

REPORT OF THE INDEPENDENT REVIEW PANEL

EXECUTIVE SUMMARY

THE INCIDENT AND THE FORMATION OF AN INDEPENDENT REVIEW PANEL

On September 9, 2010, at approximately 6:11PM, a portion of the 30-inch diameter underground natural gas transmission system (Line 132) of Pacific Gas and Electric Company (PG&E) suddenly ruptured. Operating at approximately 386 pounds per square inch gauge (psig), the pipeline was located under the asphalt paving at the intersection of Glenview Drive and Earl Avenue in a residential area of San Bruno, California. Installed in 1956, the 28 foot long section of Segment 180 Line 132 that failed consisted of five segments which were propelled into the air and landed about 100 feet away. An explosion ensued, fueled by blowing natural gas. The explosion and fire resulted in the loss of eight lives and the total destruction of 38 homes. Seventy homes sustained damage and eighteen homes adjacent to the destroyed dwellings were left uninhabitable. The individuals who lost their lives were: Greg Bullis, Lavonne Bullis, William Bullis, James E. Franco, Janessa Greig, Jacqueline Greig, Jessica Morales, and Elizabeth Torres.

The operator, PG&E, is regulated by the California Public Utilities Commission (CPUC) in terms of rate-setting, overall service and safety. Safety matters associated with pipeline facilities are subject to state authority and an annual certification to the United States Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA). After the incident, the National Transportation Safety Board (NTSB), an independent agency with oversight over transportation accidents, immediately dispatched investigators to the scene of the incident. The NTSB has since undertaken an investigation into the root cause(s) of the incident.¹

The San Bruno Incident ranks among the most significant pipeline incidents in terms of loss of life and property in recent years. The fact a large segment of pipe literally blew out of the ground in an urban neighborhood and the residents were generally unaware of the proximity of a high-pressure natural gas transmission system to their homes – raises significant public safety concerns. Not surprisingly, the San Bruno Incident garnered media attention and, in turn, the level of public concern has remained elevated.

¹ According to applicable regulations, an incident involves a release of gas from a pipeline and (1) a death, or personal injury necessitating in-patient hospitalization; or (2) estimated property damage, including cost of gas lost, of the operator or others, or both, of \$50,000 or more; or (3) an event that is significant, in the judgment of the operator, even though it did not meet the two previous criteria.

On September 23, 2010, the California Public Utilities Commission (CPUC) approved Resolution No. L-403, which included the formation of an Independent Review Panel of experts. The Panel's purpose was to gather and review facts and make recommendations to the CPUC for the improvement of the safe management of PG&E's natural gas transmission lines. The report submitted herewith is the result of efforts undertaken by the Independent Review Panel over a seven-month period. The Independent Review Panel, operating under the charter described below, retained outside independent consultants to aid in our investigation. However, the opinions and evaluations contained herein reflect the unanimous views of the members of the Independent Review Panel.

The Panel's full Charter is provided as Appendix B to this report. In brief, our mandate was as follows:

The investigation shall include a technical assessment of the events and their root causes, and recommendations for action by the Commission to best ensure such an accident is not repeated elsewhere. The recommendations may include changes to design, construction, operation, maintenance, and replacement of natural gas facilities, management practices at PG&E in the areas of pipeline integrity and public safety, regulatory changes by the Commission itself, statutory changes to be recommended by the Commission, and other recommendations deemed appropriate by the Panel. The latter shall include examining whether there may be systemic management problems at the utility and whether greater resources are needed to achieve fundamental infrastructure improvements.

Appendix D provides the biographical information on the Panel members and the professional qualifications of our consultants.

The Panel members recognize the high-pressure gas transmission infrastructure that serves California is an essential part of the quality of life our citizens enjoy. Natural gas heats homes and businesses, fuels power generation facilities and vehicles and serves as fuel and feedstock in industrial processes. If the public is concerned the natural gas transmission pipelines cannot be operated within the urban areas safely, then significant tensions among the competing parameters of industrialization, safety, and cost are likely to emerge. Emblematic of these tensions, in the aftermath of the explosion, legislators and regulators at the state and federal levels advanced a number of proposals intended to improve the safety of the infrastructure. With a fuller understanding of the San Bruno Incident, these proposals can be fully evaluated.

There are three purposes to our report. The first is to enhance the understanding of all parties as to what happened in San Bruno and what some of the underlying reasons for the incident were. The second is to delve into the complexities of how pipeline integrity management and the regulatory oversight thereof operate. The third is to offer recommendations for actions, which the operator and regulators can consider to reduce the likelihood of future incidents.

The Panel is mindful there is a great deal of interest in its findings by others involved in the natural gas pipeline industry. We do not intend our findings be applied more broadly to other regulatory jurisdictions or to the natural gas transmission industry in general. Rather, we focused on the San Bruno event and, while our recommendations may be of use to others, we did not fashion them for industry-wide consideration.

METHODOLOGY

As a first step, the Panel members familiarized themselves with the incident and reviewed various materials described in the practices and standards by which natural gas pipelines are constructed, operated, and maintained. The Panel retained the following experts to assist us in understanding the various technical and legal/regulatory aspects of operating natural gas pipelines: Jacobs Consultancy, Van Ness Feldman P.C., Dr. Robert E. Nickell, and Dr. Ralph Keeney. Our consultants are all independent and acted as investigators on our behalf in interviewing various parties, analyzing data and acting as peer reviewers to each other's and the Panel's work.

The scope of our investigation was wide-ranging. The Panel and consultants traveled to the site of the pipeline explosion and met with San Bruno city officials and PG&E personnel. We heard presentations from eight members of the top management of PG&E. Interviews were conducted by our consultants with approximately 30 other individuals at PG&E who worked in various departments, including the front-line field employees. We met with three CPUC commissioners and the Executive Director, and our consultants held interviews with staff of both the utility safety and the ratemaking branches of the CPUC. To form a basis of comparison between PG&E and other operators, we contacted the two other natural gas utility companies who operate transmission pipelines in California and we and/or our consultants met with those companies. In addition, members of the Panel and consultants interviewed engineering leadership of two interstate natural gas pipelines. Staffs of regulatory commissions in several other states were contacted by our consultants for information on their respective frameworks. Consultants met with the staff of the California Office of the State Fire Marshal (OSFM), which has jurisdiction over the liquid petroleum pipelines which operate in California. The consultants interviewed the leadership of International Brotherhood of Electrical Workers (IBEW) Local 1245; the unit represents the field employees of PG&E. Almost without exception, we received excellent cooperation from all who spoke with the Panel directly or with our consultants.

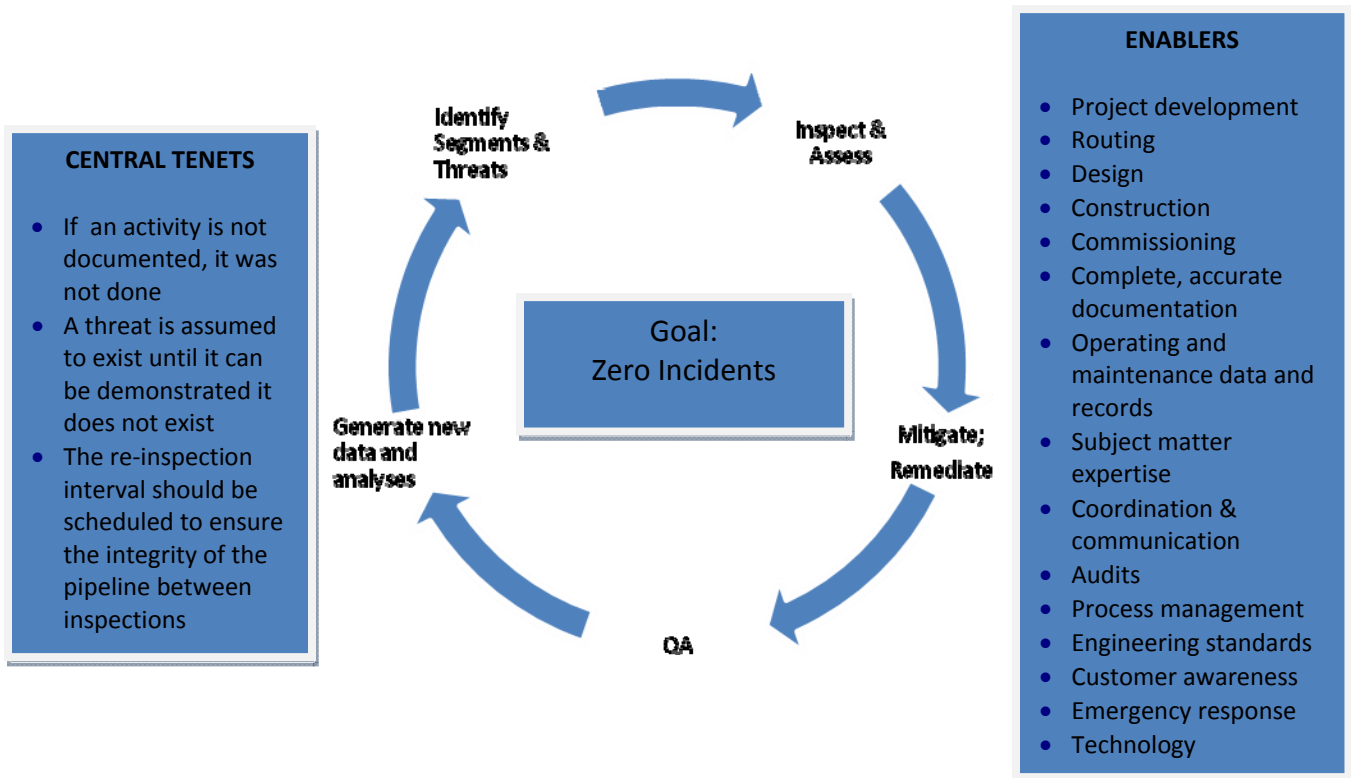
The Panel and consultants submitted over one hundred data and document requests to PG&E and eight to the CPUC staff. Although the quality of the responses varied, all of the requests were answered by the responsible individuals. The Panel appreciates the efforts of all the respondents to provide us with the information we requested. In PG&E's case, we recognize

the company is facing multiple investigations and the Panel's questions were not the only requests which the company was obliged to answer.

As noted below, the NTSB has not yet made a final determination regarding the technical root cause of the explosion. Nevertheless, the Panel believes further time in the investigative stage will not materially affect our findings and recommendations. Therefore, we respectfully submit this work to the CPUC as complete.

OUR CENTRAL FOCUS: PIPELINE INTEGRITY MANAGEMENT

Natural gas pipeline engineering design employs, at its core, the goal of *zero significant incidents*. That is, if a pipeline is constructed, operated, and maintained according to its design, then it should operate without safety risk to the public – notwithstanding it transports a combustible product because the pipeline is buried, it is not susceptible to direct inspection on an ongoing basis. Thus, it is essential an operator maintain a virtuous cycle containing the following elements, shown below.²



² The schematic shown here is a variation of the materials developed by the Interstate Natural Gas Association of America and adopted by its board-level pipeline safety task force in December 2010. A paper summarizing the concept of zero incidents was presented before PHMSA in March 2011 entitled, "Building Confidence in Pipeline Safety, A Strategic Plan by the Members of the Interstate Natural Gas Association of America."

While there is no absolute guarantee a failure will not occur, the probability of failure is materially reduced to the extent the cycle is scrupulously observed. Given this fundamental principle, the Independent Review Panel developed a detailed understanding of the *pipeline integrity management*. We immersed ourselves in the federal regulations and standards that set out integrity management requirements, how the regulations translate to practices across the industry, how integrity management is undertaken at PG&E and elsewhere, and how it is overseen by regulators in California and throughout the country. While *pipeline integrity management* is a specific term used in the natural gas transmission industry and in the regulations to which the operators are subject, it is comparable to the concept of *process safety management* in industrial facilities.

PG&E has the second highest amount of high pressure transmission pipeline located in so-called High Consequence Areas (HCA's) compared to other utilities or pipeline companies in the U.S.³ Thus, its public safety exposure is greater than most. Adherence to the zero incidents framework is essential for public safety. ***As a result of our investigation, the Panel concludes the explosion of the pipeline at San Bruno was a consequence of multiple weaknesses in PG&E's management and oversight of the safety of its gas transmission system. Furthermore, the Panel finds the CPUC did not have the resources to monitor PG&E's performance in pipeline integrity management adequately or the organizational focus that would have elevated concerns about PG&E's performance in a meaningful way.***

OBSERVATIONS REGARDING TECHNICAL ROOT CAUSE

Before proceeding to our specific findings, it is important to discuss the technical root cause of the pipeline failure. The NTSB has principal jurisdiction over investigation of the failure and has extensive technical expertise. So the Panel members agreed it would not be productive or appropriate to duplicate the NTSB's efforts. Nevertheless, the Panel and its consultants have reviewed all the NTSB materials released to date. An analysis based on these materials was undertaken and we have reviewed a report released by the Interstate Natural Gas Association of America (INGAA) Pipeline Safety Committee ("Preliminary Analysis of Publicly Available Evidence Supporting a Failure Cause of the PG&E San Bruno Incident" issued May 5, 2011).

NTSB's findings to date identified both the material and the fabrication welds of the section of pipeline that failed did not meet either: (1) the engineering consensus standards applicable to natural gas transmission pipelines at the time, or (2) the PG&E specifications in effect at the time of construction. However, the NTSB has not yet reached any conclusions about what

³ PG&E has 1,021 miles of pipeline within the urbanized or so-called high consequence areas. Sempra's Southern California Gas system and San Diego Gas & Electric have 1,320 miles of pipeline within high consequence areas.

triggered the material and fabrication weaknesses to destabilize the section and cause the explosion. (It is expected the NTSB will conclude its investigation later in 2011.)

INGAA's analysis suggests the manufacturing defect by itself did not cause the incident. The pipeline, even with defective welds and substandard materials, was "stable" for the first 50 plus years of its existence. Despite the pressure exerted on the pipeline over time, including variations that episodically exceeded the maximum allowable operating pressure (MAOP), as defined in Title 49 of the Code of Federal Regulations Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, such pressure fluctuations were not sufficient to have caused the failure.

As detailed in Appendix F to this report, our consultant had conducted independent parallel analysis to that conducted by INGAA. This work confirms INGAA's findings. Both INGAA and our consultant's analysis support the theory there was an external force that triggered the manufacturing defect to propagate, causing the pipe to fail; the force that most likely put the increased stress on the longitudinal seam was the force from a 2008 sewer replacement project undertaken by the city of San Bruno that utilized pipe bursting technology. Both the Panel and INGAA believe third-party activity (activity that was proximate to the pipe, but without direct contact would have led to visible immediate damage) could have played a key role in transforming a "stable" threat to an "unstable" threat, thus triggering the incident. **While the Panel takes no position regarding root cause, we nevertheless urge the CPUC to submit Appendix F of our report to the NTSB for its consideration.**

Notwithstanding the above, the Panel emphasizes our investigation and findings are not tied to the sewer replacement project or to any other root cause. Rather, when a pipeline fails – for any reason – the zero significant incidents program that underpins public safety has failed. Thus, our focus was to understand whether and why: (1) the potential for failure was not identified by the operator during the normal course of managing system integrity; and (2) the regulator either did not detect weaknesses in the operator's management of the system or failed to take action that would have caused weaknesses to be remediated. Whatever the root cause(s) identified by the NTSB, our findings and recommendations are relevant.

HOW THE CULTURE OF AN INSTITUTION AFFECTS EVERYTHING IT DOES?

The Panel was mindful of the external criticisms that had been leveled at PG&E. While it was acknowledged the company has many talented professionals, the CPUC admitted it was less effective in dealing with PG&E than the other utilities because of the "culture" of PG&E.

Similarly, the “culture” of the CPUC came up in media accounts of the San Bruno Incident and in discussions with the regulators themselves. Specifically, the question surfaced of whether the CPUC was “tough” enough or inquisitive enough to provide vibrant oversight.

Whether it is the regulated entity or the regulator, the issue of organizational culture is an aspect the Panel felt could not be ignored. It is difficult to capture the full spectrum of factors that make an organization unique, such as history, hierarchy, mission, leadership, experiences, attitudes and values. Nevertheless, these intangible factors can often play as much a role in an organization’s success as its processes and procedures. Therefore, our report offers perspectives on the cultures of both institutions we investigated. These perspectives necessarily involve our opinions rather than specific facts and so they will, no doubt, be subject to challenge. However, the Panel felt compelled to make an effort to address the cultural backdrop in which these organizations operate. **The Panel believes both of these institutions must confront and change elements of their respective cultures to assure the citizens of California that public safety is the foremost priority.**

PG&E’S PIPELINE INTEGRITY MANAGEMENT PROGRAM HAS NUMEROUS SHORTCOMINGS

The mindset of a prudent operator is to identify and cure defects through scrupulous attention to every activity in the integrity cycle. The following are the Panel’s findings regarding gaps in PG&E’s performance.

- Worker Safety versus System Safety - Management’s focus in recent times appears to have been on the occupational safety of its employees and lacking an equivalent focus on the public safety aspects of its system. In extensive discussions with top management and in our evaluation of the company’s goals, pipeline system safety was not substantively tracked, benchmarked, or otherwise a center of focus for the management. There was no evidence of any intent to compromise public safety, but there is the lack of management focus on how system integrity would be managed and assured that has significant consequences, as discussed below.⁴

⁴ That a company could emphasize personal safety and seemingly neglect system safety is not unique. This seemingly contradictory problem was reported by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling regarding BP in January 2011. Namely, “BP has caused a number of disastrous or potentially disastrous workplace incidents that suggest its approach to managing safety has been on individual worker occupational safety but not on process safety. These incidents and subsequent analyses indicate that the company does not have consistent and reliable risk-management processes—and thus has been unable to meet its professed commitment to safety.” (See page 218 of the Report to the President, at www.oilspillcommission.gov.)

- Data Management – It was extensively reported PG&E’s first submission of incident data to the NTSB included information that incorrectly characterized fundamental aspects of Line 132. Based on discussions with PG&E staff, experienced piping engineers were well aware the San Bruno segment was double-submerged arc welded (DSAW), rather than seamless. However, it is not clear whether the process by which data was collected and examined for threat identification and the risk ranking of piping segments (which should include examination of construction and operating records by those experienced piping engineers) has been consistently undertaken.

PG&E provided erroneous data because of a lack of: (1) robust data and document information management systems to archive historical data, and (2) processes to capture emerging information about the underground gas transmission system. There is a lack of coordination between field resources and engineering management regarding which data are to be collected and where and how records are to be preserved.

While we understand the entire pipeline industry has had challenges in digitizing and systematizing all the engineering design, construction and operating data, we find PG&E’s efforts inchoate. **The lack of an overarching effort to centralize diffuse sources of data hinders the collection, quality assurance and analysis of data to characterize threats to pipelines as well as to assess the risk posed by the threats on the likelihood of a pipeline’s failure and consequences.**

- Threat Identification – Given the questions raised about the completeness and correctness of the input data for integrity management, it appears PG&E’s program is not identifying all threats, as required by regulation; is not identifying the segments of highest risk and remediating significant anomalies; and hence is not taking programmatic actions to prevent or mitigate threats. As described below, the company is now undertaking additional testing efforts, which the Panel fully supports.

However, the Panel has observed some troubling issues with the company’s implementation of its threat identification methodology. For example, while the company identifies individual threats and the assessment of those individual threats includes a weighted accumulation of the risk from those individual threats, the interaction or multiplicative effect of those threats appears not to be given adequate consideration.

Another example, PG&E originally identified the San Bruno segment on Line 132 as seamless pipe (which was not possible given the vintage and diameter of the pipe). As noted below, there should have been a step whereby knowledgeable piping engineers could find and correct this misidentification during the annual internal review process for the integrity management program. But even if the misidentification had been caught, in PG&E’s methodology the risk ranking for that segment would not have changed because of the way it ranks risks.

As a practical matter, the portion of Line 132 that failed was installed across a ravine using very short segments (“pups”) to deal with fitting up the welds across the terrain. This configuration is highly relevant for considering the riskiness of the segment. Three other threats should have been noted and evaluated: (1) the potential for one or more of the short pup segments, (which were likely selected from pre-1950 vintage shop-welded inventory) to the lack of the quality of the more recently fabricated full-length, factory welded, and tested segments; (2) the potential for soil movement of the ravine fill from subsidence, seismic motion or other effects; and (3) the potential for third-party activity since the segment was in the city streets. Even without precise knowledge of the defective double submerged arc weld, such a combination of threats should have raised concerns about threat interaction and multiplicative increases in risk.

Had all of this information been integrated and analyzed to determine the cumulative threat, this segment should have been identified for additional assessment or for replacement sooner than 2012 when it was actually scheduled to be replaced by PG&E.⁵

- Spirit of Regulatory Compliance - PG&E appears to target its efforts to comply with pipeline safety regulations. But the goals it sets for management compensation purposes, its investments and its practices do not suggest its focus is on achieving an industry leading pipeline safety and integrity program. In 2010, a CPUC staff audit found PG&E was skirting the requirements of the integrity management regulations through use of an “exception” process, whereby critical repairs and other activities were delayed.⁶ Further, the 2010 audit found there appeared to be insufficient company resource to complete pipeline integrity assessments. We observed numerous examples of PG&E asserting it was compliant with the regulations, but also learned about resource limitations that impeded its efforts. We saw minimal evidence of the company making efforts to analyze whether more or different investments would be appropriate to strengthen public safety. We do not opine about whether PG&E was technically compliant with the letter of the regulations (presumably, the CPUC will ultimately make a determination of whether the exceptions are legitimate or whether they actually

⁵ Had PG&E been able to coordinate its integrity management with its field operations, it could have considered replacing this portion of Segment 180 in 2008 when the San Bruno sewer project was underway or in 1995 when portions the adjacent segments 181 and 178 were replaced nearby where the line failed.

⁶ In PG&E's RMP-6 Section 18, Exception Process is the company's approach to instances where deviation from the integrity management program related procedures may be necessary. The same exception process is restated in other RPM's and includes the following language: “It is expected that all requirements of this procedure be met in conducting this Integrity Management Program. However, when this is not possible, then exceptions can be made by obtaining approval... from the Manager of Integrity Management or his/her designate prior to acting on the exception.” The USRB audit noted various exception reports having been generated after the exception had been acted upon and that exception reports were routinely being generated to provide the basis for not performing procedural activities which PG&E has identified as being part of its IMP.

constitute non-compliance), but we seriously question whether PG&E has embraced the spirit of the pipeline integrity regulations.⁷

- Organizational Effectiveness - At the time of the incident, PG&E's gas transmission operations were spread over several integrated electric and gas organizational units. Further, the organization did not have clear divisions of responsibility between gas transmission and gas distribution functions, resulting in the dilution of talent dedicated to transmission integrity management. In addition, some of these units were led by individuals without background in natural gas pipeline operations.

We detected employee fatigue at the number and scope of reorganizations the company has undertaken in recent years. Frequently, employees cited poor communication and abundance of organizational silos that have impeded their ability to understand what work was being undertaken and hence the quality of the work. Moreover, over the past decade, there have been retirements and reorganizations that have undermined the continuity of institutional knowledge of the system. Current management has described recent efforts to ensure institutional knowledge is retained despite a wave of impending retirements. However, much of the knowledge and experience regarding transmission design, operation and maintenance has already been lost. For example, of the four principal architects of PG&E's pipeline integrity management program, only one is still an employee of PG&E.

During the course of our investigation, the gas business was reorganized and multiple management changes were instituted.⁸ The Panel would have recommended a separation of the gas business from the electric business and the appointment of a top leader with qualifications in the natural gas transmission industry had PG&E not done so. To wit, the Panel recognized PG&E has taken meaningful action to bring focus to its gas operations, but additional segregated focus should be established for transmission assets and distribution assets.

- Resource Allocation - While PG&E repeatedly asserted its budgeting process was a "bottoms-up" process whereby every organization would get the resources it needed to assure a quality outcome, we found operational inconsistencies. PG&E generally did spend capital at or above the amounts it requested in its rate cases over the last several years, but we did not observe a coherent planning process to assure the system was being maintained and modernized with any urgency. In particular, the resource complement of qualified and experienced engineers and other professionals was limited

⁷ In the National Commission report on the BP Deepwater Horizon Oil Spill, previously cited herein, the Commission discussed the character of safety culture which included the idea that "safety culture means doing the right thing even when no one is watching." (Page 218, www.oilspillcommission.gov).

⁸ On April 6, 2011, PG&E announced that it was creating separate gas and electric divisions (see <http://www.pgecurrents.com/2011/04/06/pge-improves-safety-flexibility-by-creating-separate-gas-and-electric-divisions/>). On May 5, 2011, PG&E announced it had hired a leader to head the gas division (see http://www.pge.com/about/newsroom/newsreleases/20110505/pgampe_names_nick_stavropoulos_to_lead_utility_natural_gas_operations_as_executive_vice_president.shtml).

throughout the period. Consequently, the staff size itself created bottlenecks in the process of how much integrity management the company could accomplish. While various integrity management policies were adopted and committees were formed pursuant to those policies, there were a number of competing priorities for the qualified engineers. One symptom of this problem of resources is employees did not hold required meetings on materials and designs -- meetings that could have improved the quality of analysis of threat identification to pipeline safety. Rather, work deemed more urgent supplanted work that was important for safety.

- Quality Assurance – Integrity management must be constantly subject to a quality assurance and improvement process. Normally, gas transmission piping is designed and constructed with sufficient safety margin to accommodate some amount of uncertainty in such factors as materials, loadings, and operating environments. However, as defects or anomalies are identified, they must be remediated expeditiously. The scope of a quality assurance effort is designed to ensure, among other things, that objective is met.

A foundation of quality assurance is that employees understand the requirements of pipeline integrity management – and how the various requirements work together to assure public safety. For example, interviews revealed several employees, while familiar with their specific role in integrity management, lacked the overall understanding required to make an effective program. This lack of knowledge manifests itself in silos of information and program ineffectiveness. Another example is PG&E's integrity management policies that require field supervision by the company during work in proximity to high-pressure lines. Interviews revealed that while some field supervisors understood the importance and connection of field supervision of third-party work near transmission facilities and to pipeline integrity, others did not.

In the San Bruno situation, where the city was replacing the sewer system in proximate contact to the natural gas pipeline, there was no on-going field supervision by PG&E of the work. The individual who was responsible for the supervision had other priorities that day and was not present throughout as the pipeline was exposed and reburied.⁹

No pre-construction engineering analysis was undertaken to determine if the sewer line work would impair the integrity of the gas pipeline. If such work had been undertaken, the company could have, at a minimum, detected the pipe had been mischaracterized. In turn, that observation should have triggered further analysis of the threats to the segment that failed. Having missed the pre-construction window, no post-construction threat analysis was conducted either. No pipeline inspection report was generated even

⁹ At least two PG&E field employees told us or other interviewers that they suspected that the sewer line work could have adversely affected the gas transmission pipeline. Also during discussions or interviews, those employees demonstrated an understanding of why the requirement to be present during third party work existed.

though the work had been properly located nor was the pipe re-exposed so PG&E could have assured itself the pipe was properly seated in the trench and other critical safety measures could have been verified.

PG&E's internal audit of its processes in 2010 identified the field personnel were not adhering to the inspection policy during third-party construction, but no training was undertaken to remediate the non-conformance. Further, the company lacks a clear, disciplined communication process between field and general office engineering and between gas transmission engineers and integrity management personnel.

The capability of a piece of pipe with a manufacturing defect to operate for 50 years in a stable manner is a tribute to the margin of safety built into the system. But the margin remains only if there is no uncertainty about the condition of the infrastructure. If the operator does not know about changes in the condition of the pipeline, then assuming the margin of safety is still adequate is an exercise in hoping to be lucky. To fail to inspect during major adjacent earth disturbance and then to fail to analyze the effect of that earth disturbance after-the-fact are examples of the operator pushing its luck. **A strong quality assurance program must be an integral part of the integrity management program.**

- Strategic Integrity Plan - PG&E has no overall strategy to improve how it assesses the integrity of its system. It has done little to redesign its system to facilitate in-line inspection through the use of in-line inspection (ILI) tools.¹⁰ Only 21 percent of PG&E's system is able to utilize in-line inspection. Yet, PG&E has substantial pipeline mileage in HCA's, which makes the significance of being able to inspect its system with the best available technology particularly important.

The Panel learned there have been many technical advances in in-line inspection equipment over the last decade, but PG&E has not developed concrete plans to take advantage of these changes in technology. As we understand the federal pipeline integrity management regulations, operators are to identify their threats and then select the inspection assessment methods which can detect where the threat(s) is present. Operators must implement the appropriate assessment methods, or else they face the prospect of not accurately characterizing their pipeline facilities. If in-line inspection is the best method to detect the threat – which is clearly the case for many of the threats PG&E identified, then it is prudent to develop a plan to use the appropriate methods. Other companies we interviewed have already begun the work to modernize their

¹⁰ An in-line inspection (ILI) tool, or "pig," (pipeline insertable gauge) is a mobile tool that incorporates one or more measurement instruments, such as non-destructive examination device, that is inserted at one point in the pipeline and recovered at some downstream point after traveling with the gas or liquid flow in the pipeline while recording and transmitting its measurements. A "smart pig" is designed to detect a number of pipeline defects, such as leakage, corrosion metallurgical anomalies, and deviations from the normal curvature of the pipe, such as from dents, bulges and ovality. The use of an ILI tool is a foundational technology for compliance with the federal pipeline integrity management regulations promulgated in 2004.

systems to enable in-line inspection and/or have begun focused pipeline replacement efforts where the in-line inspection technology could not be readily used.

In the absence of in-line inspection data, PG&E may not have made an accurate assessment of which pipeline segments should be replaced. In response to various recent CPUC orders, the company has undertaken a program to hydrostatically test certain segments it has determined are “uncharacterized” and therefore at risk, but PG&E has not had an ongoing systematic program to deploy hydrostatic testing and it may not have sufficient internal expertise to meaningfully supervise its program and analyze the results at this time.¹¹

Similarly, in the aftermath of the San Bruno Incident, PG&E was questioned by the NTSB as to its plans to re-examine the intervals on its gas transmission system through the high consequence areas where “smart valves,” (valves that can be shutoff remotely or automatically) might be used. As discussed in our report, there are many considerations that would govern the expanded use of such valves.¹² We believe this is not a move that should be made hastily or in the absence of a detailed analysis of alternatives, but at this point, it is unclear as to how PG&E is approaching this question.

PIPELINE 2020 LACKS SUFFICIENT ANALYSIS

Within a few weeks after September 9, 2010, PG&E announced a program to enhance pipeline safety it named “Pipeline 2020.”¹³ The program has five elements: (1) modernizing infrastructure, (2) installing automated or remote-controlled valves, (3) investing in next generation inspection technology, (4) developing industry best practices, and (5) building safety partnerships. In reviewing the Pipeline 2020 program, we did not find it to be well-reasoned or based on a thoughtful examination of alternatives. The plan appears to be reactive. A careful

¹¹ PG&E is using outside consultants to design and conduct its hydrostatic testing program. But the company lacks internal resources with recent hydrostatic testing experience. Moreover, as a prerequisite to the current testing, PG&E does not appear to have analyzed how the NTSB findings on metallurgy (namely, there are anomalies in the content of the steel on the affected segments) might interplay with the hydrostatic testing regimen. To address this gap, one of the Panel’s consultants recommends that PG&E take samples of the uncharacterized segments of the pipeline during hydrostatic testing.

¹² The issue of remote-controlled and/or automatic shut off valves is a major issue for the pipeline industry. These valves operate to shut off the flowing gas in a pipeline. There are safety and reliability trade-offs in deploying this technology. In the high consequence areas, the loss of gas supply may result in the loss of fuel supply to gas fired power plants or may require the relighting of all pilot lights in buildings and there is the potential for gas build up and spontaneous ignition within closed areas. In addition, the use of automatic or remote shut-off on high pressure lines of a downstream operator’s system might trigger disruptions on upstream pipelines that could impair the ability of the interstate gas systems to operate as intended. The Panel has been persuaded by the arguments of industry experts that such technology should not be mandated across-the-board. See Appendix L for a fuller discussion of automated and remote control valves.

¹³ See

http://www.pge.com/about/newsroom/newsreleases/20101012/pge_announces_pipeline_2020_program_for_enhancing_natural_gas_pipeline_safety_and_reliability.shtml

reading of the materials deepens the Panel's concerns the company has not underpinned its efforts with solid engineering and economic analysis.

The Panel found PG&E has not produced a master plan for pipeline modernization. Moreover, in its testimony before the NTSB, the company conceded its work on the installation of remote valves was in the pilot stage. Thus, PG&E has not developed the analytical support for investments in either pipe or valves. The plan does not project any cost associated with the execution of the plan nor does it set any specific goals or key performance indicators to monitor the progress and effectiveness of the program.

We assume PG&E wants regulators to agree to hundreds of millions or billions of dollars in improvements to its system to assure public safety. The Panel believes for ratepayers to be responsible in the future for investments (some of which, arguably, should have been made already), PG&E must be prepared to support its request for rate recovery with a thorough delineation of its long-term capital program, including the specification of the alternatives considered and an appraisal of the tradeoffs among safety, effectiveness, and cost for each alternative approach.

We believe PG&E does need to invest in the future, but we are unimpressed by the company's pledge to invest in research and development of inspection technology. The industry has already made significant advances in in-line inspection technology and progress will be made with or without PG&E's investment. The fact remains PG&E has not devoted the resources to determining *how* it might adapt its system to use of these emerging technologies. Rather than donating money to a research organization, we would respectfully suggest if PG&E is genuinely interested in advancing the technology of threat detection, it would open up its pipeline system to some of the most promising new devices and vendors for testing and demonstration purposes.

The fourth element of Pipeline 2020 is for PG&E to become more active in developing industry best practices. Ironically, our discussions with other operators lead us to the realization many of applicable best practices already exist. If PG&E adopted those practices, perhaps it would find its fifth goal of promoting safety partnerships would naturally emerge.

EMERGENCY RESPONSE - ANOTHER AREA FOR IMPROVEMENT

While our investigation concentrated on pipeline integrity management, the Panel did spend some time trying to understand what happened in the minutes and hours after the explosion occurred at 6:11PM on September 9, 2010. Although emergency response is not a part of the integrity management plan *per se*, when it is invoked, it is essential to public safety. Therefore, the Panel did investigate the chronology of events regarding the emergency response.

PG&E conducts various training exercises in emergency preparedness. However, when this real-life emergency took place, there was confusion within PG&E as both its Gas Control Operations and its Gas Dispatch organization sought to identify the source and location of the incident. The NTSB investigation conducted a number of interviews and a chronology of the evening is an exhibit in the matter.¹⁴ Even with these materials and interviews with company employees, the Panel did not establish a definitive view of what did or should have transpired. Nevertheless, we observed had it not been for the experience and quick reaction of the first responders from PG&E, the San Bruno Incident could have been even worse. The field personnel who returned to duty after hours to close the pipeline valves – apparently without being dispatched by PG&E– are among the true heroes of this tragedy. These were tenured employees who had the training, experience, and mindset to take the initiative and respond.

It appears PG&E's Supervisory Control and Data Acquisition (SCADA) systems were not sufficient for the company to identify the location of the failure readily and quickly. Further, the automation available to the field force was not sufficient to respond more quickly or to have secured the situation more rapidly than actually occurred. PG&E's management acknowledged to the Panel the implementation of field force automation is not as advanced as what other companies in the industry have available. We believe it is likely the complex set of systems supporting the control of the gas transmission system deserves further investment as well.

THE ROLE OF RISK MANAGEMENT

Risk Management refers to the process by which an organization identifies and analyzes threats, examines alternatives, and accepts or mitigates those threats. An organization's maturity in the area of risk management is indicated by the priority, pro-active thought and serious effort it allocates to this process. To meet the challenge of addressing the complexities inherent in risk management, the leadership of the organization needs to establish and promote a thorough and honest companywide communication system. Such a system ensures management it receives all of the information it needs to identify the key risk decisions it should be addressing and to make well-informed decisions about them in a systematic fashion. An organization with a mature risk culture is one willing and able to meet the challenge of making the organization's significant decisions in a thorough yet timely manner. The risk culture is set by the top management team, can be influenced by its Board of Directors, and is informed by a workforce engaged in a vibrant communication process, underpinned by subject matter expertise in the business.

The Panel learned PG&E had developed a process framework for an enterprise-wide risk management. In reviewing various materials provided to us, we found the framework reflected a comprehensive catalogue of the major threats the company faces, including the possibility of a

¹⁴Exhibit 2-B of NTSB Docket SA-534

San Bruno type event.¹⁵ Given the amount of high consequence natural gas facilities PG&E operates, it was encouraging the company identified the potential threat of its exposure.

In early 2007, the Enterprise Risk Management (ERM) program identified gas and electric system safety as one of the top 10 catastrophic risks facing PG&E. In examining this risk, PG&E demonstrated a high degree of intellectual understanding of the complex factors that impinge on system safety. The examination evaluated a number of business processes in the gas transmission operation and identified many items that should be improved. The Board of Directors was advised the company would apply its internal audit and quality assurance efforts to the key processes on which the safe operation of the system depends and the work of mitigating the threats would begin in the first quarter of 2007. In July 2010, an ERM summary of the safety status of the gas distribution still described a number of items as “weak.”¹⁶

Given this Panel’s findings regarding gas transmission integrity management, one conclusion is inescapable. Simply put, “the rubber did not meet the road” when it came to PG&E’s implementation of the recommendations of its enterprise risk management process.

COMPANY CULTURE

When we met with the top utility management, the Panel found them to be committed to operational improvement. In recent years, the company has made strides in setting objective and measurable goals and rewarding employees based on achievement. However, as noted above, the management team did not mention system safety as a goal in its operational improvement drive. Thus, this is one obvious source of the problem. From 2007, when the risk management framework identified process safety concerns until 2010 when the San Bruno Incident occurred, the management’s focus was elsewhere. This is not to say improvements in PG&E’s integrity management did not take place, but the improvements do not appear to have been given the priority, resources, recognition and rewards that would have led to greater progress.

Ironically, the utility management described its vision to be “the leading utility in the United States.” Management experts point out; however, inspirational goals must also be grounded in reality. In other words, leadership must have a realistic view of the current state in order to set goals which will mobilize the workforce to improvement. Thus, to set a vision of being “the best” and have that vision be credible, management must make sure it is on *terra firma*. In the gas transmission business, management made a faulty assumption. It did not make the connection

¹⁵ PG&E defined a major natural gas transmission incident as one that had any of the following consequences: financial exposure from \$100-\$500 million; significant injury, illness or environmental impact; and/or national or international attention resulting in a severe negative consequence to the company’s image or reputation with regulators, customers or the general public.

¹⁶ Enterprise Risk Management Systems Safety Risk Review - 2009/2010, which is included as part of the material referred to as "EMC Systems Safety ERM Package Final.pdf." See Appendix G

among its high level goals, its enterprise risk management process, and the work that was actually going on in the company.

We think this failing is a product of the culture of the company – a culture whose rhetoric does not match its practices. The Panel is not trained in industrial psychology, but collectively, we have been leaders of large, complex organizations. As such, we would cite the following five factors as contributing to a dysfunctional culture.

- Excessive levels of management - In certain silos, there were as many as nine levels between the CEO and the front line employee. As a result, the management that is setting the direction is distant from those who know the business the best.
- Inconsistent presence of subject matter expertise in the management ranks - Repeated reorganizations, the interchange of gas and electric supervisors and managers, the homogenization of gas transmission and distribution personnel, the large presence of telecommunications, legal and finance executives in top leadership positions, and the under representation of engineers and professionals with significant operating experience in the natural gas utility industry have impaired the effectiveness of the organization.
- Appearance-led strategy setting - In a business with the complexity of PG&Es, there is no substitute for long-term planning and careful execution, but there appears to be an elevated concern about the company's image may get in the way of concentrating resources on the most important things. For example, PG&E announced Pipeline 2020 a few weeks after the San Bruno Incident, but the plan is grossly underdeveloped. We realize PG&E has to manage its relations with the media. However, putting forth a major initiative without having done the necessary work underneath ultimately undermines the company's credibility with its employees as well as the public.
- Insularity – In many instances over its long and storied history, PG&E has been an industry innovator and leader, but no company can maintain its edge without a certain degree of humility and an outward focus, both of which enable it to learn from and be influenced by others. As a large company with many different disciplines represented, it is a challenge to be sure one is listening to outside colleagues as attentively as it does to internal voices. Beginning in 2000, when PG&E went through its bankruptcy, much of the outside interaction – participation in industry conferences, committees, testing programs and colloquia – was curtailed. One consequence of this lapse is there appears to be an insular mindset in many of the individuals we interviewed. The mindset, if not addressed, can breed a corporate myopia that stands in the way of an honest assessment of the company's strength, weaknesses, and performance relative to others. Absent a realistic view of a company's performance, the drive for continuous improvement is diminished.
- Overemphasis on financial performance – While the company has multiple stated goals, top management may be overly focused on financial performance. Certainly the company must be financially healthy to fulfill its mission, but when top management

focuses on financial performance and does not appear to be engaged in operational safety and performance, leadership may dampen the willingness of the organization to challenge the priorities or resources put in place by upper management.¹⁷

It is difficult for a company to change its culture, but we hope the lessons of San Bruno will propel the Board and management of PG&E to examine the process, by which it organizes its company, selects its leaders, sets its priorities, provides its resources, and evaluates its results. With the retirement of the incumbent CEO of PG&E on April 30, 2011, this juncture represents a singular opportunity for the company to get “back to basics” and re-establish its core competencies.

CPUC REGULATION OF SAFETY IS A STRUGGLE FOR RESOURCES

If the task of implementing integrity management is challenging for the utility, the monitoring of utility compliance is fraught with its own difficulties. The CPUC derives its authority to regulate gas pipeline safety from the broad powers granted to it by the California Constitution and Public Utilities Code, and from federal pipeline safety laws. Pursuant to those authorities, the Commission has adopted PHMSA’s federal pipeline safety regulations. Further, the CPUC has specific state statutory responsibility to regulate certain natural gas systems in mobile home parks and propane systems.

The gas section of Utilities Safety and Reliability Branch (USRB) of the Consumer Protection and Safety Division (CPSD) is currently staffed with 18 positions located in Los Angeles and San Francisco. This group has historically been responsible for performing audits of the natural gas utilities on a regular basis to ensure compliance with all DOT regulations. In addition to oversight of the three major gas operators in the state, this group must also inspect the small propane systems and the distribution systems of mobile home operators every five years. In total, this creates an additional inspection responsibility for over 3,200 small mobile home and propane operators once every five years.

However, since 2004 when the federal pipeline integrity rules were placed into effect, the gas safety staff must perform an in-depth analysis of the approach taken by the pipeline operators to know, evaluate, and assess the risks in their pipelines and take appropriate mitigation actions. This means, in addition to its normal audits of utilities’ operations for compliance with federal

¹⁷ In one interview with a top leader of PG&E, the question was asked about what change factor(s) would most positively affect safety in the future. The response given by the leader was that the provision for the recovery of costs for safety improvements would be the most important factor. We believe that while the recovery in rates of PG&E’s prudently incurred costs for agreed-upon safety improvements must occur, the view articulated by the executive distracts from what should be the company’s principal focus given the current situation – namely maintaining a safe, efficient and effective gas transmission infrastructure.

pipeline safety regulations on 11,000 miles of transmission pipeline,¹⁸ the safety staff now has almost 2,350 miles of transmission pipeline in high consequence areas for which it must also assure compliance with federal integrity management requirements.

Conducting audits of performance-based regulations such as pipeline integrity management is a different skill set from that required to conduct audits of prescriptive regulations. Auditing of pipeline integrity management requires an understanding of the utility's system, the utility's threat identification process, and its risk management and decision processes. Thus, the very issues that surface regarding the quality of PG&E's pipeline integrity management are mirrored in the requirements for effective CPUC oversight. A CPUC auditor must have substantial expertise to understand and critically evaluate all the elements of the integrity and management processes in order to fulfill his role as a regulator. It is possible to become a PHMSA certified auditor for pipeline integrity, but the process can take years to achieve, represents a significant commitment of time for coursework, and requires out-of-state travel to Oklahoma City, Oklahoma for training classes.

The CPUC is funded predominantly (over 80%) via user fees assessed on customers' utility bills. In addition, the CPUC pipeline safety program receives annual grants from PHMSA to defray some of the costs of integrity management; grants cover approximately 60% of the cost of the gas safety program, including integrity management audit efforts. Presumably, as the responsibilities of the CPUC increase, the Commission could raise the user fees to cover the new costs that arise and are not otherwise reimbursed by PHMSA. However, in practice, the Governor's Finance Director has authority over the budget of the Commission. In the recent years of state budget austerity, it has been difficult for the Commission to increase its budget even though it has a revenue source separate from the general revenues of the state. Consequently, the safety staffing complement has remained generally unchanged despite the increased scope of its responsibilities.

Budget restrictions and state travel policy prevent all but the minimum amount of travel. The restriction limits the ability of staff to take PHMSA and other training courses. There is perhaps an equally important, albeit subtle, additional impact. With the travel limitation in place, the southern California and northern California personnel no longer meet to review and compare notes on their findings between different utilities. There is limited potential to rotate responsibilities. As a result, it becomes difficult to determine whether the various utilities' efforts at integrity management are comparable or whether differences have to do with the personnel assigned to the respective audits. The Panel and its consultants observed the integrity management efforts varied widely among the utilities; given the constraints under which the staff operates, to achieve a consistent regulatory approach appears challenging.

¹⁸ This includes 6,034 miles of pipeline for PG&E, 4235 miles for Sempra, and 937 miles for Southwest Gas Company. For pipeline mileage within HCA's, and therefore subject to federal integrity management requirements, see data in Figure 1 of main report.

Arguably, the Commission management should have been more aware of the problem of priorities across the entire organization and made efforts to shift resources. However, even a shift would have been problematic given the training and expertise required for monitoring pipeline integrity management. The budget restriction is part of the exceedingly difficult environment in which our public employees must operate. While the taxpayers say, “Do more with less,” in this case, the message also is, “Do more.” **The Panel is mindful of the constraints the Commission faces in fulfilling its mission and believes the ultimate responsibility lies with the Finance Director to set budgets for the CPUC consistent with the responsibilities for public safety.**

OPERATIONAL CHALLENGES WITHIN THE CPUC SAFETY PROGRAM

The struggle for adequate resources affects almost every aspect of the CPUC’s program for monitoring pipeline construction, operations, and integrity. The following are some of the specific problems the Panel identified.

- Qualifications to Audit Integrity Management - The audit staff appears to be generalist engineers at a time when the PHMSA regulations militate for greater levels of specialization in the various disciplines associated with pipeline integrity management. Nevertheless, the staff has conducted two integrity management audits of PG&E and has raised substantive issues. (The CPUC has also twice conducted integrity management audits of the other gas utilities in the state.) However, the CPUC’s ability to audit gas pipelines in the future will require not only greater technical and management skills, but enhanced information systems and analytical tools, including training in risk and integrity management. Moreover, we have not seen any evidence that the CPUC staff has the skills to perform quality analysis of operator risk management choices, either at an enterprise level or at the technical level specific to pipeline integrity management. The staff does not appear to have the skills necessary to perform an in-depth appraisal of any such analyses that might be offered by the operators. **At a minimum, there must be an effort to provide more engineers with PHMSA integrity management training. Further, CPUC employees must be encouraged and rewarded for outside continuing education in the area of integrity and risk management.**
- Use of Consultants – Given budget constraints, the CPUC has a very limited budget for the use of outside consultants, but as PG&E’s activities of integrity management have increased, the CPUC staff does not have the internal resources to evaluate the activities, nor is it likely to develop the depth of expertise necessary for highly technical and management evaluation, except perhaps over an extended period of time. As an example of the problem, PG&E is now in the process of hydrostatically testing 152 miles of its system. This is a complex testing regime involving many judgments that can only

be validated by an experienced independent resource. **The CPUC has not previously monitored the design of a hydrostatic testing program, so its commentary and analysis are unlikely to be meaningful unless the staff is supported by a core set of highly qualified independent consultants with specialized expertise in gas integrity management.**

- Ability to Hire Talent – The CPUC needs to have talent on par with what is being hired in the industry, but the state pay scale is not comparable to either other governmental units or the private sector. (The CPUC has told the Panel this problem afflicts all of its hiring; recently it has made efforts in the Railway Safety Branch to raise compensation so experienced personnel would not leave the CPUC for federal government safety inspection jobs.) There are currently two vacancies in the gas safety group which have been difficult to fill; between the pay scale and a long hiring cycle process used, even applicants who are interested in state service end up taking other jobs because they cannot afford to wait on an offer from the CPUC.
- Enforcement Regime – The CPUC operates under a regime of *Graduated Enforcement* whereby it has a four-step process of increasing severity when it finds safety violations. The four steps are: (1) Staff notice to utility of possible violations; (2) Staff investigation and notice to utility of non-compliance with a set timeframe for remediation by the utility; (3) Staff requests Commissioners vote to open a formal Order Instituting Investigation (OII) which could result in fines and penalties; and (4) Staff requests CPUC Commissioners vote to refer the matter for civil or criminal prosecution by the Attorney General or the local District Attorney. The safety staff does have the ability to issue relatively small penalties and citations with respect to pipeline safety violations on the small distribution systems (propane and mobile home parks), but does not have authority to fine the large operators. Furthermore, enforcement is uneven across the Commission because utilities can be and are penalized by the Staff for billing errors (e.g., overcharging) while safety violations are, for the most part, only documented.

Everyone with whom the Panel spoke supported the idea of graduated enforcement because it maintains an atmosphere of cooperation between the regulators and the operators. This atmosphere, in turn, encourages the utilities to self-report any violations. However, the Staff observed and we agree the levels of graduation may not be well calibrated. In particular, the OII process has rarely been invoked in pipeline safety cases.¹⁹ Because the OII is a formal adjudicatory process that may involve administrative law judges, hearings, and pleadings, it is unwieldy for any but the most severe violations. As a result, the Staff has little flexibility to address significant violations that do not warrant an OII or judicial process.

¹⁹ The only two safety cases which escalated to the OII level were the 2008 gas distribution system incident in Rancho Cordova where one person died and five were injured and the San Bruno Incident.

Meanwhile, the Office of the California State Fire Marshal (OSFM), which has jurisdiction over liquid petroleum pipelines, has a different scheme of graduated enforcement. The State Fire Marshal staff has the ability to exact penalties of up to \$500,000. (In addition, the OSFM has a framework to update its evaluation criteria for assessments, requirements for the use of in-line inspection, the ability to limit encroachment to pipeline easements, an inspection protocol for valves and the authority to take other preventative safety actions.). It is not clear why the two agencies have different enforcement schemes despite regulating pipelines with identical safety mandates.

The Panel did not undertake a full analysis of the differing capabilities of the OSFM relative to the CPUC. However, we have included Appendix P, which describes the organization, responsibilities, authority and expertise of the OSFM because we believe there may be lessons for the CPUC in understanding how the OSFM pursues its oversight of the pipelines under its jurisdiction.

- California Laws on Mobile Home Parks and Propane Systems - Under California law, the CPUC must inspect all 3,200+ mobile home park and propane gas distribution systems at least once every five years, and in some cases more often. As a result, the CPUC commits substantial pipeline safety inspection resources on these systems. In 2008, the CPUC spent 43% of its inspection days on these facilities. Large private distribution systems took up another 40% and only 17% of inspection days were spent on transmission pipelines. In our interviews, the CPUC staff indicated it would prefer to spend more time on integrity management and transmission lines, but is hampered from doing so by California mobile home park and propane requirements, which focus limited resources elsewhere.

The CPUC staff and the Executive Director generally recognize how problematic these limitations have become. Absent efforts to address the foregoing issues, it would be difficult for the gas safety staff to offer assurances on the quality of prevailing integrity management efforts they audit.

HOW SAFETY IS HANDLED IN THE RATE CASE PROCESS

The Panel wondered if the regulatory process for setting rates had any influence on the level of safety pursued by PG&E. PG&E had told the Panel the company has a “bottoms-up” budgeting process and, via rate case settlements, it was being granted approximately 98% of what it had requested for compliance activities. PG&E operates under a regulatory regime of “future test year ratemaking.” Under this framework, PG&E forecasts its future expenditures and gains approval for them before it actually spends the money. So, with an agreement that the company would be authorized rates sufficient to undertake 98% of what it planned, the ratemaking process affords the company a good deal of planning certainty. Further, one might

conclude there was a high level of agreement among parties to the rate case PG&E was properly allocating resources to system integrity.

However, an alternative explanation was suggested to us by the CPUC Executive Director. Namely, he stated there was very little colloquy in the rate cases about safety. Hence, the rate case was not serving as an objective process by which PG&E's integrity management budgets were being scrutinized. With this in mind, our consultants interviewed a number of parties to PG&E's rate proceedings to gain an understanding of how ratemaking might influence the commitment to pipeline safety.

We found parties were only casually familiar with PG&E's safety programs; none had devoted resources to determining whether PG&E's proposed programs were appropriate. Although parties were aware there was a list of the top 100 riskiest segments, they did not monitor which of those pipeline segments were remediated before the next rate case. Occasionally, the safety branch of the CPUC did communicate with the CPUC Division of Ratepayer Advocates on selected matters, but there was, in no case, a critical assessment of whether PG&E's efforts were calibrated to the actual risk to pipeline safety.

Periodically, the CPUC has approved rate settlements that include so-called "one-way balancing accounts" for utilities that are designed to ensure the affected utility spends what has been agreed upon in the case. The purpose of such a mechanism is to: (1) ensure the utility doesn't "load up" safety given expenditure estimate and later spend less in order to enhance its returns; or (2) ensure expenditures deemed important are, in fact, made by the utility. The CPUC has recently approved such a mechanism for PG&E to assure the company spends all designated amounts authorized for safety integrity management expenses or else PG&E returns any excess revenues to the ratepayers. There is significant disagreement among the parties, including the other utilities in the state, about the efficacy of the one-way balancing account mechanism in general and its use for safety expenditures in particular. The Panel believes the underlying issue in PG&E's case, at least, is that the stakeholders do not trust one another – and no regulatory mechanism is going to solve that credibility gap.

On a related note, there is a proposal pending in another CPUC proceeding that would change existing regulations regarding reporting requirements for PG&E and which would involve the USB safety staff. While reporting can create more transparency in the process, we would observe the safety staff does not have the resources to analyze the new reports on safety PG&E would submit. So we question the benefit of the new reporting requirements at this juncture. We do believe, though, as PG&E develops a longer term plan for investment, the safety staff's evaluation of that plan can provide useful input to the rate-setting process.

CPUC: A CULTURE OF COMPLIANCE

The regulatory requirement for new reporting strikes the Panel as a visceral response to a problem with inherently more complexity. It is not an atypical response of government, by any means. Yet, we found in the CPUC – as we found in PG&E – an aspiration to be better than one's peers. However, if the CPUC is to rise above the standard of its peers, like PG&E, it must address its cultural issues.

By way of background, the CPUC can be thought of almost as two separate institutions: the Commissioners, who are appointed for six-year terms; and the Staff, which is chiefly comprised of career professionals. The role of the Executive Director is particularly important because it is that individual who must balance the changing policy orientations of the Commissioners (and the governor who appoints them) and the roles, responsibilities, and capabilities of the permanent Staff.

The CPUC has a long-standing reputation for policy innovation. In recent years, the CPUC has been engaged in a number of policy initiatives that are far-reaching in their scope. These include climate change, renewable energy development, and innovative telecommunications policies.²⁰ There is some disagreement among the Commissioners, however, as to the Commission's priorities. The particular significance of this disagreement is that there is no unanimity of view regarding how the agency's resources should be allocated, what issues should become the primary agenda of the Commissioners, what skills are needed within the Commission, and what areas provide the best promotional paths for talented individuals. In general, however, it was acknowledged by all the Commissioners with whom we spoke that as commissioners they do not focus on the Commission's safety mandate – unless there is a problem escalated to them.

We found the Executive Director to be exceptionally adept at recognizing and navigating these cross-currents. He has recommended the appointment of a deputy director in charge of safety and has encouraged the Staff to reach out and attract outside experts to deepen expertise and recommends one Commissioner should be designated as a focal point for safety. He also believes the enforcement regime needs to change. These are good developments, and we admire his ability to think beyond the current state of the organization. He also recognized the importance of culture and made observations about the culture, which are consistent with our own views. Areas where the culture serves as an impediment to effective regulation are as follows.

- Operating with Ambiguity/Compliance Orientation – The technology for utility operations and the regulations regarding safe utility operations are constantly changing. It is challenging for the Staff to keep up with all of these changes, particularly as training

²⁰ See the CPUC's 2010 Annual Report at http://www.cpuc.ca.gov/NR/rdonlyres/5F23A699-5830-40DC-BD0D-7A335DD89C1A/0/AR2010_web.pdf for further discussion about its activities.

opportunities diminish. As individuals whose responsibility is to uphold the regulations, their oversight becomes increasingly prescriptive. The utilities reinforced this compliance-oriented mindset because it reduces the ambiguity of regulation for them. While Staff is conscientious, there are many forces that drive towards a “check the boxes” type of regulatory enforcement. To move to a regulatory model based on performance and effectiveness will require a shift in the mindset of the entire agency and will require courage and innovation to implement.

- Victim Mentality – State government has suffered many cuts in resources that have affected quality. This breeds a sense of hopelessness in the organization that things cannot get better and exceptional performance is not worth the effort. The current administration at the Commission has tried to avoid many of the restrictions to which other agencies have been subjected (e.g., furloughs), but there is the need for a renewal of commitment to the agency’s mission and a re-examination of agency priorities.
- Where talent is rewarded – There is an unspoken reality at the agency that the path to greater responsibility is not in the compliance area of the Commission. Rather, one must be engaged in the policy-oriented roles if one wants to be recognized and given opportunities for more responsibility. This reality tends to create specializations and silos which limit creative thinking.

These are embedded attitudes, which are challenging to address. In the aftermath of the San Bruno Incident, the safety staff has been striving to be more engaged in the details of PG&E’s integrity management program in real-time. However, it will take a concerted effort on the part of the Commissioners and the career leadership of the organization to address these cultural and organizational issues that face them.

RECOMMENDATIONS

Our full report includes detailed recommendations for the respective parties to consider. We refer readers to the “Recommendations” portion of Chapters 5-7 of our report for these specific recommendations, a number of which are technical in nature. What follows in this Executive Summary is the Panel’s overarching recommendations, a number of which are policy-oriented in nature. The Panel believes that PG&E, the CPUC, and those legislators who have proposed or are interested in proposing legislation, may gain additional benefit in considering such recommendations.

Before listing our recommendations, however, the Panel offers several observations which we think must guide the various stakeholders as they take steps to ensure a San Bruno Incident does not occur again.

First, the natural gas infrastructure in North America, with all of its imperfections, represents a stable system. It is designed and built with a margin of safety so it should not fail without warning. A catastrophic incident such as the San Bruno tragedy is, therefore, a rare occurrence. In general, industry standards and government regulations are already designed to ensure the margin of safety will not be compromised to a point where there is a likelihood the pipeline will fail. What we have in the San Bruno situation is one operator, PG&E, who did not properly account for the threat of failure of a section of pipeline system and hence did not take appropriate remedial action. We must rely on the inherent safety margin of the infrastructure while the operator undertakes the painstaking effort to rehabilitate its processes and methodically recheck its pipeline system. *There is no one methodology, technology or regulation for the CPUC to mandate -- nor legislation for lawmakers to enact -- that will immediately improve safety.*

Second, the breakdown in PG&E's pipeline integrity management is the result of a series of compromises made in the quantity and quality of resources dedicated to the transmission system. Similarly, the inability of the CPUC's safety organization to understand this breakdown and sound alarms is also the result of compromises made in the resources dedicated to oversight of the gas transmission pipelines of the state. Both organizations failed to understand the critical technical and managerial nature of the pipeline integrity mandate and neither created an environment in which excellence was demanded. However, the degradation of quality took place over a decade or more. The actions to rebuild these organizations will take time as well. *Urgency needs to be tempered with patience and realism.*

Last, successful implementation of the actions we recommend here will come only through the collective commitment of all the stakeholders. There will be arguments over which investments should be made, who will pay for them, and what represents an acceptable level of safety risk. *There must be fact-based discussion and civil colloquy among the stakeholders about the path to a safer gas transmission system.* In addition, the Panel is hopeful a commitment to future investments in infrastructure will bring with it an investment in the talents and capabilities of a next generation of engineers, technologists, and other energy professionals.

We recommend PG&E consider the following:

- Undertake an immediate and thorough review of the integrity management threat assessment methodology and consider changes to the default assumptions and interactive and cumulative threat analysis.
- Commission an independent operations and management audit of the gas transmission and gas distribution functions, including an organizational, staffing and skills assessment of the two distinct functions.²¹

²¹During the pendency of this investigation, PG&E advertised in gas industry publications seeking job applicants with gas pipeline integrity management and engineering expertise. We recommend that the company first complete its assessment and then pursue actions to ensure that the staff is adequate and has appropriate skills.

- Establish a multi-year program that collects, corrects, digitizes and effectively manages all relevant design, construction and operating data for the gas transmission system and which leads to a multi-year capital program, based on sound risk criteria (i.e., a methodology that addresses the likelihoods of various possible failures given competing alternatives), which leads to either the retrofitting of existing pipelines to accommodate inline inspection technology or to pipeline segment replacement.
- Conduct a study of SCADA needs with the goals of improving: (1) the visibility of the transmission operations to system operators, (2) the ability of automation to sense line breaks, (3) the ability to model failure events; and (4) the capability to transmit schematic and real-time information to pipeline field personnel. When completed, establish a multi-year program to make implement the results of the study.
- Review and restructure all division, regional, and company emergency plans for consistency and ease of use.
- Commence benchmarking of key natural gas transmission safety measures that are comparable to measures used by other operators in the natural gas industry.
- Ensure all individuals in top management, who have direct responsibility for managing the operation of the natural gas system, have thorough knowledge of gas transmission and distribution operations, and those individuals also have the management experience and style to engage with all levels of the organization in a meaningful way.
- Improve the risk management maturity of the organization by re-examining the entirety of the work done to date, including review by the Board of Directors, of the framework of management programs, actions, monitoring, and compensation that should be in place to ensure meaningful progress in reducing the risk of a catastrophic failure of the natural gas system.

The Panel recognizes the foregoing suggestions were not solicited by PG&E and the company has its own internal review underway. Nevertheless, we hope the company accepts these recommendations in the spirit in which they were intended – as constructive steps towards restoring the confidence of the public in the safety of the natural gas system.

We recommend the CPUC undertake the following:

- Adopt as a formal goal, the commitment to move to performance-based regulatory oversight of utility pipeline safety.
- Commission an independent management audit of the USBR organization, including a staffing and skills assessment, to determine the future training requirements and technical qualifications to provide effective risk-based regulatory oversight of pipeline safety and integrity management, focused on outcomes rather than process.
- Retain independent industry experts in the near term to provide needed technical expertise as PG&E proceeds with its hydrostatic testing program, in order to provide a

high level of technical oversight and to assure the opportunity for legacy piping characterization through sampling is not lost in the rush to execute the program.

- Improve the interaction between the gas safety organization and the Division of Ratepayer Advocates of the CPUC so there is an enhanced understanding of the costs associated with pipeline safety.
- If indicated, seek approval from the State Budget Director for an increase in gas utility user fees to implement performance-based regulatory oversight for all gas utilities.
- Require PG&E support its case for rate recovery of the costs of future investments in pipeline integrity by including state-of-the-art risk analysis of the full range of alternatives.
- Continue efforts commenced on January 3, 2011 to implement the NTSB's recommendations P-10-02, P-10-03, and P-10-04 regarding production of pipeline records by all the state's gas utilities.
- Revise the graduated enforcement framework to provide for the ability of the safety staff to levy civil penalties for violations.
- Institute a program for safety and pipeline integrity audits of the utilities that includes the following features: (1) posting of audit findings and company responses on the CPUC's website; (2) use of a "plain English" standard to be applied for both staff and operators in the development of their findings and responses, respectively; and (3) a certification by senior management of the operator that parallels the certifications now required of corporate financial statements pursuant to Sarbanes-Oxley.²²
- Examine the pipeline regulatory authority, duties, and capabilities of the Office of the State Fire Marshal (OSFM), and determine, as part of the independent management audit of USRB described above, if and how the enforcement responsibilities of the gas safety group of the USRB could be aligned with OSFM, including consideration of whether a transfer of the CPUC's gas transmission safety function to OSFM would improve the overall quality of the oversight of gas transmission pipeline safety;
- Upon thorough analysis of benchmark data, adopt performance standards for pipeline safety and reliability for PG&E, including the possibility of rate incentives and penalties based on achievement of specified levels of performance.
- Request the California General Assembly enact legislation that would centralize the damage prevention authority in the CPUC by granting it the authority to adopt and enforce one-call notification.²³
- Request the California General Assembly enact legislation that would replace the mandatory minimum five-year audit requirements with a risk-based regime that would provide the USRB with needed flexibility in how it allocates inspection resources.

²² Section 302 of the Sarbanes-Oxley Act requires the principal executive and financial officers of a company filing periodic reports to certify in each quarterly and annual report, among other things, that the report does not contain any untrue statement of a material fact or omit to state a material fact and to present the company's financial condition and results of operations fairly present in all material respects.

²³ Assembly Bill No. 56 as amended (Cal.Feb 23,2011) and Senate Bill No. 216 as amended (Cal. April 25, 2011)

- Request the California General Assembly enact legislation that would provide the state's gas utilities with the right to expedited permitting by counties and municipalities for pipeline inspection, remediation and replacement work undertaken pursuant to pipeline integrity management.
- Advise relevant lawmakers of the information contained in Appendix L regarding the complex issues associated with automatic shutoff and remote valves and request sponsors suspend legislative proposals that would require the use of such valves until such time as the detailed plans of the utilities for integrity management have been reviewed and approved by the CPUC.

It has been a privilege for this Panel to convene, to learn from experts in the industry and from one another. We believe our findings should serve as a source of useful information to parties in the Commission's pending gas pipeline safety rulemaking and can guide a renewed commitment to pipeline safety in the state of California.

In closing, the Panel hopes this report provides encouragement to the families of the San Bruno victims that this tragic incident has been thoroughly investigated, that stakeholders will be better informed as a result, and that it is within our collective capabilities to mitigate the chance such a catastrophic incident will ever occur again.