1101.html
12 49 CFR 845.10
13 49 CFR 845.11
14 49 CFR 845.11
15 49 CFR § 845.13
16 49 CFR § 845.13(a)
17 49 CFR § 845.22
18 49 CFR § 845.23
19 49 CFR § 845.23

Part 131 (summarized below). The NTSB can also conduct a full hearing, pursuant to 49 CFR Part 845 procedures. The Chairman designated all parties to the action to attend and participate in the public hearing. The purpose of the March 2011 hearing is to assist the NTSB in determining the accident's cause or probable cause by reporting its facts, conditions, and circumstances, and in ascertaining measures to help prevent future accidents and promote transportation safety. [20] The hearing is purely a fact-finding proceeding with no formal issues or adverse parties[21]. The NTSB stated the purpose of the hearing: "This accident has exposed issues that merit further attention and have implications for the pipeline infrastructure throughout the country," and "[t]he hearing will gather additional factual information for the investigation, and will also provide the pipeline industry, state and federal regulators, and our citizens with an opportunity to hear more about this accident and important safety issues as the investigation progresses."[22]

On March 1-3, 2011, the NTSB held an investigative hearing concerning the San Bruno pipeline explosion in Washington, D.C. at the NTSB's Board Room. NTSB Chairman Deborah Hersman chairing the en banc hearing. As a result of the investigation into the explosion, the NTSB made recommendations and findings to the U.S. Secretary of Transportation, PHMSA, the Governor of the State of California, the California Public Utilities Commission (CPUC), PG&E, the American Gas Association (AGA), and the Interstate Natural Gas Association of America (INGAA).

Conduct of the Hearing

Unlike interviews and other investigatory proceedings before the hearing, the hearing itself was open to the public. (Hearings not open to the public occur only if a classified nature or threat to national security is evident.[23]) The hearing was webcast at NTSB's website. As stated above, the Chairman presided over the hearing and had the ability to:

- Designate parties to the hearing and revoke such designations; [24]
- Open, continue, or adjourn the hearing; [25]
- Determine the admissibility of evidence;[26]
- Dispose of procedural requests or similar matters; and [27]
- Take any other action necessary or incident to the orderly conduct of the hearing.[28]

The Chairman may also designate a hearing officer who has the ability to:

- Give notice concerning the time and place of the hearing; [29]
- Administer oaths and affirmations of witnesses; and[30]
- Issue subpoenas requiring attendance and testimony of witnesses and productions of documents.[31]

Examination of Witnesses and Evidentiary Matters

Each witness was first examined by the Board or its technical panel.[32] Afterwards, the parties to the hearing examined the witnesses.[33] Any person who appears to testify at a public hearing has a right to be accompanied by counsel. Unlike an examination in federal proceedings, the materiality, relevancy, and competency of the witness testimony, exhibits, or physical evidence are not objectionable during the hearing. Rather, these determinations are to be controlled by the Chairman. *Id.*

Evidentiary rules are also not applicable. Instead, the Chairman may listen to all testimony and view all evidence that he or she believes to be of aide in determining the accident's cause. The Chairman may

20 49 CFR § 845.2 and 49 U.S.C. § 1903(b)
21 49 CFR § 845.2
22 http://www.ntsb.gov/news/2011/110103.html
23 49 CFR § 845.3
24 49 CFR §§ 845.13 and 845.20(a)
25 49 CFR § 845.20(b)
26 49 CFR § 845.20(c)
27 49 CFR § 845.20(d)
28 49 CFR § 845.20(e)
29 49 CFR § 845.21(a)
30 49 CFR § 845.21(b)
31 49 CFR § 845.21(c)
32 49 CFR § 845.25(a)
33 49 CFR § 845.24

exclude from the record testimony or evidence he or she believes is not pertinent to the investigation.[34] The Board also usually meets with the victims of accidents to explain the hearing and post-hearing process.

Before the hearing, the City developed a list of questions important to the City's interests to use in examining witnesses at the hearing.

Proposed Findings

Any person, government agency, company, or association whose employees, functions, activities, or products were involved in an accident or incident under investigation may submit to the NTSB written proposed findings. These findings are to be drawn from the evidence produced during the investigation, a proposed probable cause, and/or a proposed safety recommendations designed to prevent future accidents.[35] Likewise, any party to the hearing may submit proposed findings to be drawn from the testimony and exhibits, a proposed probable cause, and proposed safety recommendations designed to prevent future accidents.[36] These proposals must be submitted within the time specified by the presiding officer at the close of the hearing and will become part of the public docket. *Id.*

In its submittal to NTSB on the root cause of the explosion, the City opined that PG&E had systemic and pervasive problems with its integrity management program, record-keeping, safety and emergency operation procedures, and operation of gas transmission pipelines. The City also took the position that NTSB's fact-finding process ensures that the deficiencies are corrected and that catastrophic failure never happens again by addressing the necessary and appropriate actions and oversight required to protect the everyone's safety within the City and throughout California. The City said it believed numerous contributing and precipitating causes led to the rupture of Line 132:

- The segment of Line 132 that failed on September 9, 2010 was constructed using inferior steel and unusually configured pipe segments that were never intended to be used in the construction of a high-pressure gas transmission pipeline.
- Post construction inspection and testing programs were not adequate to identify the deficiencies before the pipeline ruptured due in part to the absence of verifiable as-built records. This unusually configured pipe segment and improper welding caused the material failure.
- PG&E used an unusual practice that is not accepted within the industry of spiking the operating pressure above the highest actual operating pressure to which the line was subjected during the preceding five years to maintain the Maximum Allowable Operating Pressure (MAOP) for Line 132 in high consequence areas (HCAs). The City believes that PG&E's interpretation of federal pipeline safety regulations for determining the MAOP for older pipeline systems, the so called "grandfather provisions," resulted in the actions by PG&E to periodically spike pressure on the pipeline system. This spiking created cyclical pressurization stresses in Line 132 that led to the propagation of existing weld defects and, ultimately, to failure.
- Subsurface geologic conditions in the vicinity of the failed portion of Line 132 were known to PG&E as long ago as 1992 and such accumulated geologic stresses could have further weakened defective welds.
- Deficiencies in PG&E's record-keeping, documentation and integrity management programs contributed to the company's failure to identify and address deficiencies in the transmission pipeline system.
- The loss of pressure control at the Milpitas station minutes before the explosion spiked the pressure in Line 132, ultimately precipitating the final catastrophic failure. Inadequate maintenance and control room coordination, protocols and/or procedures during maintenance activities at the control station (upstream of the accident site) likely resulted in inadequate management of Line 132 and acted as contributing cause that triggered the pipeline rupture. Control room operators appeared to not have been properly alerted to the pressure increase and/or the loss of pressure. Consequently, the controllers did not take the necessary action to

34 49 CFR § 845.26
35 49 CFR § 831.14
36 49 CFR § 845.27

prevent or to mitigate the conditions that triggered the rupture.

- Complete absence of remote control valves and automatic shut-off devices along with the lack of timely identification of the rupture location and response permitted the fire to consume the Glenview neighborhood for over 90 minutes.

Second NTSB Hearing - Hearing Results and Board Deliberation

As discussed above, the purpose of the investigation and first public hearing is to assist the NTSB in determining the accident's cause or probable cause by reviewing the facts, conditions, and circumstances, and in ascertaining measures to help prevent future accidents and promote transportation safety.[37] he end result of the investigation and hearing is for the NTSB to issue an accident report. The accident report is a detailed report setting forth the facts, conditions, and circumstances relating to the accident and its probable cause, along with any recommendations formulated on the basis of the investigation compiled by the NTSB's technical staff. NTSB staff then presents its recommendations in a public hearing and the Board reviews and deliberates during and after the presentation.

At the hearing on August 30, 2011, the NTSB issued, deliberated, and voted on the final accident report's findings. The report summarized the accident's emergency response, post-accident excavation and field testing, NTSB tests and research, and a determination of the probable cause of the accident. The NTSB rejected the notion that the pipeline explosion and fire which devastated the community was an "anomaly" as industry representatives had previously testified. Rather, the report found that the combined systemic organizational failures of PG&E, the California Public Utilities Commission, and Pipeline and Hazardous Materials Safety Administration allowed a defective pipeline to remain undiscovered for 60 years.

Ultimately, the NTSB determined that the probable cause of the explosion was PG&E's[38] due to:

- Inadequate quality assurance and quality control in 1956 during its Line 132 relocation project. This allowed the installation of a substandard and poorly welded pipe section with a visible seam weld flaw that over time grew to a critical size, causing the pipeline to rupture during a pressure increase stemming from poorly planned electrical work at the Milpitas Terminal.
- Inadequate pipeline integrity management program, which failed to detect and repair or remove the defective pipe section.
- Other contributed causes to the severity of the accident were:
- CPUC's and U.S. DOT's exemptions of existing pipelines from the regulatory requirement of pressure testing, which likely would have detected the installation defects.
- CPUC's failure to detect the inadequacies of PG&E's pipeline integrity management program.
- The lack of either automatic shutoff valves or remote control valves on the line and PG&E's flawed emergency response procedures and delay in isolating the rupture to stop the flow of gas.

As a result of the investigation, the NTSB issued safety recommendations to PG&E, PHMSA, CPUC, DOT, the Governor of the State of California, and INGAA[39]:

PHMSA

1. Require operators of natural gas transmission and distribution pipelines and hazardous liquid pipelines to provide system-specific information about their pipeline systems to the emergency response agencies of the communities and jurisdictions in which those pipelines are located. This information should include pipe diameter, operating pressure, product transported, and potential impact radius. (P-11-8) This recommendation supersedes Safety Recommendation P-11

37 49 CFR §§ 831.4 and 845.2

38 http://www.ntsb.gov/investigations/summary/PAR1101.html

39 http://www.ntsb.gov/investigations/summary/PAR1101.html

2. Require operators of natural gas transmission and distribution pipelines and hazardous liquid pipelines to ensure that their control room operators immediately and directly notify the 911 emergency call center(s) for the communities and jurisdictions in which those pipelines are located when a possible rupture of any pipeline is indicated. (P-11-9) This recommendation supersedes Safety Recommendation P-11-.

3. Require that all operators of natural gas transmission and distribution pipelines equip their supervisory control and data acquisition systems with tools to assist in recognizing and pinpointing the location of leaks, including line breaks; such tools could include a real-time leak detection system and appropriately spaced flow and pressure transmitters along covered transmission lines. (P-11-10)

4. 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. (P-11-11)

5. Amend Title 49 Code of Federal Regulations 199.105 and 49 Code of Federal Regulations 199.225 to eliminate operator discretion with regard to testing of covered employees. The revised language should require drug and alcohol testing of each employee whose performance either contributed to the accident or cannot be completely discounted as a contributing factor to the accident. (P-11-12)

6. Issue immediate guidance clarifying the need to conduct postaccident drug and alcohol testing of all potentially involved personnel despite uncertainty about the circumstances of the accident. (P-11-13)

7. Amend Title 49 Code of Federal Regulations 192.619 to delete the grandfather clause and require that all gas transmission pipelines constructed before 1970 be subjected to a hydrostatic pressure test that incorporates a spike test. (P-11-14)

8. Amend Title 49 Code of Federal Regulations Part 192 of the Federal pipeline safety regulations so that manufacturing- and construction-related defects can only be considered stable if a gas pipeline has been subjected to a postconstruction hydrostatic pressure test of at least 1.25 times the maximum allowable operating pressure. (P-11-15)

9. Assist the California Public Utilities Commission in conducting the comprehensive audit recommended in Safety Recommendation P-11-22. (P-11-16)

10. Require that all natural gas transmission pipelines be configured so as to accommodate in-line inspection tools, with priority given to older pipelines. (P-11-17)

11. Revise your integrity management inspection protocol to (1) incorporate a review of meaningful metrics; (2) require auditors to verify that the operator has a procedure in place for ensuring the completeness and accuracy of underlying information; (3) require auditors to review all integrity management performance measures reported to the Pipeline and Hazardous Materials Safety Administration and compare the leak, failure, and incident measures to the operator's risk model; and (4) require setting performance goals for pipeline operators at each audit and follow up on those goals at subsequent audits. (P-11-18)

12. Develop and implement standards for integrity management and other performance-based safety programs that require operators of all types of pipeline systems to regularly assess the effectiveness of their programs using clear and meaningful metrics, and to identify and then correct deficiencies; and (2) make those metrics available in a centralized database. (P-11-19)

13. Work with state public utility commissions to (1) implement oversight programs that employ meaningful metrics to assess the effectiveness of their oversight programs and make those metrics available in a centralized database, and (2) identify and then correct deficiencies in those programs. (P-11-20)

PG&E

1. Revise your work clearance procedures to include requirements for identifying the likelihood and consequence of failure associated with the planned work and for developing contingency plans. (P-11-24)

2. Establish a comprehensive emergency response procedure for responding to large-scale emergencies on transmission lines; the procedure

should (1) identify a single person to assume command and designate specific duties for supervisory control and data acquisition staff and all other potentially involved company employees; (2) include the development and use of trouble-shooting protocols and checklists; and (3) include a requirement for periodic tests and/or drills to demonstrate the procedure can be effectively implemented. (P-11-25)

3. Equip your supervisory control and data acquisition system with tools to assist in recognizing and pinpointing the location of leaks, including line breaks; such tools could include a real-time leak detection system and appropriately spaced flow and pressure transmitters along covered transmission lines. (P-11-26)

4. Expedite the installation of automatic shutoff valves and remote control valves on transmission lines in high consequence areas and in class 3 and 4 locations, and space them at intervals that consider the factors listed in Title 49 Code of Federal Regulations 192.935(c). (P-11-27)

5. Revise your postaccident toxicological testing program to ensure that testing is timely and complete. (P-11-28)

6. Assess every aspect of your integrity management program, paying particular attention to the areas identified in this investigation, and implement a revised program that includes, at a minimum, (1) a revised risk model to reflect the Pacific Gas and Electric Company's actual recent experience data on leaks, failures, and incidents; (2) consideration of all defect and leak data for the life of each pipeline, including its construction, in risk analysis for similar or related segments to ensure that all applicable threats are adequately addressed; (3) a revised risk analysis methodology to ensure that assessment methods are selected for each pipeline segment that address all applicable integrity threats, with particular emphasis on design/material and construction threats; and (4) an improved self-assessment that adequately measures whether the program is effectively assessing and evaluating the integrity of each covered pipeline segment. (P-11-29)

7. Conduct threat assessments using the revised risk analysis methodology incorporated in your integrity management program, as recommended in Safety Recommendation P-11-29, and report the results of those assessments to the California Public Utilities Commission and the Pipeline and Hazardous Materials Safety Administration. (P-11-30)

8. Develop, and incorporate into your public awareness program, written performance measurements and guidelines for evaluating the plan and for continuous program improvement. (P-11-31)

CPUC

1. With assistance from the Pipeline and Hazardous Materials Safety Administration, conduct a comprehensive audit of all aspects of Pacific Gas and Electric Company operations, including control room operations, emergency planning, record-keeping, performance-based risk and integrity management programs, and public awareness programs. (P-11-22)

2. Require the Pacific Gas and Electric Company to correct all deficiencies identified as a result of the San Bruno, California, accident investigation, as well as any additional deficiencies identified through the comprehensive audit recommended in Safety Recommendation P-11-22, and verify that all corrective actions are completed. (P-11-23)

Governor of the State of California

1. Expeditiously evaluate the authority and ability of the pipeline safety division within the California Public Utilities Commission to effectively enforce state pipeline safety regulations, and, based on the results of this evaluation, grant the pipeline safety division within the California Public Utilities Commission the direct authority, including the assessment of fines and penalties, to correct noncompliance by state regulated pipeline operators. (P-11-21)

DOT

1. Conduct an audit to assess the effectiveness of the Pipeline and Hazardous Materials Safety Administration's oversight of performance-based safety programs. This audit should address the (1) need to expand the program's use of meaningful metrics; (2) adequacy of its inspection protocols for ensuring the completeness and accuracy of

pipeline operators' integrity management program data; (3) adequacy of its inspection protocols for ensuring the incorporation of an operator's leak, failure, and incident data in evaluations of the operator's risk model; and (4) benefits of establishing performance goals for pipeline operators. (P-11-4)

2. Include in the audit conducted pursuant to Safety Recommendation P-11-4 a review of the Pipeline and Hazardous Materials Safety Administration's enforcement policies and procedures, including, specifically, the standard of review for compliance with performance-based regulations. (P-11-5)

3. Conduct an audit of the Pipeline and Hazardous Materials Safety Administration's state pipeline safety program certification program to assess and ensure state pipeline safety programs and Federal pipeline safety grants are used effectively to conduct oversight of intrastate pipeline operations, including an evaluation of state inspection and enforcement activities. (P-11-6)

4. Ensure that the Pipeline and Hazardous Materials Safety Administration amends the certification program, as appropriate, to comply with the findings of the audit recommended in Safety Recommendation P-11-6. (P-11-7)

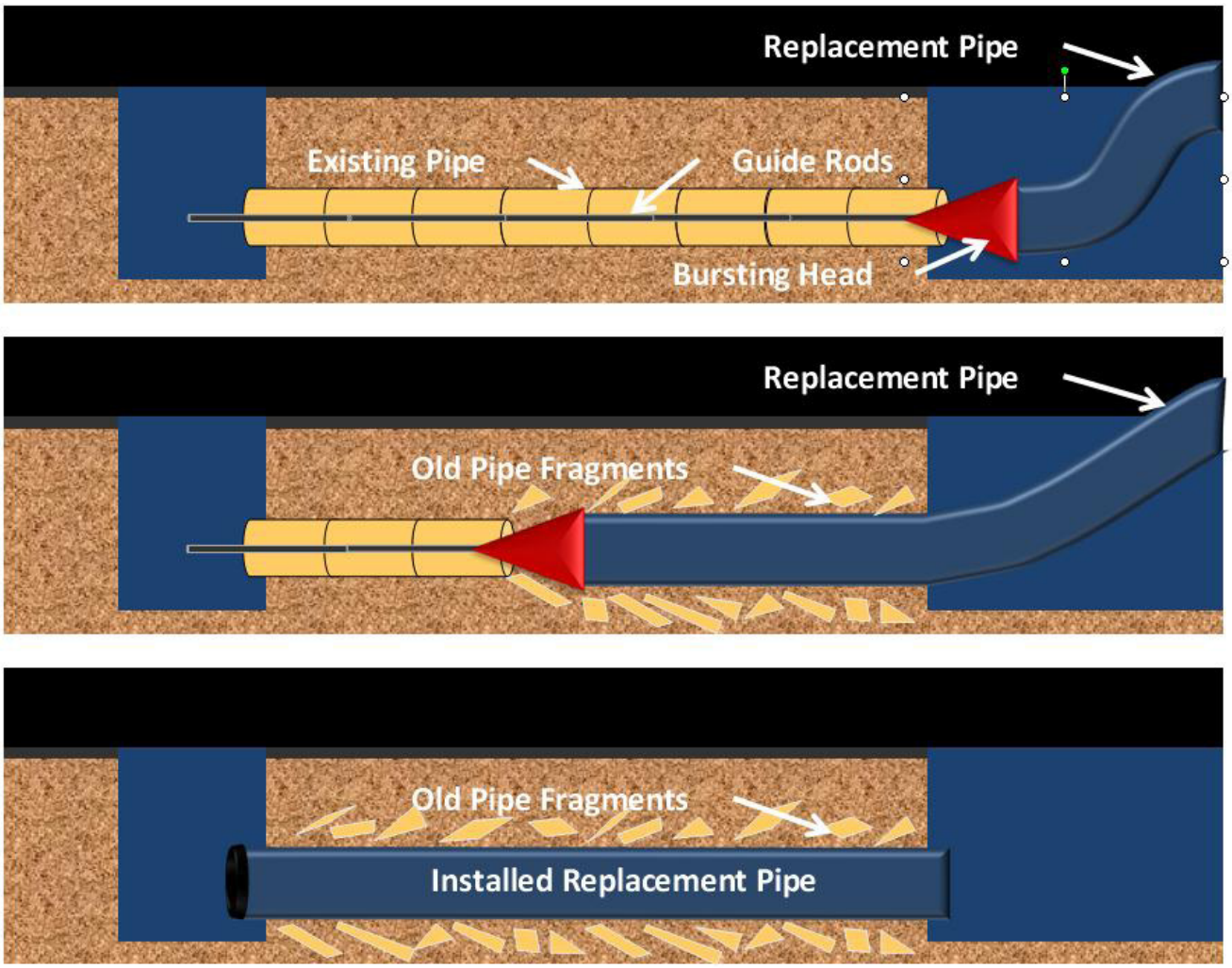
If a party to the investigation or hearing who has a direct interest in the accident disagrees with the accident report, the party can petition for reconsideration or modification. [40] The petition will only be considered if it is based on the discovery of new evidence or on a showing that the NTSB's findings are erroneous. [41]The regulations do not specify a deadline by which the petition must be filed, as accident investigations are never officially closed, but are to be kept open for the submission of new and pertinent evidence by any interested person.[42]

San Bruno's 2008 Sewer Project

In 2008, the City completed a trenchless pipe bursting project that replaced and expanded an existing 6-inch clay sewer pipe passing under Line 132, which was replaced with a 10-inch pipe. The NTSB investigated whether this trenchless pipe bursting project contributed to the explosion. The investigators examined whether 1) the possibility that vibration from the bursting head could have caused "fatigue crack growth" along the seam that ruptured; and 2) the possibility that constant soil or variations in soil shifting developed at the side of the exit pit, causing fatigue crack growth on the seam that ruptured. Moreover, an industry organization, the Interstate Natural Gas Association of America (INGAA), submitted an unsolicited report to the NTSB, finding that the City's 2008 sewer replacement project most likely increased stress on the pipe. The CPUC's Independent Review Panel also adopted this position. As a result of the inquiries and the City's desire to understand the root cause of the explosion, the City hired a preeminent trenchless technology expert to review the trenchless pipe bursting project. As more and more cities replace aging sewer infrastructure, possible conflicts with gas links is a growing issue.

In a filing to the CPUC, the City took the position that the CPUC Panel and INGAA never interviewed the contractor that conducted the trenchless pipe replacement, nor reviewed the specifications for the project, nor did the Panel discuss details of the sewer project with the City's engineering staff. The City's expert found no facts linking the 2008 sewer project to the rupture of the 30-inch PG&E natural gas pipeline in 2010. Rather, the City's contractor followed industry-accepted best practices during the replacement of the pipe and took all necessary precautions to ensure that the natural gas pipeline would not be compromised during the trenchless pipe replacement operation. The City argued that it was speculative and unsubstantiated by any engineering certainty to conclude that a trenchless pipe replacement operation completed in June 2008 could have led to the ultimate failure of the 30-inch diameter natural gas pipeline (or any other underground utility) over two years later in September 2010. The City also stated that it remained uncontroverted in its belief that PG&E's lack of proper integrity management over its failed,

40 49 CFR § 845.41
41 49 CFR § 845.41
42 49 CFR § 844.51



substandard, high-risk pipeline was one, if not the main, precipitating cause of the explosion.

The NTSB directed Corps geotechnical engineers to evaluate data, reports, and studies concerning the 2008 sewer project. Based on its review, the Corps engineers confirmed that the sewer project was not a significant external force on the pipeline and, therefore, not a precipitating cause of the explosion. In its final accident report, the NTSB unequivocally concluded that the 2008 sewer project did not damage the defective pipe.

The California Public Utilities Commission Investigation and Rulemaking Proceedings

Rulemaking Proceeding

On February 24, 2011, the CPUC instituted a formal rulemaking process entitled "Order Instituting Rulemaking" (OIR) to set new rules for the safe and reliable operation of natural gas pipelines in California to help prevent future gas explosions.[43] The CPUC regulates privately owned natural gas companies and promulgates rules that promote pipeline safety. The CPUC's stated goal is to ensure that consumers have "safe, reliable utility service at reasonable rates, protecting against fraud, and promoting the health of California's economy." Unlike the NTSB, the Commission has the power to regulate PG&E by issuing directives, ordering that PG&E comply with its directives, and issuing penalties against PG&E. The CPUC enforces a variety of federal and state laws that impose safety requirements pertaining to the design, construction, inspection, testing, operation, and maintenance of investor-owned utility intrastate natural gas transmission pipeline systems in California.

43 http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/131324.htm

The CPUC's goal of the rulemaking process include:

- Developing and adopting safety related changes to the CPUC's regulation of natural gas transmission pipelines;
- Considering ways the CPUC can undertake a comprehensive risk assessment for all natural gas transmission pipelines;
- Considering available options for the CPUC to better align ratemaking policies to elevate safety considerations;
- Examining the appropriate balance between the CPUC's obligations to conduct its proceedings in a manner open to the public with legitimate public safety concerns;
- Considering if further rules or other protection is needed for whistleblowers; and
- Expanding emergency and disaster planning coordination with local officials.

Assigned to the Rulemaking are an Administrative Law Judge and one of the five Commissioners. An arm of the Commission, the Consumer Protection and Safety Division (CPSD), acts as the "Plaintiff," administers the safety oversight of pipelines, and investigates PG&E's recordkeeping practices to determine whether they violated the Utilities Code.

Through the Rulemaking proceeding, the CPUC obtains public input as well as collects and analyzes the data and conclusions from the investigations and reports. Meanwhile, the CPUC's Independent Review Panel issues recommendations that are presented, considered, and implemented through the Rulemaking proceeding.

In addition, the Rulemaking proceeding considers who should pay for needed improvements to PG&E's gas system and whether to adopt more aggressive use of fines and penalties in progressive enforcement. The proceeding is not necessarily limited to the issues identified in the Rulemaking, but the CPUC must prioritize the issues based on information obtained in the initial stages of the Rulemaking. The initial Rulemaking order included specific proposed rules on several issues that immediately required actions. The CPUC permitted parties to submit written comments on the rulemaking proposals and CPUC also proposed additional rule changes as the proceeding developed..

City's Participation in the CPUC Rulemaking Process

San Bruno is a party to the Rulemaking Process—reminding the Commission and the public that it has a vested interest in enhanced safety measures. Its inclusion ensures that the human face of the tragedy is not overlooked by the complex technical issues addressed in this rulemaking process or the agendas of those reimbursed by the utilities who support more lax enforcement of pipeline safety. The City vocalizes its residents' interests and concerns in this process and in the filings so just conclusions are reached. The City's participation is also important because the Commission is the sole authority regulating utilities in California. Therefore, the City helps achieve its goal of improved pipeline safety by ensuring that the Commission enacts rules designed to prevent future pipeline explosions.

The Commission is also focusing on public awareness and coordination with first responders during the rulemaking process as well as examining other issues related to pipeline safety that concern the City. Examples include the efficacy of remote-controlled shut-off valves, the grandfather clause, and pressure testing.

To "achieve the goal of orderly and cost effectively replacing or testing" for all natural gas transmission pipelines that have not been pressure tested, the Administrative Law Judge on May 10, 2011 ordered all California natural gas transmission operators, including PG&E, to develop and file "Implementation Plans." On May 31, 2011, Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) recommended that the Commission expand the scope of the Commission's Proposed Implementation so it is not limited solely to addressing threats to transmission pipeline long

seams, but rather presents a more comprehensive scope in pipeline safety issues. On June 2, 2011, the Commission decided to institute SoCalGas and SDG&E's process to address pipeline safety issues in the order of importance to the Commission.

On August 26, 2011, PG&E filed its Implementation Plan to replace or test all natural gas pipelines within its system, currently estimated to cost $2.2 billion. To analyze PG&E's Implementation Plan, the City hired an independent expert to prepare its response and direct testimony. In addition to analyzing the technical aspects of the plan, the City argued that the CPUC must examine the need for rules, regulations and changes in practice addressing emergency response and its impact on public safety, including first responder issues and communication between PG&E and public officials. The City said a formal CPUC proceeding carried out on a timely basis should be included in the Plan. The City participated in workshops relating to public safety and emergency response, but the City was concerned that the CPUC has yet to determine what formal forum it will use to address important safety issues. Vital to this process is the City and its staff commenting on any action that the CPUC plans relating to emergency response. Given the City's direct experience in what can go wrong, it knows firsthand what should be done in emergency response.

The City also examined the following regarding PG&E's Implementation Plan:

- Whether it was reasonable and technically sound;
- Whether it provided appropriate assurance of the safety of pipes near San Bruno, both in the interim and in the longer term;
- Whether the Implementation Plan will be implemented effectively;
- How the City will know the plan has been implemented effectively;
- How PG&E will work to improve City and County emergency response capability;
- If there other actions needed to ensure the City is protected from pipeline explosions; and
- How PG&E's Implementation Plan addressed the NTSB recommendations.
- The City, through its expert, provided its analysis of PG&E's Implementation Plan.

Independent Review Panel

To assist, the Commission established an Independent Review Panel, comprised of impartial experts. The Panel's goal was to gather facts and make recommendations to the Commission regarding "general improvement" of pipeline safety, namely to consider whether PG&E has "systemic management problems."[44] The panel had complete freedom to investigate the accident; its process is essentially unscripted. The Independent Review Panel issued its first report to the Commission on the root cause of the explosion.

CPUC's Three Investigations Relating to the Explosion Investigation in PG&E's Recordkeeping Practices

The CPUC instituted a penalty consideration phase into whether PG&E's gas transmission pipeline recordkeeping practices were unsafe, whether it violated the law, and if so, whether deficient PG&E recordkeeping caused or contributed to the explosion. The CPUC commenced the investigation to determine whether PG&E has accurate and up-to-date knowledge of critical aspects of its gas transmission pipeline system. The CPUC began examining PG&E's recordkeeping practices immediately after the San Bruno explosion and after the NTSB determined that PG&E had incorrectly identified the San Bruno pipe as seamless when in fact it was seamed and welded. In response to an urgent recommendation by the NTSB, the CPUC immediately directed PG&E to undertake the NTSB's Safety Recommendations and conduct a complete and comprehensive records search of pipeline documents to determine the valid Maximum Allowable Operating Pressure, which was

44 http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_RESOLUTION/123786.htm

based on the weakest section of the pipeline or component to ensure safe operation of all PG&E's pipelines.

During the penalty consideration phase, the CPUC assigned an Administrative Law Judge (ALJ) and Commissioner to the case, which will take place in September 2012 and will hear testimony related to the safety and lawfulness of PG&E's recordkeeping. The CPSD is expected to issue a report on its investigation. This could include statutory fines and penalties against PG&E, if warranted, of up to $20,000 per each day of a continuing violation of law.

Investigation on Violations of State and Federal Laws

In a second investigation on the explosion, the CPUC issued an investigative staff report alleging that PG&E violated state law and various federal and state pipeline safety regulations and failed to adhere to accepted industry standards, leading to the San Bruno pipeline rupture. The CPUC's Commissioners voted unanimously to immediately open a penalty consideration case to examine the report and, as appropriate, consider proper penalties and remedies for such violations. In a 176-page report, the CPSD alleged that the pipeline rupture was caused by "PG&E's failure to follow accepted industry practice when installing the section of pipe that failed, PG&E's failure to comply with federal pipeline integrity management requirements, PG&E's inadequate record keeping practices, deficiencies in PG&E's data collection and reporting system, inadequate procedures to handle emergencies and abnormal conditions, PG&E's deficient emergency response actions after the incident, and a systemic failure of PG&E's corporate culture that emphasized profits over safety."[45]

The investigation was not solely limited to the events that took place on the day of the explosion; rather, it included all past operations, practices, and other events leading to the explosion. The CPUC's next step is to consider what monetary fines and other penalties are appropriate.

Investigation on Misidentification of Class Locations

On November 10, 2011, the Commission instituted a formal investigation to determine whether PG&E and its officers, directors, and managers, violated any provisions of the 1) California Public Utilities Code; 2) Commission rules; 3) general orders; or 4) decisions, federal regulations, or other applicable rules or requirements "pertaining to the operation of its natural gas transmission pipeline system in or near locations of higher population density."[46] The CPUC will determine whether PG&E failed to classify its pipelines correctly and to comply with federal standards requiring that it regularly study, patrol, and survey these locations for increased population density.

During the penalty consideration phase, an ALJ and Commissioner will be assigned to the case and will hear testimony from parties. Based on the record that will be developed, the ALJ will prepare a recommendation for consideration by the CPUC's Commissioners. This could include statutory fines and penalties against PG&E, if warranted, of up to $20,000 per each day of a continuing violation of law.

Penalties in CPUC Investigations on Violations of State and Federal Laws

The CPUC is currently conducting scheduled hearings on how much PG&E should be fined for its violations of state and federal laws. The penalty is predicted to be the largest penalty levied against a utility for gas-system violations in history. In the evidentiary hearings, the CPUC is considering reports from the Consumer Protection and Safety Division (CPSD), the prosecutorial arm of the CPUC, to determine whether PG&E violated several Public Utilities Code, federal and state pipeline safety regulations, and failed to follow accepted industry standards. A single violation of the Public Utilites Code, Commission decision, or order is subject to a fine of $500 to $20,000 for each violation.[47] In January

45 http://docs.cpuc.ca.gov/published/News_release/157272.htm

46 See "INTRODUCTION," Order Instituting Investigation I.11-11-009

47 Public Utlities Code Section 2107 and 2108

of 2012, Senate Bill 879 increased the penalties up to $50,000 for each violation. The CPSD reports in the three investigations allege several Public Utilites Code violations over a 50 year period, potentially totaling to billions of dollars in fines.

As part of the CPSD investigation, CPSD hired a consulting group to review PG&E's financial viability if CPUC levied a historically high penalty against the utility. In a 15 page report, the consulting group determined that PG&E's parent corporation could absorb $2.5 billion in penalties and still could remain financially viable. The consulting company concluded that PG&E could sell $2.25 billion in stock to pay any imposed fine. PG&E set aside $300 million from stockholders in anticipation of San Bruno-related penalties. When fined, the company will be barred from using ratepayers' money to subsidize the fines. Consequently, PG&E stockholders would ultimately pay any penalty the CPUC levies against PG&E for the San Bruno disaster. Fines levied and recovered from PG&E are paid into the State Treasury to the credit of the General Fund.[48]

Additional Investigations

Federal, state, and local prosecutors are conducting a criminal investigation into PG&E's business practices as a result of the explosion. At this time, the investigation is confidential.

City's Participation in CPUC Investigations

The City of San Bruno is a party to the all three investigations. The City is an indispensible party to the CPUC's investigation and is participating to support any investigation of PG&E's systemic operational failures, relating to PG&E's gas services, facilities and pipelines in order to address residents' interests and concerns in the investigations and to help ensure that a full and accurate conclusion is reached. Similarly, the City supports the efforts being undertaken by the CPUC to complete the necessary fact finding and to impose the necessary and appropriate actions and oversight required to protect residents' safety throughout California. Any fine levied against PG&E is directed to the state's general revenue fund.[49] While the investigations are in preliminary phases, a settlement process that will include fines and admissions from PG&E is anticipated.

In the investigation process, the City is looking to the Commission as the authority for regulating utilities in California. It hopes the Commission will enact rules that improve pipeline safety and hold accountable the party responsible for the explosion. To that end, the City will participate as an active party in any potential settlement negotiations between PG&E and CPSD. The City argued that the community of San Bruno has been irreparably harmed as result of the accident and will continue to indefinitely feel the impact of the horrific explosion. Considering that the worst natural gas explosion in the United States occurred in the City's own backyard, the City took the position that it had the legitimate right to be a full participant in potential settlement negotiations.

Through participation in the investigation process, the City's leadership role ensures that local communities have a voice. The City strives to be in lockstep with the CPSD and PG&E throughout the entire negotiation and settlement process, if commenced, and to confirm that the end result, including fines levied against PG&E, takes into account the City's input and perspective.

Role of PHMSA

The Office of Pipeline Safety is the federal safety authority for ensuring the safe, reliable, and environmentally sound operation of the country's pipeline transportation system. The Department of Transportation's ("DOT") Pipeline and Hazardous Material Safety Administration ("PHMSA"), acting through the Office of Pipeline Safety ("OPS"), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by the pipeline facilities. OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, the entire pipeline safety

48 Public Utilites Code Section 2104.5

49 Public Utilities Code Section 2104

program has been funded by a user fee assessed on a per-mile basis on each pipeline operator that OPS regulates.

PHMSA is currently seeking information and analyzing whether or not to propose new safety requirements for gas transmission pipelines through an "Advanced Notice of Proposed Rulemaking Process ("ANPRM"). U.S. Transportation Secretary Ray LaHood launched a national pipeline safety initiative to prevent potentially catastrophic incidents. The ANPRM asked the public to comment on whether certain regulatory exemptions for pipelines constructed before 1970 should be eliminated and whether integrity management requirements for pipelines should be strengthened and broadened.

PHMSA is also considering whether to propose requirements reducing the operating pressure for some pipelines that were built before 1970 and were previously exempt from other requirements, called the "grandfather clause." Other matters under consideration include revising requirements on valves for new or existing pipelines, whether requirements for corrosion control of steel pipelines should be strengthened, and whether new regulations are needed to govern the safety of gathering lines and underground gas storage facilities.

In total, PHMSA is seeking public comment on 14 specific topics related to pipeline integrity management and pipeline system integrity. Integrity management programs combine periodic inspection and testing of a pipeline's condition with continuous management processes to collect, integrate, analyze, and apply information about possible risks.[50]

50 www.phmsa.dot.gov

Legislation Update

The following is an abbreviated summary of some new legislation in the aftermath of the San Bruno pipeline explosion.

- H.R. 2845, "The Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011," signed into law by President Obama and passed by both houses of Congress with unanimous support. The law doubles the maximum fines that pipeline operators face for safety violations to $200,000 for single violations and up to $2 million for a series of violations stemming from obstruction of the investigation of pipeline accidents. It also authorizes PHMSA to award $110 million in safety-related grants each year to state and local governments. PHMSA must issue new pipeline safety standards requiring operators to install automatic or remote-controlled shut-off valves and excess flow valves in new or replaced transmission pipelines.
- S.B. 275, the "Pipeline Transportation Safety Improvement Act of 2011," passed by the Senate on October 17, 2011 raises a violation of "major consequence violations" to $250,000 a day. It also adds a penalty for obstruction of inspections and investigations and mandates that DOT require the use of remote or automatic shut off valves on new or replaced gas transmission lines when operationally, economically, and technically feasible.
- H.R. 2485, the "Pipeline Safety, Regulatory, Certainty, and Job Creation Act of 2011," as reported by the House Transportation & Transportation & Infrastructure Committee on September 8, 2011 is similar to S.B. 275. It raises the cap for violations to $175,000 a day, but doesn't include the "major consequence violation" provision.
- H.R. 2937, the "Pipeline Infrastructure and Community Protection Act of 2011," as reported by the House and Commerce Committee on September 21, 2011, includes the same provision as S.B. 275 by raising a violation of "major consequence violations" to $250,000 a day. It also require the use of remote or automatic shut off valves on new or replaced transmission lines.