Pittsburg Range Room

P.1 Other Studies:

Stage 3 Pipeline Risk Analysis

LFR ENVIRONMENTAL MANAGEMENT & CONSULTING ENGINEERING

4/27
4/24/07

September 30, 2006

003-09226-01

Mr. Mark Bonnett
Assistant Superintendent
Business Services
Pittsburg Unified School District
2000 Railroad Avenue
Pittsburg, CA 94565

Subject: Stage 2 Pipeline Risk Analysis of the Natural Gas Pipelines and Water Pipelines located within 1,500 feet of the proposed Range Road Middle School site, Pittsburg, California

Dear Mr. Bonnett:

LFR, Inc. (LFR) is pleased to provide this report to the Pittsburg Union School District (PUSD) presenting the results of a risk analysis for the natural gas pipelines and water pipelines within 1,500 feet of the proposed Range Road Middle School site located at the corner of Range Road and W. Leland Road in Pittsburg, California ("the Site"; Figure 1).

This report presents an evaluation of potential risks to identify imminent health and safety threats posed by the pipelines to students, faculty, and staff within the boundaries of the Site. This report summarizes the evaluation's findings and describes the methodology used.

EXECUTIVE SUMMARY

This risk analysis considered the potential impacts associated with hypothetical worst-case accidental releases from six natural gas pipelines and four water pipelines located within 1,500 feet of the Site. One of the six natural gas pipelines and three of the four water main lines run along the southern boundary of the Site. The natural gas pipeline that runs along the southern boundary of the Site [SP3(a)] was found to pose both significant individual and societal risks to the Site. Accidental release risk mitigation measures, such as setbacks and/or barriers could reduce risk. Therefore, risk mitigation measures should be developed and evaluated as a part of a more detailed site-specific (Stage 3) risk analysis.

According to topographic maps, the Site is located on land that gradually slopes to the east. As a result, water from a leak or rupture of any of the four water pipelines will most likely not accumulate on the Site in a way that will pose imminent health and safety risks to the school population.

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INTRODUCTION

The California Code of Regulations (CCR) Title 5, Section 14010(h) stipulates that proposed school sites not be located near an aboveground water storage tank or within 1,500 feet of the easement of an aboveground or underground pipeline that can pose a safety hazard as determined by a risk analysis study. If the risk analysis shows potential hazards, exemptions to specific sections of these regulations may be granted as described under CCR Title 5 Sections 14010(u) and 14011(n) if the risks associated with these potential hazards can be mitigated.

Ten (10) pipelines were discovered to be located within 1,500 feet of the Site, which include the following:

- Six (6) Pacific Gas and Electric Company (PG&E) natural gas pipelines;
- Three (3) East Bay Municipal Utility District (EBMUD) aqueduct water lines; and,
- One (1) Contra Costa Water District (CCWD) Multi Purpose Pipeline (MPP).

A pipeline risk analysis was performed to assess the potential imminent health and safety risks from hypothetical worst-case accidental releases from these pipelines.

SITE AND PIPELINE INFORMATION

The proposed Range Road Middle School site is located at the corner of Range Road and W. Leland Road in Pittsburg, California (Figure 1). The maximum occupancy at the Site is estimated to be 1,000 people.

The easement of one of the PG&E natural gas pipelines [SP3(a)] transverses along the southern boundary of the Site; The easements of the other five P&E natural gas pipelines transverse to the east of the Site within the 1,500 evaluation boundary (Figure 2). The easements of three EBMUD water pipelines, which run along the southern boundary of the Site, and one CCWD water pipeline also traverse within 1,500 feet of the Site (Figure 3). Specific pipeline information was obtained from PG&E, EBMUD, and CCWD, which is summarized in Tables 1 and 2.

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Table 1: Summary of Natural Gas Pipeline Information

Pipeline Information	PG&E Natural Gas Pipelines					
	PG&E 26-inch NG	PG&E 26-inch NG	PG&E 24-inch NG	PG&E 20-inch NG	PG&E 20-inch NG	PG&E 24-inch NG
Operator	PG&E	PG&E	PG&E	PG&E	PG&E	PG&E
Pipeline Reference	SP3(a)	SP3(b)	191	191-1(a)	191-1(b)	191-1(c)
Date of Installation	1977	1974	2005	1957	2005	1954
Diameter (inches)	26	26	24	20	20	24
Pressure [maximum] (psig)	600	600	720	390	720	390
Pressure [operational] (psig)	600	600	338	338	338	338
Contents	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Type	Transmission	Transmission	Transmission	Transmission	Transmission	Transmission
Location	Runs along southern perimeter of site. Crosses the site near the intersection of Range Rd. and W. Leland Rd.	Extension of SP3(a) pipeline.	Located approx. 1,500 feet to the northeast of the site	Runs parallel to the site along the eastern side	Runs parallel to the site along the northeast corner	Extension of 191-1(b) to the north of the site
Stations	5.5 miles west of site	5.5 miles west of site	5.5 miles west of site	5.5 miles west of site	5.5 miles west of site	5.5 miles west of site
Valves	N/A	N/A	N/A	N/A	N/A	N/A
Valve Type	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Components	Unk	Unk	Unk	Unk	Unk	Unk
Depth of Burial (feet)	4	4	4.5	8.5	5.33	3
Pipe Grade/ Classification	3	3	3	3	3	3
Construction	Steel, Plastic	Steel, Plastic	Steel, Plastic	Steel, Plastic	Steel, Plastic	Steel, Plastic
Wall Thickness (inches)	0.260	0.300	0.312	0.318	0.500	0.313
Corrosion Prevention	Cathodic Protection	Cathodic Protection	Cathodic Protection	Cathodic Protection	Cathodic Protection	Cathodic Protection
% of Specified Minimum Yield Strength	50.00	50.00	21.70	26	11.30	30.90
Leak/Spill History	None	None	None	None	None	None
Inspection/Testing Results	Per CPUC 112E	Per CPUC 112E	Per CPUC 112E	Per CPUC 112E	Per CPUC 112E	Per CPUC 112E
Stage 2 Required?	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
MGD = million gallons per day
NG = natural gas
N/A = Not Applicable (provided by pipeline operator)
PG&E = Pacific Gas and Electric Company
psig = pounds per square inch-gauge
Unk = unknown

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Table 2: Summary of Water Pipeline Information

Pipeline Information	Water Pipeline			
	EBMUD 87-inch Water	EBMUD 67-inch Water	EBMUD 65-inch Water	CCWD 42-inch Water
Operator	EBMUD	EBMUD	EBMUD	CCWD
Pipeline Reference	Mokelumne Aqueducts			MPP
Date of Installation	Unk	Unk	Unk	Unk
Diameter (inches)	87	67	65	42
Pressure [maximum] (psig)	200	200	200	175
Pressure [operational] (psig)	<200	<200	<200	100
Flow Rate [minimum] (barrels/hour)	Unk	Unk	Unk	Unk
Flow Rate [maximum] (MGD)	100	50	40	35
Contents	Raw Water	Raw Water	Raw Water	Treated Water
Type	Transmission	Transmission	Transmission	Pressurized Transmission Main
Location	Runs East-West along southern boundary of Site (EBMUD 87-inch Water, EBMUD 67-inch Water, and EBMUD 65-inch Water are in same pipe run in this area)			Runs approximately southwest of the Site area
Stations	~15 miles	~15 miles	~15 miles	7 miles at Treatment Plant
Valves	~18 miles upstream; ~7 miles downstream			~2,200 feet upstream
Valve Type	Automatic			Manual
Aboveground Components	Manhole structure @ 3513	Vacuum valve structure @ 3502 and 3520	Exposed Pipe @ 3491; Vacuum valve structure @ 3502 and 3520	Air relief valve, blow-off, and manways
Depth of Burial (feet)	4			4-5
Pipe Grade/ Classification	N/A	N/A	N/A	AWWA C200
Construction	Class 360 ML&C	Steel ML&C	steel	Welded Steel Pipe
Wall Thickness (inches)		3/8	3/8	Unk
Corrosion Prevention	Exterior coating and an impressed current Cathodic protection system.			Cathodic Protection
% of Specified Minimum Yield Strength	N/A	N/A	N/A	N/A
Leak/Spill History	One minor leak in the area about 18 years ago.			None
Inspection/Testing Results	Unk	Unk	Unk	Monitored by SCADA and C.P. Testing Stations
Stage 2 Required?	Yes	Yes	Yes	Yes

AWWA = American Water Works Association
CPOC = Cochrane Pipeline Operators Committee
CCWD = Contra Costa Water District
psig = pounds per square inch-gauge
SCADA = Supervisory Control and Data Acquisition
EBMUD = East Bay Municipal Utility District
MGD = million gallons per day
na = not applicable to pipeline
N/A = Not Applicable (provided by pipeline operator)
NG = natural gas
Unk = unknown

Distances from each pipeline to significant Site areas are summarized in Table 3.

Table 3: Summary of Distances from Pipelines

Pipeline	Approximate Distance from Pipeline		Approximate Segment Length within 1,500-foot Perimeter (feet)
	To Property Line (feet)	To Property Centerpoint (feet)	
PG&E: SP3(a)	115	580	4,257
PG&E: SP3(b)	1,160	2,130	290
PG&E: 191	1,500	2,325	194
PG&E: 191-1(a)	970	1,740	1,838
PG&E: 191-1(b)	970	1,935	775
PG&E: 191-1(c)	1,450	2,235	100
EBMUD-87	0	750	4,650
EBMUD-67	0	750	4,650
EBMUD-65	0	750	4,650
CCWD42	775	1,163	3,295

Risk Assessment Approach

The purpose of this risk assessment is to analyze potential imminent health and safety risks including fatalities to students, faculty, and staff at the Site associated with possible accidental releases from a pipeline. The indication of risk developed by this risk analysis is intended for use for threat prioritization and planning purposes only. It is not intended as a prediction of the number of injuries or fatalities that could occur as a result of pipeline failure.

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Natural Gas Pipeline Risk Analysis

For the natural gas pipelines, as stated previously, the document entitled "Draft California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis" dated May 2002 ("the May 2002 Protocol") provided by the California Department of Education (CDE) was used as a guidance. Other revisions of this protocol have been published; however, the May 2002 Protocol was used in this assessment due to instructions received from the CDE in a memo from Michael O'Neill, dated March 7, 2006. The memo addressed the "Delay in Release of California Department of Education's Pipeline Risk Assessment Protocol Update (March 1, 2006)", which stated that assessments performed after the date of the memo should follow the Protocol from May 2002 and not any of the revisions published to date.

In accordance with the May 2002 Protocol, a Stage 2 probabilistic analysis ("Stage 2 risk analysis") was conducted to develop a quantitative estimate of the individual and societal risks posed by the natural gas pipelines to the Site. The indication of risk developed by this Stage 2 risk analysis is intended for use for threat prioritization and planning purposes only.

The Stage 2 risk analysis combines the probability or likelihood of an accident occurring with an estimate of the predicted consequences of the accident to provide an overall indication of risk. In the context of pipelines conveying flammable or explosive materials near proposed school sites, this pipeline risk evaluation estimates the probability of harm to people at the school site that could be caused by an accidental release and ignition of material from a pipeline.

Both individual and societal risks were considered as recommended in the May 2002 Protocol and in a memo on public safety risk acceptance thresholds issued by the County of Santa Barbara California in October 1999.

Total Individual Risk (TIR) is defined as the annual probability of fatality for an individual at the proposed school site resulting from pipeline failure. The Individual Risk Criterion (IRC), which is equal to 1 in 1,000,000, is defined as the annual probability of fatality above which a facility requires additional prevention and/or mitigation measures. Thus, based on the May 2002 Protocol, if the TIR is greater than the IRC, the risk is classified as "significant"; if the TIR is less than the IRC, the risk is classified as "insignificant".

Societal risk is defined as an annual probability of fatality for a specified number of persons at the school site. If the societal risk is greater than 1 in 100,000, the risk is classified as "significant"; if less than 1 in 100,000, the risk is classified as "insignificant".

Potential pipeline failures (releases) considered include leaks or ruptures caused by corrosion, excavation, natural forces, operational issues, material and weld defects, and other outside forces. These are the primary categories of pipeline failure considered by the U.S. Department of Transportation.

Potential impact (ignition) scenarios considered were jet fires and vapor cloud explosions. The consequences of concern are injuries or fatalities from exposure to fire thermal radiation or explosion blast pressures that exceed safe thresholds. These are the relevant impact scenarios addressed in the May 2002 Protocol and in the document entitled "Risk Management Program Guidance for Offsite Consequence Analysis," dated April 1999 (authored by the Environmental Protection Agency [EPA 550-B-99-009]; "OCA Guidance").

It should be noted that in addition to jet fires and vapor cloud explosions, the May 2002 Protocol discusses the possibility of flash fires resulting from pipeline failures. However, neither the May 2002 Protocol nor the OCA Guidance provides guidance for quantifying flash-fire impacts or estimating the potential harmful affects of flash fires. In the May 2002 Protocol the assumption is made that the conditional probability of a fatality from exposure to a flash fire at a site is zero. Therefore, flash fire impacts are not considered in this Stage 2 risk analysis.

Releases were assumed to occur under worst-case meteorological conditions of Class D atmospheric stability and a wind speed of 3.0 meters per second over rural terrain. A leak was assumed to occur through a 1-inch diameter hole and to ignite within 15 minutes of the release, resulting in either a jet fire ("leak-jet fire scenario") or a vapor cloud explosion ("leak-explosion scenario"). A rupture of the pipeline was assumed to occur through the full diameter of the pipeline and to ignite within 15 minutes of the release, resulting in either a jet fire ("rupture-jet fire scenario") or a vapor cloud explosion ("rupture-explosion scenario").

Exposure thresholds predicted to produce a finite but minimal fatality risks were derived from information provided in the May 2002 Protocol. These thresholds are a radiation exposure of 10 kilowatt per square meter (kW/m^2) or an overpressure exposure of 1 pound per square inch (psi). In addition to the Stage 2 risk analysis, the maximum potential distances from the pipeline to point at which these exposure levels could occur were calculated for each accidental release scenario. These distances are considered "zero risk" endpoints, the point at which an exposure following an accidental release and ignition could cause less than 1% serious injury or fatality to individuals without regard for the probability or likelihood that such a scenario could occur.

Water Pipeline Risk Analysis

The May 2002 Protocol does not address assessment of water pipelines. Therefore, for the assessment of the water pipelines, the document entitled "California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis, Revised Draft 2" dated September 2005 (the September 2005 Protocol) was used as a guidance. Most of the calculations and guidance referenced in the September 2005 Protocol for liquid releases are from the OCA Guidance.

Based on the September 2005 Protocol, the criteria assumed sufficient to pose an imminent health and safety threat from a water line release is potential exposure to a 1-foot deep pool without regard for the probability or likelihood that such a release scenario could occur. Where the estimated impact zone poses a severe flooding threat to the school property, the site should be designed with appropriate mitigation measures or the area should be restricted from use.

The types of pipeline failures (releases) considered for this analysis include leaks or ruptures caused by corrosion, excavation, natural forces, operational issues, material and weld defects, and other outside forces. These are the primary categories of pipeline failure considered by the U.S. Department of Transportation.

In accordance with the September 2005 Protocol, a leak was assumed to occur through a 1-inch diameter hole at the bottom of the pipeline for a period of 15 minutes. A rupture of the pipeline was assumed to occur through the full diameter of the pipeline for a period of 15 minutes.

Using a minimum pool depth of 1-foot (September 2005 Protocol criterion), a maximum pool diameter was estimated. As the flow is mostly unrestricted, it is assumed that a circular pool would occur and that the pool center would be located towards the east of the pipelines, approximately half the diameter's distance from the pipeline (the radius of the estimated circular pool).

Each release scenario from a pipeline was considered individually; therefore, no cumulative risk was assessed for the water pipelines by LFR.

RISK ANALYSIS FINDINGS

For the PG&E natural gas pipelines, the CDE required forms and detailed calculations of the risk analyses are provided in Appendix A (attached). For the water pipelines, detailed calculations, which followed the guidelines outlined in Appendix C – Part 2 (Liquids Release Consequence Modeling Calculations) of the September 2005 Protocol, are provided in Appendix B (attached). The potential maximum impact distances from the natural gas and water pipelines are summarized in Table 4 along with the potential site areas affected. Figure 4 shows the setback distances of the natural gas pipelines that will affect the Site.

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Table 4: Summary of Approximate Impact Distances from Pipelines and Areas Affected

Pipeline	Scenario	Impact Distance From Pipeline (feet) 10 kW/m² Radiation	1 psi Overpressure	1-foot Pool	Areas of Site Affected
PG&E: SP3(a)	Leak-Jet Fire	48			None of the site
	Rupture-Jet Fire	1,030			Majority of site
	Leak-Explosion		530		Southern half of site
	Rupture-Explosion		1,800		Entire site
PG&E: SP3(b)	Leak-Jet Fire	48			None of the site
	Rupture-Jet Fire	1,030			None of the site
	Leak-Explosion		530		None of the site
	Rupture-Explosion		1,800		Southeastern corner of site
PG&E: 191	Leak-Jet Fire	53			None of the site
	Rupture-Jet Fire	1,100			None of the site
	Leak-Explosion		560		None of the site
	Rupture-Explosion		1,875		Northeastern corner of site
PG&E: 191-1(a)	Leak-Jet Fire	40			None of the site
	Rupture-Jet Fire	780			None of the site
	Leak-Explosion		470		None of the site
	Rupture-Explosion		1,500		Eastern portion of site
PG&E: 191-1(b)	Leak-Jet Fire	53			None of the site
	Rupture-Jet Fire	1,030			Northeastern corner of site
	Leak-Explosion		560		None of the site
	Rupture-Explosion		1,825		Northeastern portion of site
PG&E: 191-1(c)	Leak-Jet Fire	40			None of the site
	Rupture-Jet Fire	850			None of the site
	Leak-Explosion		470		None of the site
	Rupture-Explosion		1,575		Northeastern corner of site
EBMUD 87-inch Water	Leak			30	Southeastern corner of site
	Rupture			422	Southeastern corner of site
EBMUD 67-inch Water	Leak			30	Southeastern corner of site
	Rupture			298	Southeastern corner of site
EBMUD 65-inch Water	Leak			30	Southeastern corner of site
	Rupture			267	Southeastern corner of site
CCWD 42-inch Water	Leak			29	None of the site
	Rupture			250	None of the site

Notes:
kW/m^2 = kiloWatts per meter square
psi = pounds per square inch

The results of the PG&E natural gas pipeline assessments indicate that all six of the pipelines would have an impact on the Site. Four of the six pipelines [SP3(b), 191, 191-1(a), and 191-1(c)] would have an impact on the site only under the rupture-explosion scenario. Pipeline 191-1(b) would impact the Site under the rupture-jet fire and rupture-explosion scenarios. Pipeline SP3(a), which transverses the southern boundary of the Site, would have an impact on the Site under three possible scenarios (rupture-jet fire, leak-explosion, and rupture-explosion).

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SP3(a) was the only pipeline to pose significant individual and societal risks to the Site population. The Total Individual Risk (TIR) was estimated to be 2.4 in 1,000,000 at the property line of the Site. The societal risk was shown to be significant (greater than 1 in 100,000) for the rupture-jet fire and rupture-explosion scenarios based on the criterion provided in the May 2002 Protocol.

Site conditions indicate that any release that occurs from the three EBMUD water pipelines along the southern border of the Site would flow east towards W. Leland Road. Even though the water from a potential leak or rupture could flow over the southeastern portion of the Site, the topography of the area would prevent the formation of a 1-foot deep pool within the Site boundaries. On the other side of W. Leland Road, the three EBMUD water lines are above ground for approximately 100 feet and encompassed in a trench. The trench would prevent any water from a leak or rupture on the eastern side of W. Leland Road from flowing west towards the Site.

For the CCWD 42-inch water pipeline, topography indicates the water would flow towards the northeast, which is towards the Site. However, the area between the CCWD 42-inch water pipeline and the Site is vast, containing streets, fields, and developed areas. As a result, water from a leak or rupture of the CCWD water pipeline will most likely not accumulate on the Site in a way that will pose imminent health and safety risks to the school population.

CONCLUSIONS AND RECOMMENDATIONS

The risk analysis indicates that the TIR posed by the PG&E SP3(a) natural gas pipeline is greater than 1 in 1,000,0000, which is considered significant based on the criteria provided in the May 2002 Protocol. In addition, the societal risks for the rupture-jet fire and rupture-explosion scenarios are greater than 1 in 100,000, which is also considered significant based on the criteria provided in the May 2002 Protocol.

In accordance with the May 2002 Protocol, if a Stage 2 analysis indicates that a significant potential risk exists, then a Stage 3 analysis should be conducted to obtain a detailed assessment of risks and to evaluate risk prevention or mitigation measures with the goal of maximizing public safety by reducing overall risk.

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LIMITATIONS

The opinions and recommendations presented in this report are based upon the scope of services, information obtained through performance of the services, and the schedule as agreed upon by LFR and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the environmental consulting industry. No representation, warranty, or guarantee, expressed or implied, is intended or given. To the extent that LFR relied upon any information prepared by other parties not under contract to LFR, LFR makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared for a particular purpose. Only the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Results of any investigation or testing and any findings presented in this report apply solely to conditions existing at the time when LFR's investigative work was performed. It must be recognized that any such investigative or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected. LFR's ability to interpret investigation results is related to the availability of the data and the extent of the investigation activities. As such, 100% confidence in environmental investigation conclusions cannot reasonably be achieved.

LFR, therefore, does not provide any guarantees, certifications, or warranties regarding any conclusions regarding environmental contamination of any such property. Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

It has been a pleasure to work with you on this project. If you have any questions concerning this report or attachments, please call the undersigned at (510) 652-4500.

Sincerely,

Douglas G. Wolf
Principal Engineer

Alan D. Gibbs, R.G., C.HG., R.E.A. II
Principal Hydrogeologist

Attachments

FIGURES

-------- Site Location

0 500 FEET

SOURCE: Google Earth 2006

Site Location Map
Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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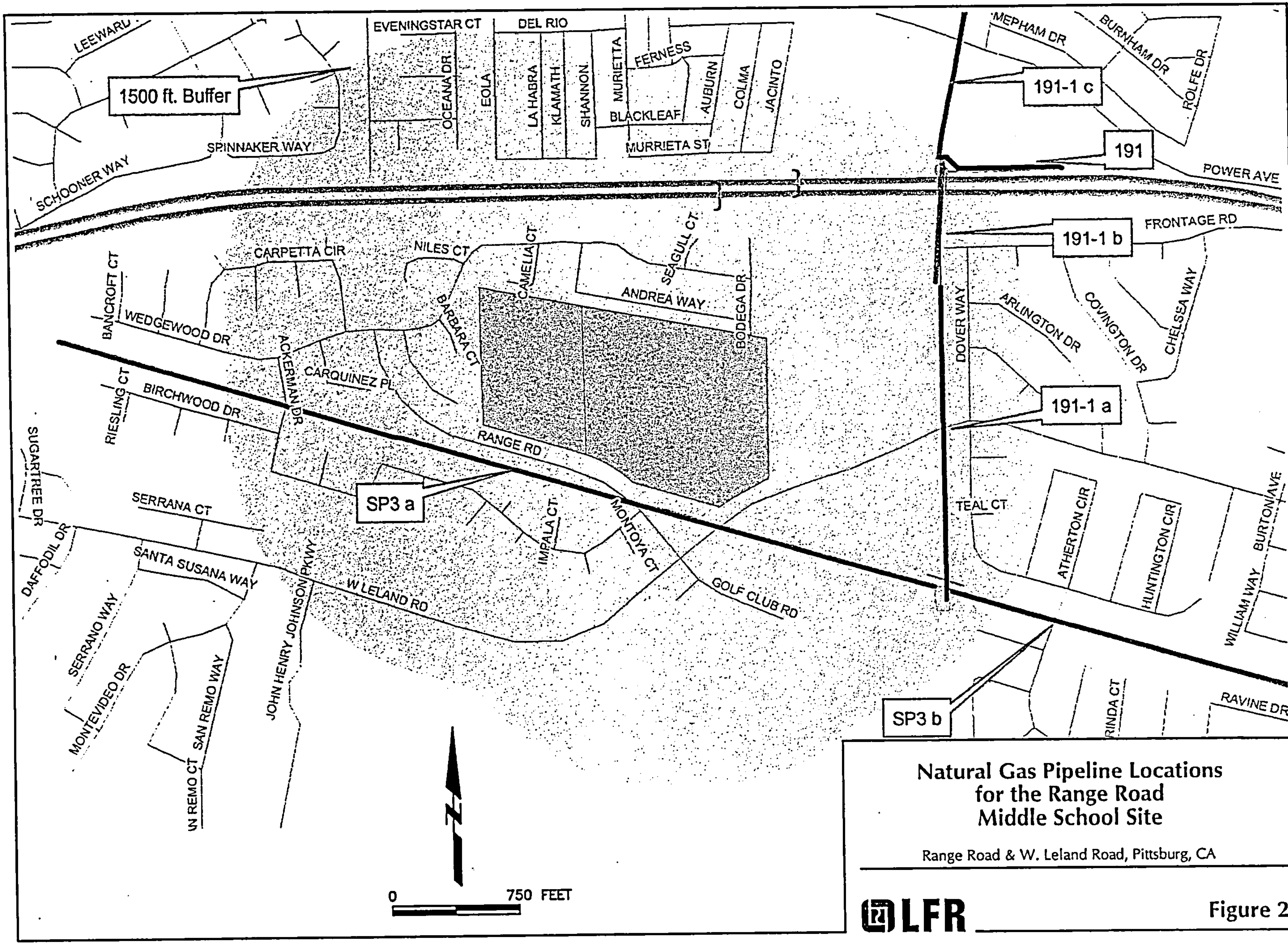
Figure 1

I:\Design\003\09226\01\dwg\Site Location - Range Road Middle School.dwg Jan 17,2007-3:55pm



Natural Gas Pipeline Locations for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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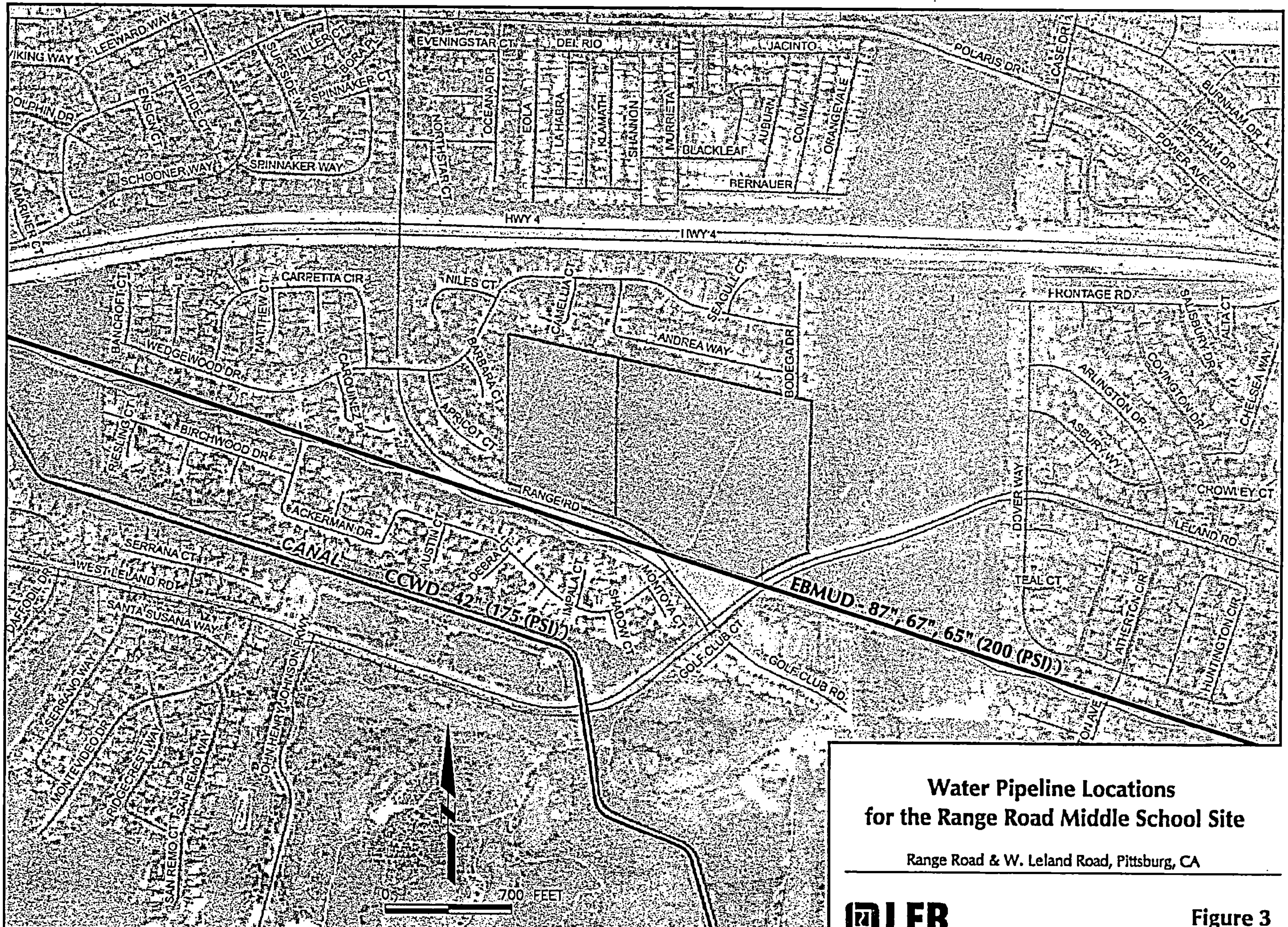
Figure 2



Water Pipeline Locations for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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Figure 3

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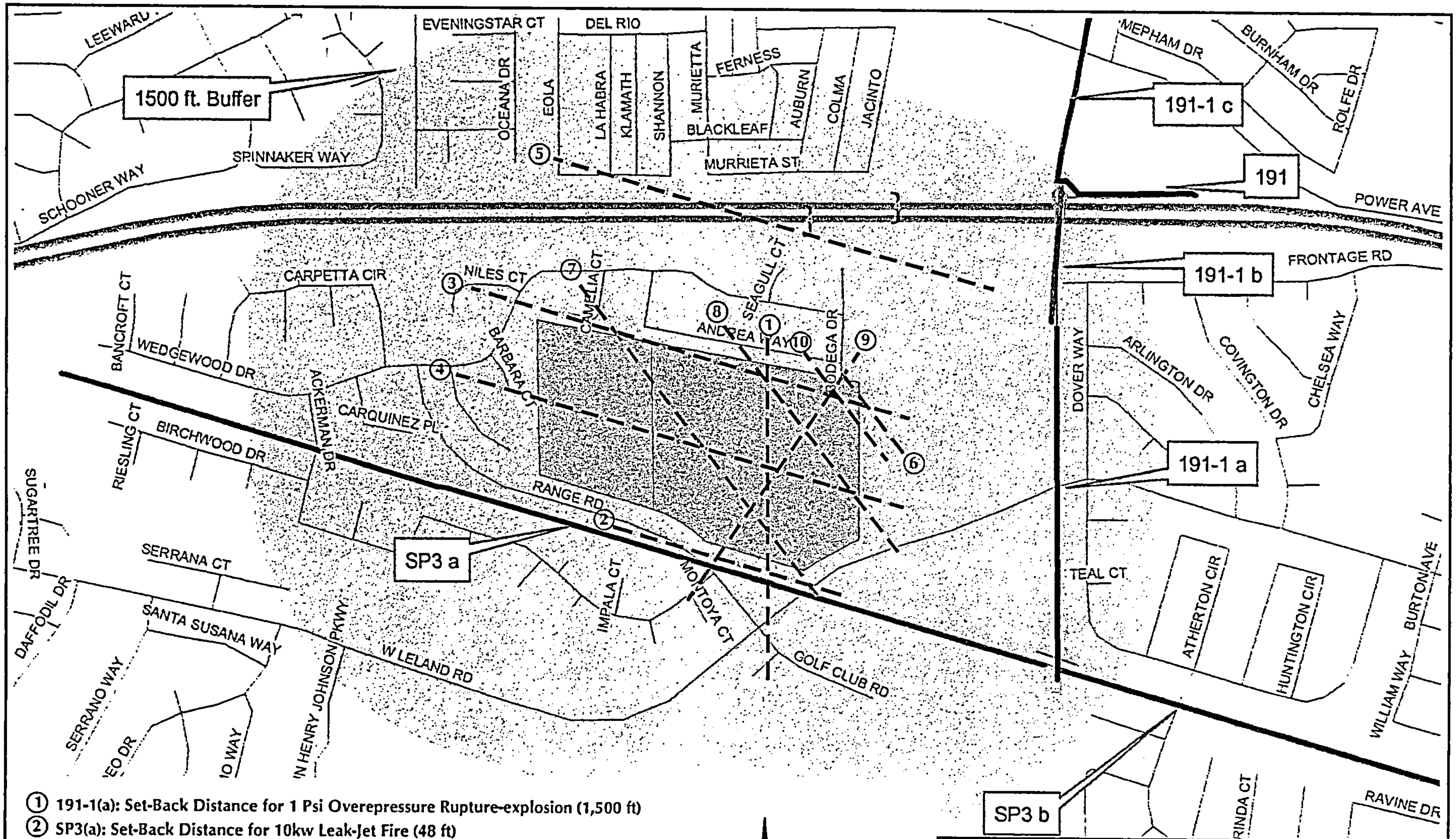

1. 191-1(a): Set-Back Distance for 1 Psi Overepressure Rupture-explosion (1,500 ft)
2. SP3(a): Set-Back Distance for 10kw Leak-Jet Fire (48 ft)
3. SP3(a): Set-Back Distance for 10kw Rupture-Jet Fire (1,030 ft)
4. SP3(a): Set-Back Distance for 1 Psi Overpressure Leak-Explosion (530 ft)
5. SP3(a): Set-Back Distance for 1 Psi Overpressure Rupture-Explosion (1,800 ft)
6. 191-1(b): Set-Back Distance for 1 10kw Rupture-Fire (1,030 ft)
7. 191-1(b): Set-Back Distance for 1 Psi Overpressure Rupture-Jet Fire (1,825 ft)
8. 191: Set-Back Distance for 1 Psi Overpressure Rupture-Explosion (1,875 ft)
9. SP3(b): Set-Back Distance for 1 Psi Overpressure Rupture-Explosion (1,800 ft)
10. 191-1(c): Set-Back Distance for 1 Psi Overpressure Rupture-Explosion (1,575 ft)

N

0 750 FEET

Pipeline Location and Approximate Setback Distances for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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Figure 4

APPENDIX A

PG&E NATURAL GAS PIPELINES

Individual Risk Analysis Probability Calculations

Site:	Range Road Middle School
Pipeline Type:	Natural Gas Transmission Line
Pipe Diameter (inches):	26.00
Pipe Pressure (psig):	600
Pipeline Identificaiton	SP3(a)

Line	Release Probability Calculations	Variable	Value	Data Source
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04	default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.81	local map
3	Base release frequency (releases/year)	F0	9.7E-05	F0 = FT x SEG
4	Base release probability	P0	9.7E-05	P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0	default value
6	Adjusted base probability	P1	9.7E-05	P1 = P0 x PAF
7	Probability of leak	PC1	0.8	default value
8	Probability of rupture	PC2	0.2	default value
9	Probability of ignitition	PC3	0.3	default value
10	Probability of fire upon ignition	PC4	0.7	default value
11	Probability of explosion upon ignition	PC5	0.3	default value
12	Probability of leak-fire	PC6	1.6E-05	PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	4.1E-06	PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	7.0E-06	PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	1.7E-06	PC9 = P1 x PC2 x PC3 x PC5

Individual Risk Calculations by Cause

Line		Variable	Site Location: Centerpoint (580 ft)	Site Location: Property Line (115 ft)	Data Source
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m^2)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m^2)	RF1	32	>37.5	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	83.0%	95.0%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	11.5	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	95%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	6.4	>12	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	43%	100%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	6.7E-07	7.7E-07	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	1.5E-07	1.7E-06	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	8.2E-07	2.4E-06	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	8.2E-01	2.4E+00	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-		sig.	-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.		-

Societal Risk Probability Calculations

Line	Event	Event Probability		Fatality Probability		SP	SC (PCj*SP)	SRC	SC/ SRC	Significant?	
		PCi	Value	PCj	Value					Yes (SC/SRC>1)	No (SC/SRC <=1)
Societal Risk Calculation											
38	leak jet fire	= PC6 x PC16	3.3E-06	= PC12	0	1000	0	1.8	0.0		no
39	rupture jet fire	= PC7 x PC16	8.1E-07	= PC13	0.83	1000	830	3.6	230.6	yes	
40	leak explosion	= PC8 x PC16	1.4E-06	= PC14	0	1000	0	2.6	0.0		no
41	rupture explosion	= PC9 x PC16	3.5E-07	= PC15	0.43	1000	430	5.0	86.0	yes	

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

Individual Risk Analysis Probability Calculations

				Site:	Range Road Middle School
				Pipeline Type:	Natural Gas Transmission Line
				Pipe Diameter (inches):	26.00
				Pipe Pressure (psig):	600
				Pipeline Identificaiton	SP3(b)
Line	Release Probability Calculations	Variable	Value		Data Source
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04		default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.05		local map
3	Base release frequency (releases/year)	F0	6.6E-06		F0 = FT x SEG
4	Base release probability	P0	6.6E-06		P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0		default value
6	Adjusted base probability	P1	6.6E-06		P1 = P0 x PAF
7	Probability of leak	PC1	0.8		default value
8	Probability of rupture	PC2	0.2		default value
9	Probability of ignitition	PC3	0.3		default value
10	Probability of fire upon ignition	PC4	0.7		default value
11	Probability of explosion upon ignition	PC5	0.3		default value
12	Probability of leak-fire	PC6	1.1E-06		PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	2.8E-07		PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	4.7E-07		PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	1.2E-07		PC9 = P1 x PC2 x PC3 x PC5
Individual Risk Calculations by Cause					
			Site Location		
			Centerpoint (2130 ft)	**Property Line (1160 ft)**	
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m^2)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m^2)	RF1	<5	8.0	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	0.0%	0.0%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	<1	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	0.0%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	<1	3.3	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	0.0%	3.0%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	0.0E+00	0.0E+00	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	0.0E+00	7.1E-10	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	0.0E+00	7.1E-10	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	0.0E+00	7.1E-04	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-			-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.	insig.	-

Societal Risk Probability Calculations

Line	Event	Event Probability		Fatality Probability		SP	SC	SRC	SC/	Significant?	
		PCi	Value	PCj	Value		(PCj*SP)		SRC	Yes (SC/SRC>1)	No (SC/SRC <=1)
	Societal Risk Calculation										
38	leak jet fire	= PC6 x PC16	2.2E-07	= PC12	0	1000	0	6	0.0		no
39	rupture jet fire	= PC7 x PC16	5.5E-08	= PC13	0	1000	0	14.0	0.0		no
40	leak explosion	= PC8 x PC16	9.5E-08	= PC14	0	1000	0	10.0	0.0		no
41	rupture explosion	= PC9 x PC16	2.4E-08	= PC15	0	1000	0	18.0	0.0		no

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

Individual Risk Analysis Probability Calculations

				Site:	Range Road Middle School
				Pipeline Type:	Natural Gas Transmission Line
				Pipe Diameter (inches):	24.00
				Pipe Pressure (psig):	720
				Pipeline Identificaiton	191
Line	**Release Probability Calculations**	**Variable**	**Value**		**Data Source**
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04		default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.04		local map
3	Base release frequency (releases/year)	F0	4.4E-06		F0 = FT x SEG
4	Base release probability	P0	4.4E-06		P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0		default value
6	Adjusted base probability	P1	4.4E-06		P1 = P0 x PAF
7	Probability of leak	PC1	0.8		default value
8	Probability of rupture	PC2	0.2		default value
9	Probability of ignitition	PC3	0.3		default value
10	Probability of fire upon ignition	PC4	0.7		default value
11	Probability of explosion upon ignition	PC5	0.3		default value
12	Probability of leak-fire	PC6	7.4E-07		PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	1.9E-07		PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	3.2E-07		PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	7.9E-08		PC9 = P1 x PC2 x PC3 x PC5
Individual Risk Calculations by Cause					
			Site Location		
			Centerpoint (2325 ft)	**Property Line (1500 ft)**	
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m^2)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m^2)	RF1	<5	<5	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	0.0%	0.0%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	<1	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	0.0%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	<1	2.2	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	0.0%	2.0%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	0.0E+00	0.0E+00	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	0.0E+00	3.2E-10	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	0.0E+00	3.2E-10	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	0.0E+00	3.2E-04	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-			-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.	insig.	-

Societal Risk Probability Calculations

Line	Event	Event Probability PCi	Event Probability Value	Fatality Probability PCj	Fatality Probability Value	SP	SC (PCj*SP)	SRC	SC/ SRC	Significant? Yes (SC/SRC>1)	No (SC/SRC <=1)
	Societal Risk Calculation										
38	leak jet fire	= PC6 x PC16	1.5E-07	= PC12	0	1000	0	4	0.0		no
39	rupture jet fire	= PC7 x PC16	3.7E-08	= PC13	0	1000	0	8.0	0.0		no
40	leak explosion	= PC8 x PC16	6.3E-08	= PC14	0	1000	0	6.0	0.0		no
41	rupture explosion	= PC9 x PC16	1.6E-08	= PC15	0	1000	0	13.0	0.0		no

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

Individual Risk Analysis Probability Calculations

				Site:	Range Road Middle School
				Pipeline Type:	Natural Gas Transmission Line
				Pipe Diameter (inches):	20.00
				Pipe Pressure (psig):	390
				Pipeline Identificaiton	191-1(a)
Line	**Release Probability Calculations**	**Variable**	**Value**		**Data Source**
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04		default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.35		local map
3	Base release frequency (releases/year)	F0	4.2E-05		F0 = FT x SEG
4	Base release probability	P0	4.2E-05		P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0		default value
6	Adjusted base probability	P1	4.2E-05		P1 = P0 x PAF
7	Probability of leak	PC1	0.8		default value
8	Probability of rupture	PC2	0.2		default value
9	Probability of ignitition	PC3	0.3		default value
10	Probability of fire upon ignition	PC4	0.7		default value
11	Probability of explosion upon ignition	PC5	0.3		default value
12	Probability of leak-fire	PC6	7.0E-06		PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	1.8E-06		PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	3.0E-06		PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	7.5E-07		PC9 = P1 x PC2 x PC3 x PC5
Individual Risk Calculations by Cause					
			Site Location		
			Centerpoint (1740 ft)	**Property Line (970 ft)**	
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m²)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m²)	RF1	<5	6.5	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	0.0%	0.0%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	<1	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	0.0%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	<1	3.2	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	0.0%	3.0%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	0.0E+00	0.0E+00	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	0.0E+00	4.5E-09	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	0.0E+00	4.5E-09	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	0.0E+00	4.5E-03	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-			-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.	insig.	-

Societal Risk Probability Calculations

Line	Event	Event Probability		Fatality Probability		SP	SC	SRC	SC/	Significant?	
		PCi	Value	PCj	Value		(PCj*SP)		SRC	Yes (SC/SRC>1)	No (SC/SRC <=1)
Societal Risk Calculation											
38	leak jet fire	= PC6 x PC16	1.4E-06	= PC12	0	1000	0	2.6	0.0		no
39	rupture jet fire	= PC7 x PC16	3.5E-07	= PC13	0	1000	0	5.0	0.0		no
40	leak explosion	= PC8 x PC16	6.0E-07	= PC14	0	1000	0	4.0	0.0		no
41	rupture explosion	= PC9 x PC16	1.5E-07	= PC15	0	1000	0	7.5	0.0		no

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

Individual Risk Analysis Probability Calculations

			Site:	Range Road Middle School
			Pipeline Type:	Natural Gas Transmission Line
			Pipe Diameter (inches):	20.00
			Pipe Pressure (psig):	720
			Pipeline Identificaiton	191-1(b)

Line	Release Probability Calculations	Variable	Value		Data Source
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04		default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.15		local map
3	Base release frequency (releases/year)	F0	1.8E-05		F0 = FT x SEG
4	Base release probability	P0	1.8E-05		P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0		default value
6	Adjusted base probability	P1	1.8E-05		P1 = P0 x PAF
7	Probability of leak	PC1	0.8		default value
8	Probability of rupture	PC2	0.2		default value
9	Probability of ignitition	PC3	0.3		default value
10	Probability of fire upon ignition	PC4	0.7		default value
11	Probability of explosion upon ignition	PC5	0.3		default value
12	Probability of leak-fire	PC6	3.0E-06		PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	7.4E-07		PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	1.3E-06		PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	3.2E-07		PC9 = P1 x PC2 x PC3 x PC5
Individual Risk Calculations by Cause					
			Site Location		
			Centerpoint (1935 ft)	**Property Line (970 ft)**	
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m^2)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m^2)	RF1	<5	11.0	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	0.0%	7.5%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	<1	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	0.0%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	<1	4.0	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	0.0%	10.0%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	0.0E+00	1.1E-08	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	0.0E+00	6.3E-09	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	0.0E+00	1.7E-08	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	0.0E+00	1.7E-02	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-			-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.	insig.	-

Societal Risk Probability Calculations

Line	Event	Event Probability PCi	Event Probability Value	Fatality Probability PCj	Fatality Probability Value	SP	SC (PCj*SP)	SRC	SC/ SRC	Significant? Yes (SC/SRC>1)	No (SC/SRC <=1)
	Societal Risk Calculation										
38	leak jet fire	= PC6 x PC16	5.9E-07	= PC12	0	1000	0	4	0.0		no
39	rupture jet fire	= PC7 x PC16	1.5E-07	= PC13	0	1000	0	8.0	0.0		no
40	leak explosion	= PC8 x PC16	2.5E-07	= PC14	0	1000	0	6.0	0.0		no
41	rupture explosion	= PC9 x PC16	6.3E-08	= PC15	0	1000	0	13.0	0.0		no

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

Individual Risk Analysis Probability Calculations

				Site:	Range Road Middle School
				Pipeline Type:	Natural Gas Transmission Line
				Pipe Diameter (inches):	24.00
				Pipe Pressure (psig):	390
				Pipeline Identificaiton	191-1(c)
Line	**Release Probability Calculations**	**Variable**	**Value**		**Data Source**
1	Baseline frequency per pipeline mile (releases/mile-year)	FT	1.2E-04		default from Table 4-3
2	Baseline segment miles within 1,500 feet (miles)	SEG	0.02		local map
3	Base release frequency (releases/year)	F0	2.2E-06		F0 = FT x SEG
4	Base release probability	P0	2.2E-06		P0 = 1 - e(-F0 x t)
5	Probability adjustment factor	PAF	1.0		default value
6	Adjusted base probability	P1	2.2E-06		P1 = P0 x PAF
7	Probability of leak	PC1	0.8		default value
8	Probability of rupture	PC2	0.2		default value
9	Probability of ignitition	PC3	0.3		default value
10	Probability of fire upon ignition	PC4	0.7		default value
11	Probability of explosion upon ignition	PC5	0.3		default value
12	Probability of leak-fire	PC6	3.7E-07		PC6 = P1 x PC1 x PC3 x PC4
13	Probability of rupture-fire	PC7	9.3E-08		PC7 = P1 x PC2 x PC3 x PC4
14	Probability of leak-explosion	PC8	1.6E-07		PC8 = P1 x PC1 x PC3 x PC5
15	Probability of rupture-explosion	PC9	4.0E-08		PC9 = P1 x PC2 x PC3 x PC5
Individual Risk Calculations by Cause					
	—		**Site Location**		
			Centerpoint (2325 ft)	**Property Line (1450 ft)**	
	Jet Fire Impacts				
16	Leak-jet fire impact at site (kW/m^2)	LF1	<5	<5	1-inch-release jet fire radiation exposure from Figure 5
17	Probability of leak-jet fire fatality	PC12	0.0%	0.0%	from Figure 28
18	Rupture-jet fire impact at site (kW/m^2)	RF1	<5	<5	full-bore-release jet fire radiation exposure from Figure 11
19	Probability of rupture-jet fire fatality	PC13	0.0%	0.0%	from Figure 28
	Explosion Impacts				
20	Leak-explosion impact at site (psi)	LE1	<1	<1	1-inch-release overpressure from Figure 18
21	Probability of leak-explosion fatality	PC14	0.0%	0.0%	from Figure 27
22	Rupture-explosion impact at site (psi)	REI	<1	1.5	full-bore-release overpressure from Figure 24
23	Probability of rupture-explosion fatality	PC15	0.0%	2.0%	from Figure 27
	Individual Risk Calculation				
24	Probability of occupancy	PC16	0.2	0.2	default value
25	Annual fire fatality individual risk	FFIR	0.0E+00	0.0E+00	=PC16*(PC10*PC6+PC11*PC7+PC12*PC6+PC13*PC7)
26	Annual explosion fatality individual risk	EFIR	0.0E+00	1.6E-10	= PC16 x (PC14 x PC8 + PC15 x PC9)
27	Total individual risk (TIR)	TIR	0.0E+00	1.6E-10	= FFIR + EFIR
28	Individual risk criterion (IRC)	IRC	1.0E-06	1.0E-06	default value
29	TIR / IRC	TIR/IRC	0.0E+00	1.6E-04	= TIR / IRC
30	If TIR / IRC > 1.0, "significant"	-			-
31	If TIR / IRC <= 1.0, "insignificant"	-	insig.	insig.	-

Societal Risk Probability Calculations

Line	Event	Event Probability PCi	Event Probability Value	Fatality Probability PCj	Fatality Probability Value	SP	SC (PCj*SP)	SRC	SC/ SRC	Significant? Yes (SC/SRC>1)	No (SC/SRC <=1)
Societal Risk Calculation											
38	leak jet fire	= PC6 x PC16	7.4E-08	= PC12	0	1000	0	12	0.0		no
39	rupture jet fire	= PC7 x PC16	1.9E-08	= PC13	0	1000	0	27.0	0.0		no
40	leak explosion	= PC8 x PC16	3.2E-08	= PC14	0	1000	0	15.0	0.0		no
41	rupture explosion	= PC9 x PC16	7.9E-09	= PC15	0	1000	0	30.0	0.0		no

Notes: SP = Site Population
SC = Site Casualties
SRC = Societal Risk Criterion

APPENDIX B

CCWD AND EBMUD WATER LINES

Site:	Range Road Middle School
Pipeline Type:	Water Aqueduct Line
Pipe Diameter (inches):	42.00
Pipe Pressure (psig):	175
Pipeline Identification:	CCWD42

Parameter	Variable	Values		Units	Notes
		Full Bore	1-Inch Leak[1]		
Estimated Amount Released					
Flow (max)	Q	35		MMGal/day	provided by pipeline operator
		24,306		gal/min	unit conversion
	Q_a	3,249		ft^3/min	unit conversion
Pressure (max)	P	175		psig	provided by pipeline operator
Diameter	D_{Pipe}	42.00		inches	provided by pipeline operator
Hole Diameter	$D_{Release}$	42.00	1.00	inches	
Height of Liquid above Hole	LH	na	42.00	inches	IAW Protocol, assumes equal to pipe diameter for conservative, worst-case scenario
Cross-Section Area of Pipe		1,385		in^2	calculated
	CA	9.62		ft^2	unit conversion
Cross-Section Area of Release Hole	HA	na	0.785	in^2	calculated
		na	0.005	ft^2	unit conversion
Release Time	$t_{Release}$	15		min	default from Protocol
Release Pipe Length	$L_{Release}$	25		miles	default from Protocol
Pipeline Pressure (max)	P_T	175.0		psia	total pressure on liquid in pipeline
	I	62.4		lb/ft^3	default from Protocol (41.9 for gasoline or 53 for crude oil)
Density Factor	DF	0.49			calculated
Height of Pipeline at	Z_a	0		feet	
Height of Pipeline at Break Outlet	Z_b	0		feet	
Initial (Inlet) Velocity	v_a	338		ft/min	calculated operational velocity based on Volumetric Flow Rate provided by pipeline operator
Release Velocity	v_b	9,269		ft/min	calculated using OCAG Eqn 7-6 from Protocol
Est Volumetric Release Rate	$Q_{Release\text{-}Est}$	89,178	42	ft^3/min	calculated
		667,096	317	gal/min	calculated based on $M_{Release}$
Volumetric Release Rate		3,249	42	ft^3/min	for full bore: equal to smaller of $Q_{Release\text{-}Est}$ and Q_a
	$Q_{Release}$	24,306	317	gal/min	for 1-inch: based on $M_{Release}$
Mass Release Rate	$M_{Release}$	202,763	2,643	lb/min	aka QR_{Mass}; for Full Bore, calculated based on $Q_{Release}$; for 1-Inch Leak, calculated using OCAG Eqn D-14 from Protocol
Total Released based on Time		48,741	635	ft^3	calculated
	Q_{RelTot}	364,583	4,753	gal	unit conversion
	M_{RelTot}	3,041,444	39,650	lb	aka QS
Total Released based on Pipe Length		1,269,989		ft^3	calculated
	Q_{RelTot}	9,499,516		gal	unit conversion
	M_{RelTot}	79,247,303		lb	aka QS
Pool Dimensions					
Depth (default)		1.0		feet	default from Protocol
Berm Height		4		inches	site conditions (if known)
		0.167		feet	50% factor; unit conversion
Depth to Use	d	1.0		feet	used 1 cm for most conservative, worst-case scenario
Pool Area based on Time	A_{Pool}	48,741	635	ft^2	calculated based on d
Circular Diameter	D	250	29	feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		1,950	26	feet	
Pool Area based on Pipe Length	A_{Pool}	1,269,989		ft^2	calculated based on d
Circular Diameter	D	1,272		feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		50,800		feet	

Site:	Range Road Middle School
Pipeline Type:	Water Aqueduct Line
Pipe Diameter (inches):	87.00
Pipe Pressure (psig):	200
Pipeline Identification:	EBMUD-87

Parameter	Variable	Values		Units	Notes
		Full Bore	1-Inch Leak[1]		
Estimated Amount Released					
Flow (max)	Q	100		MMGal/day	provided by pipeline operator
		69,444		gal/min	unit conversion
	Q_a	9,284		ft^3/min	unit conversion
Pressure (max)	P	200		psig	provided by pipeline operator
Diameter	D_{Pipe}	87.00		inches	provided by pipeline operator
Hole Diameter	$D_{Release}$	87.00	1.00	inches	
Height of Liquid above Hole	LH	na	87.00	inches	IAW Protocol, assumes equal to pipe diameter for conservative, worst-case scenario
Cross-Section Area of Pipe		5,945		in^2	calculated
	CA	41.28		ft^2	unit conversion
Cross-Section Area of Release Hole	HA	na	0.785	in^2	calculated
		na	0.005	ft^2	unit conversion
Release Time	$t_{Release}$	15		min	default from Protocol
Release Pipe Length	$L_{Release}$	25		miles	default from Protocol
Pipeline Pressure (max)	P_T	200.0		psia	total pressure on liquid in pipeline
	I	62.4		lb/ft^3	default from Protocol (41.9 for gasoline or 53 for crude oil)
Density Factor	DF	0.49			calculated
Height of Pipeline at Inlet	Z_a	0		feet	
Height of Pipeline at Break Outlet	Z_b	0		feet	
Initial (Inlet) Velocity	v_a	225		ft/min	calculated operational velocity based on Volumetric Flow Rate provided by pipeline operator
Release Velocity	v_b	9,961		ft/min	calculated using OCAG Eqn 7-6 from Protocol
Est Volumetric Release Rate	$Q_{Release-Est}$	411,235	45	ft^3/min	calculated
		3,076,247	340	gal/min	calculated based on $M_{Release}$
Volumetric Release Rate		9,284	45	ft^3/min	for full bore: equal to smaller of $Q_{Release-Est}$ and Q_a
	$Q_{Release}$	69,444	340	gal/min	for 1-inch: based on $M_{Release}$
Mass Release Rate	$M_{Release}$	579,323	2,836	lb/min	aka QR_{Mass}; for Full Bore, calculated based on $Q_{Release}$; for 1-Inch Leak, calculated using OCAG Eqn D-14 from Protocol
Total Released based on Time		139,260	682	ft^3	calculated
	Q_{RelTot}	1,041,667	5,099	gal	unit conversion
	M_{RelTot}	8,689,840	42,535	lb	aka QS
Total Released based on Pipe Length		5,449,289		ft^3	calculated
	Q_{RelTot}	40,760,680		gal	unit conversion
	M_{RelTot}	340,035,622		lb	aka QS
Pool Dimensions					
Depth (default)		1.0		feet	default from Protocol
Berm Height		4		inches	site conditions (if known)
		0.167		feet	50% factor; unit conversion
Depth to Use	d	1.0		feet	used 1 cm for most conservative, worst-case scenario
Pool Area based on Time	A_{Pool}	139,260	682	ft^2	calculated based on d
Circular Diameter	D	422	30	feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		5,571	28	feet	
Pool Area based on Pipe Length	A_{Pool}	5,449,289		ft^2	calculated based on d
Circular Diameter	D	2,635		feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		217,972		feet	

Site:	Range Road Middle School
Pipeline Type:	Water Aqueduct Line
Pipe Diameter (inches):	67.00
Pipe Pressure (psig):	200
Pipeline Identification:	EBMUD-67

Parameter	Variable	Values		Units	Notes
		Full Bore	1-Inch Leak[1]		
Estimated Amount Released					
Flow (max)	Q	50		MMGal/day	provided by pipeline operator
		34,722		gal/min	unit conversion
	Q_a	4,642		ft^3/min	unit conversion
Pressure (max)	P	200		psig	provided by pipeline operator
Diameter	D_{Pipe}	67.00		inches	provided by pipeline operator
Hole Diameter	$D_{Release}$	67.00	1.00	inches	
Height of Liquid above Hole	LH	na	67.00	inches	IAW Protocol, assumes equal to pipe diameter for conservative, worst-case scenario
Cross-Section Area of Pipe		3,526		in^2	calculated
	CA	24.48		ft^2	unit conversion
Cross-Section Area of Release Hole	HA	na	0.785	in^2	calculated
		na	0.005	ft^2	unit conversion
Release Time	$t_{Release}$	1.5		min	default from Protocol
Release Pipe Length	$L_{Release}$	25		miles	default from Protocol
Pipeline Pressure (max)	P_T	200.0		psia	total pressure on liquid in pipeline
	I	62.4		lb/ft^3	default from Protocol (41.9 for gasoline or 53 for crude oil)
Density Factor	DF	0.49			calculated
Height of Pipeline at Inlet	Z_a	0		feet	
Height of Pipeline at Break Outlet	Z_b	0		feet	
Initial (Inlet) Velocity	v_a	190		ft/min	calculated operational velocity based on Volumetric Flow Rate provided by pipeline operator
Release Velocity	v_b	9,961		ft/min	calculated using OCAG Eqn 7-6 from Protocol
Est Volumetric Release Rate	$Q_{Release\text{-}Est}$	243,876	45	ft^3/min	calculated
		1,824,317	339	gal/min	calculated based on $M_{Release}$
Volumetric Release Rate		4,642	45	ft^3/min	for full bore: equal to smaller of $Q_{Release\text{-}Est}$ and Q_a
	$Q_{Release}$	34,722	339	gal/min	for 1-inch: based on $M_{Release}$
Mass Release Rate	$M_{Release}$	289,661	2,831	lb/min	aka QR_{Mass}; for Full Bore, calculated based on $Q_{Release}$; for 1-Inch Leak, calculated using OCAG Eqn D-14 from Protocol
Total Released based on Time		69,630	680	ft^3	calculated
	Q_{RelTot}	520,833	5,090	gal	unit conversion
	M_{RelTot}	4,344,920	42,459	lb	aka QS
Total Released based on Pipe Length		3,231,848		ft^3	calculated
	Q_{RelTot}	24,174,223		gal	unit conversion
	M_{RelTot}	201,667,315		lb	aka QS
Pool Dimensions					
Depth (default)		1.0		feet	default from Protocol
Berm Height		4		inches	site conditions (if known)
		0.167		feet	50% factor; unit conversion
Depth to Use	d	1.0		feet	used 1 cm for most conservative, worst-case scenario
Pool Area based on Time	A_{Pool}	69,630	680	ft^2	calculated based on d
Circular Diameter	D	298	30	feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		2,786	28	feet	
Pool Area based on Pipe Length	A_{Pool}	3,231,848		ft^2	calculated based on d
Circular Diameter	D	2,029		feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		129,274		feet	

Site:	Range Road Middle School
Pipeline Type:	Water Aqueduct Line
Pipe Diameter (inches):	65.00
Pipe Pressure (psig):	200
Pipeline Identification:	EBMUD-65

Parameter	Variable	Values		Units	Notes
		Full Bore	1-Inch Leak[1]		
Estimated Amount Released					
Flow (max)	Q	40		MMGal/day	provided by pipeline operator
		27,778		gal/min	unit conversion
	Q_a	3,714		ft³/min	unit conversion
Pressure (max)	P	200		psig	provided by pipeline operator
Diameter	D_{Pipe}	65.00		inches	provided by pipeline operator
Hole Diameter	$D_{Release}$	65.00	1.00	inches	
Height of Liquid above Hole	LH	na	65.00	inches	IAW Protocol, assumes equal to pipe diameter for conservative, worst-case scenario
Cross-Section Area of Pipe		3,318		in²	calculated
	CA	23.04		ft²	unit conversion
Cross-Section Area of Release Hole	HA	na	0.785	in²	calculated
		na	0.005	ft²	unit conversion
Release Time	$t_{Release}$	15		min	default from Protocol
Release Pipe Length	$L_{Release}$	25		miles	default from Protocol
Pipeline Pressure (max)	P_T	200.0		psia	total pressure on liquid in pipeline
	I	62.4		lb/ft³	default from Protocol (41.9 for gasoline or 53 for crude oil)
Density Factor	DF	0.49			calculated
Height of Pipeline at Inlet	Z_a	0		feet	
Height of Pipeline at Break Outlet	Z_b	0		feet	
Initial (Inlet) Velocity	v_a	161		ft/min	calculated operational velocity based on Volumetric Flow Rate provided by pipeline operator
Release Velocity	v_b	9,960		ft/min	calculated using OCAG Eqn 7-6 from Protocol
Est Volumetric Release Rate	$Q_{Release\text{-}Est}$	229,522	45	ft³/min	calculated
		1,716,941	339	gal/min	calculated based on $M_{Release}$
Volumetric Release Rate		3,714	45	ft³/min	for full bore: equal to smaller of $Q_{Release\text{-}Est}$ and Q_a
	$Q_{Release}$	27,778	339	gal/min	for 1-inch: based on $M_{Release}$
Mass Release Rate	$M_{Release}$	231,729	2,830	lb/min	aka QR_{Mass}; for Full Bore, calculated based on $Q_{Release}$; for 1-Inch Leak, calculated using OCAG Eqn D-14 from Protocol
Total Released based on Time		55,704	680	ft³	calculated
	Q_{RelTot}	416,667	5,089	gal	unit conversion
	M_{RelTot}	3,475,936	42,452	lb	aka QS
Total Released based on Pipe Length		3,041,782		ft³	calculated
	Q_{RelTot}	22,752,527		gal	unit conversion
	M_{RelTot}	189,807,174		lb	aka QS
Pool Dimensions					
Depth (default)		1.0		feet	default from Protocol
Berm Height		4		inches	site conditions (if known)
		0.167		feet	50% factor; unit conversion
Depth to Use	d	1.0		feet	used 1 cm for most conservative, worst-case scenario
Pool Area based on Time	A_{Pool}	55,704	680	ft²	calculated based on d
Circular Diameter	D	267	30	feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		2,229	28	feet	
Pool Area based on Pipe Length	A_{Pool}	3,041,782		ft²	calculated based on d
Circular Diameter	D	1,968		feet	calculated; assume circular release to obtain entire area
Width		25		feet	
Rectangular Length		121,672		feet	

LFR ENVIRONMENTAL MANAGEMENT & CONSULTING ENGINEERING

January 23, 2007

003-09226-01

Mr. Mark Bonnett
Assistant Superintendent
Business Services
Pittsburg Unified School District
2000 Railroad Avenue
Pittsburg, CA 94565

Subject: Final Report – Stage 3 Pipeline Risk Analysis Report, Range Road Middle School site, Pittsburg, California.

Dear Mr. Bonnett:

LFR, Inc. (LFR) is pleased to provide this report to the Pittsburg Unified School District (PUSD) presenting the findings of a Stage 3 pipeline risk analysis for the proposed Range Road Middle School site. The site is to be located at the corner of Range Rd. and W. Leland Rd. in Pittsburg, California ("the Site"; Figure 1). This analysis has been completed in accordance with our proposal dated July 21, 2006.

This report presents an evaluation of potential risks to identify imminent health and safety threats to students, faculty, and staff within the boundary of the Site and provide suggestions for risk control through preventative and mitigation measures. This report was prepared in accordance with California Education Code Section 17213 and summarizes the evaluation's findings as well as describes the methodology used.

EXECUTIVE SUMMARY

Potential consequences of accidental releases were considered from six (6) natural gas pipelines (PG&E), three (3) East Bay Municipal Utility District (EBMUD) water pipelines, and one (1) Contra Costa Water District (CCWD) water pipeline located within 1,500 feet of the Site's boundary lines.

A Stage 2 pipeline risk analysis was performed for the six natural gas pipelines and the four water pipelines. The results of the risk analysis were discussed in LFR's report entitled "Stage 2 Pipeline Risk Analysis of the Natural Gas Pipelines and Water Pipelines located within 1,500 feet of the proposed Range Road Middle School site, Pittsburg, California" dated September 30, 2006 ("Stage 2 Pipeline Risk Analysis"). The Stage 2 report is included as Appendix A and includes a description of the risk analysis methodology, map of the site vicinity and pipeline locations, detailed calculations, and risk analysis findings.

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In the Stage 2 Risk Analysis, five of the six natural gas pipelines were found to pose an insignificant individual and societal risk to the Site. However, one of the natural gas pipelines [PG&E: SP3(a)] was found to pose a significant individual and societal risk to the Site if a full rupture release of the pipeline were to occur and the release were to ignite, resulting in a vapor cloud explosion. The Stage 2 Risk Analysis recommended risk mitigation measures be developed and evaluated as a part of a more detailed site-specific risk analysis (Stage 3).

According to topographic maps, the Site is located on land that gradually slopes to the east. As a result, a leak or rupture from any of the four (4) water pipelines will most likely not accumulate on the Site in a way that will pose imminent health and safety risks to the school population.

Site specific preventative and mitigation measures developed in this Stage 3 risk analysis should reduce the individual and societal risk at the Site to within acceptable limits. Measures discussed include operator's practices, school practices, and site plan considerations.

Geotechnical Analysis

Two types of accidental release scenarios were assessed during the Stage 2 pipeline risk analysis. The first scenario was a leak due to a 1-inch diameter hole in a pipeline. Such a leak could result from various incidents, including accidents during excavation along the pipelines. This is the most common type of release event and is evaluated in all pipeline assessments. The second scenario was a full pipeline rupture. A full pipeline rupture is less likely to occur and is usually only considered if the subject site is within an active seismic region or may be subject to potential landslide or ground erosion. Geologic or geotechnical conditions that could affect the performance of a pipeline are related to ground movement such as landsliding, fault rupture, or liquefaction due to ground shaking.

The Geohazards report done for the Site by CRA (CRA, 2005) identified one seismic hazard that could affect the proposed Range Road Middle School site. The Greenville fault, which is classified as a "Type B" fault in the Unified Building Code (UBC), is located approximately three miles southwest of the Site. The geohazard report states that this fault has potential to generate a Maximum Credible Earthquake of M-6.9, which could result in significant seismic ground motion. Therefore, state law mandates that UBC Seismic Zone 4 parameters (i.e. building design) be implemented.

According to the geotechnical report conducted by Kleinfelder (Kleinfelder, 2006), an issue that may affect the Site is the presence of near-surface expansive soils throughout the Site. Potential impacts of these soils on project features may include post-construction movement or heave of concrete slabs and lightly loaded foundations. Recommendations and mitigation measures (i.e. positive site drainage, replacing top layer with fill) to deal with the expansive soils are further outlined in the geotechnical report.

The potential for fault rupture is considered remote since the pipelines do not cross an active fault (with surface expression) within a few miles of the Site area. Also, the potential for slope failure and inundation from flooding of nearby watercourses or failure of reservoirs is considered very low.

Liquefaction risk is not usually regarded as significant if the water table is more than 50 feet below ground surface. Based on the borings collected by Kleinfelder for the geotechnical report, the Site is underlain by interbedded layer of very stiff to hard clay/silt soils. Free ground water was not observed within 50 feet of the surface, thus making the potential for liquefaction at the Site low. Moreover, the plasticity index (PI) of the soil material is greater than 12, which classifies the soil as "not potentially liquefiable".

Electric Power Line Analysis

California Code of Regulation (CCR) Title 5, Section 14010(c) requires that the property line of a proposed school site, even if it is a joint use area, be located the following minimum distances from the edge of power-line easements unless an analysis is provided that incorporates buffering or shielding of the lines:

- 100 feet for a 50- to 133-kilovolt (kV) line
- 150 feet for a 220- to 230-kV line
- 350 feet for a 500- to 550-kV line

The primary concern is electromagnetic fields and their potential health effects on persons using the Site.

Currently, the eastern edge of the proposed Site is located near a PG&E easement containing two 230 kilovolt (kV) power lines (Figure 2). The boundary of the PG&E easement is approximately 50 feet from the Site. Since the setback distance required from a 230kV easement is 150 feet, it is recommended that no buildings or playfields be constructed within 100 feet of the Site's eastern boundary. The architectural site plans produced by California Design (West Architects, Inc.) for the Range Road Middle School site have incorporated the recommended setback distance of 150 feet and the associated design restrictions (Attachment 1). Same as at Central?

Risk Control Through Prevention and Mitigation (Stage 3)

The May 2002 Protocol identifies commonly adhered to measures that can potentially reduce risk, including pipeline operator's practices, school site practices, and school design factors. LFR has also investigated additional mitigation measures that are not specifically addressed in the Protocol in order to further improve the safety of the Site population. These measures are discussed below and evaluated based on Site conditions to assess whether the measures could potentially reduce the risk posed by the pipelines.

Operator's Practices

The May 2002 Protocol identifies commonly adhered to risk control measures, including the Code of Federal Regulations, Title 49, Part 192, that defines prevention and mitigation measures for many different types of pipeline leaks. In particular, an operator's practice must conform to the minimum requirements of applicable federal or state regulations. In practice, pipeline operators adhere to these requirements.

A common cause of pipeline leaks that may lead to explosions/jet fires is excavation activities. In order to lower the risk of potential incidences during excavation near the pipelines, LFR has prepared a Risk Management Plan (see Attachment 2). The Risk Management Plan (RMP) highly recommends notification to school officials (PUSD Assistant Superintendent and Principal of Range Road Middle School) prior to any excavation or maintenance activities of any pipeline segment located within 1,500 feet of the school boundary. It also outlines the proper procedures to follow in the event of an accidental release incident. LFR recommends this RMP be filed with the local public works department and utility company.

School Site Practices

Mitigation measures are usually pre-engineered systems, procedures, and practices that reduce the consequences of a pipeline product release. Emergency preparedness and emergency response plans are among the basic elements of mitigation.

LFR has prepared an Emergency Evacuation Plan (EEP) as part of the RMP for the Site. The EEP outlines appropriate evacuation routes and procedures for the Site population in the event of a release incident. In accordance with the setback distances recommended in this pipeline risk assessment, the emergency evacuation areas are located at least 530 feet (leak-explosion setback distance) from the SP3(a) pipeline. Routine emergency evacuation drills should also be performed to allow all site occupants to be familiar with the procedures.

Site Layout Considerations

PG&E has maintained Incident Statistics since 1984 which show that no full ruptures of pipelines greater than 4-inch nominal diameter or .5 inches in wall thickness have occurred. According to the document entitled, "California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis, Revised Draft 2", dated September, 2005, incident statistics can be used in a Stage 3 analysis to determine the risk probability. In the Stage 2 analysis, a probability of 20% for a full rupture release event was assumed. By using the PG&E incident statistics in the Stage 3 analysis, risk due to a full pipeline rupture would be eliminated for all six of the PG&E natural gas pipelines within 1,500 feet of the Site boundary.

It is LFR's opinion that site safety would be adequately addressed by implementing a project design according to the constraints shown in Figure 3. Segment A corresponds to the setback distance of 530 feet from the SP3(a) pipeline location (southern boundary of Site). As stated on

Figure 3, any buildings, playfields, or parking located in this area would require mitigation such as blastwalls, berms, or structural reinforcement designed for the psi values listed in Table 1:

Table 1

SP3(a) 26-inch NG (600 psi max)

Overpressure (psi)	Distance from pipeline (ft)
>12	<100
7.8	150
5.0	200
4.3	250
3.7	300
3.2	350
2.5	400
1.8	450
1.4	500

On December 15, 2006, LFR attended a meeting with Mr. Mark Bonnett (PUSD Assistant Superintendent), Mr. Jim Bush (School Site Solutions), Mr. Mitch McAllister (Design West), and Mr. Steven Granieri (SMF Consulting) to discuss the Site layout and structural design of Range Road Middle School. At the meeting, it was determined that the structural integrity of the buildings located within the 530-foot setback will be designed to withstand the side-on overpressure from a leak-explosion blast (which is based on the building's distance from the pipeline as outlined in Table 1). Mr. Granieri, a blast window consultant, recommended windows that will be able to withstand the designated psi values at a given distance from the pipeline as shown in Table 1. A summary of his recommendations and qualifications can be found in Attachment 3. The window performance design will be HS-HC50 or HS-AW40 and will also incorporate partial or full lamination of the glass.

As shown in Attachment 1, there are parking areas and two basketball courts located within 530 feet of the SP3(a) natural gas pipeline. It is LFR's opinion that no additional mitigation is required for these areas since they lay approximately 15 feet below the pipeline elevation. The molecular weight of natural gas (CH_4) is less than that of air. Therefore, the blast from a leak-explosion will approach the Site at an angle and will most likely not impact the parking areas and basketball courts significantly since they are at a lower elevation than the pipeline.

A setback distance of 150 feet from the PG&E 230 kV power line easement on the eastern edge of the Site will be observed. Currently, the only feasible mitigation measure that would reduce the potential impact from the electromagnetic fields within the 150 foot setback distance is to bury and shield the power lines. Therefore, the setback area will not contain any buildings, playfields, or parking.

Conclusions and Recommendations

To reduce the individual and societal risk posed by the SP3(a) pipeline at the property boundary and centerpoint of the Site, preventative and mitigation measures have been developed. Implementation of the following measures should reduce the individual and societal risk at the Site to within acceptable levels:

- Follow the Risk Management Plan (RMP) as outlined in Attachment 2
- Adhere to the design constraints labeled in Figure 3
- Construct the buildings and windows within the 530-foot setback to withstand the designated psi values at a given distance from the pipeline as shown in Table 1

Limitations

The opinions and recommendations presented in this report are based upon the scope of services, information obtained through performance of the services, and the schedule as agreed upon by LFR and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the environmental consulting industry. No representation, warranty, or guarantee, expressed or implied, is intended or given. To the extent that LFR relied upon any information prepared by other parties not under contract to LFR, LFR makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared for a particular purpose. Only the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Results of any investigation or testing and any findings presented in this report apply solely to conditions existing at the time when LFR's investigative work was performed. It must be recognized that any such investigative or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected. LFR's ability to interpret investigation results is related to the availability of the data and the extent of the investigation activities. As such, 100% confidence in environmental investigation conclusions cannot reasonably be achieved.

LFR, therefore, does not provide any guarantees, certifications, or warranties regarding any conclusions regarding environmental contamination of any such property. Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

LFR

It has been a pleasure to work with you on this project. If you have any questions concerning this report or attachments, please call the undersigned at (510) 652-4500.

Sincerely,

Douglas G. Wolf
Principal Engineer

Alan D. Gibbs, R.G., C.HG., R.E.A. II
Principal Hydrogeologist

Attachments

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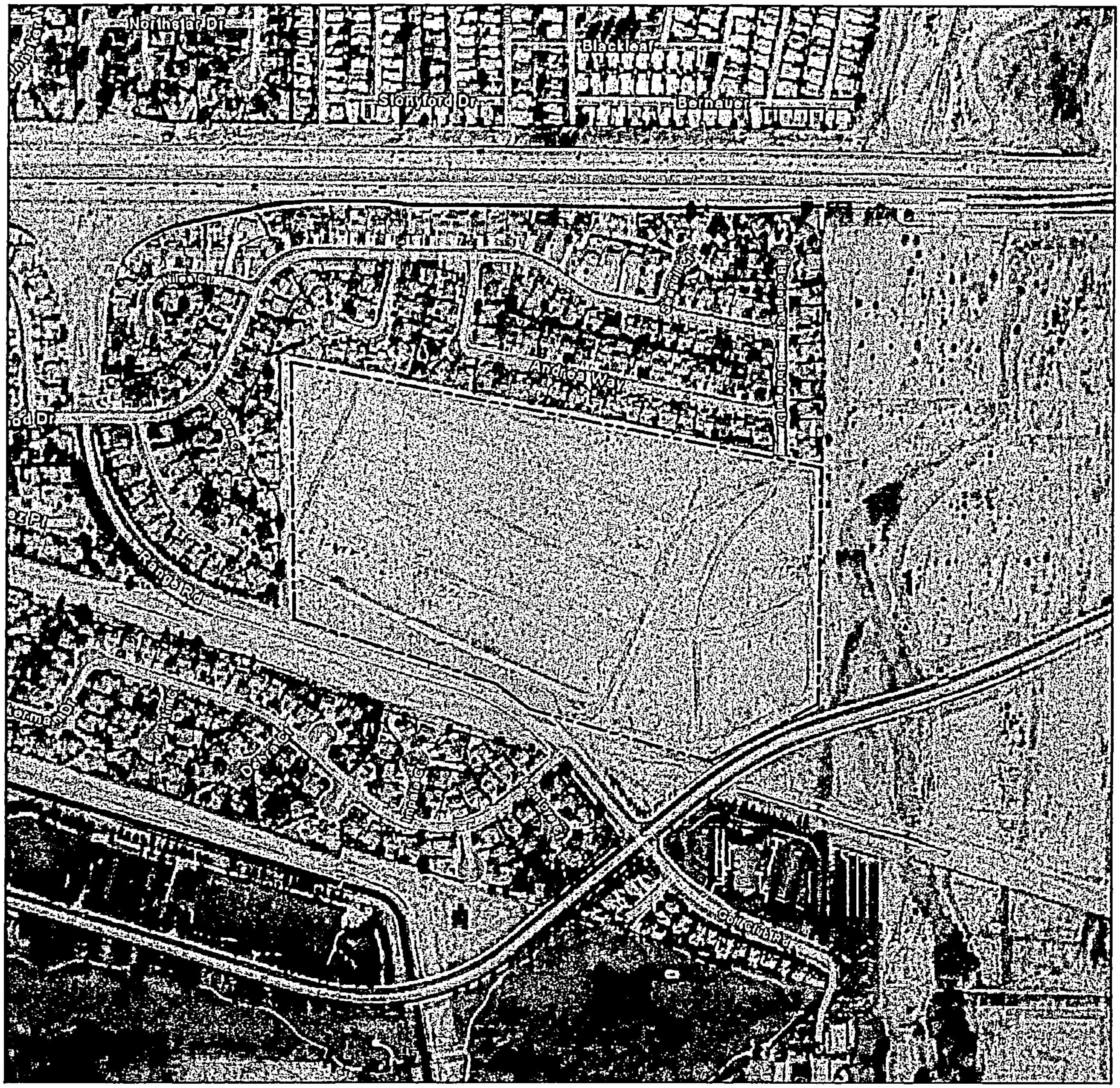
References

CRA, March 2005. Geological Hazards Assessment, Range Road Middle School Site. October 1.

Kleinfelder, May 2006. Geotechnical investigation Report, Range Road Middle School Site. October 1.

FIGURES



- - - - - - - - Site Location

0 500 FEET

SOURCE: Google Earth 2006

Site Location Map
Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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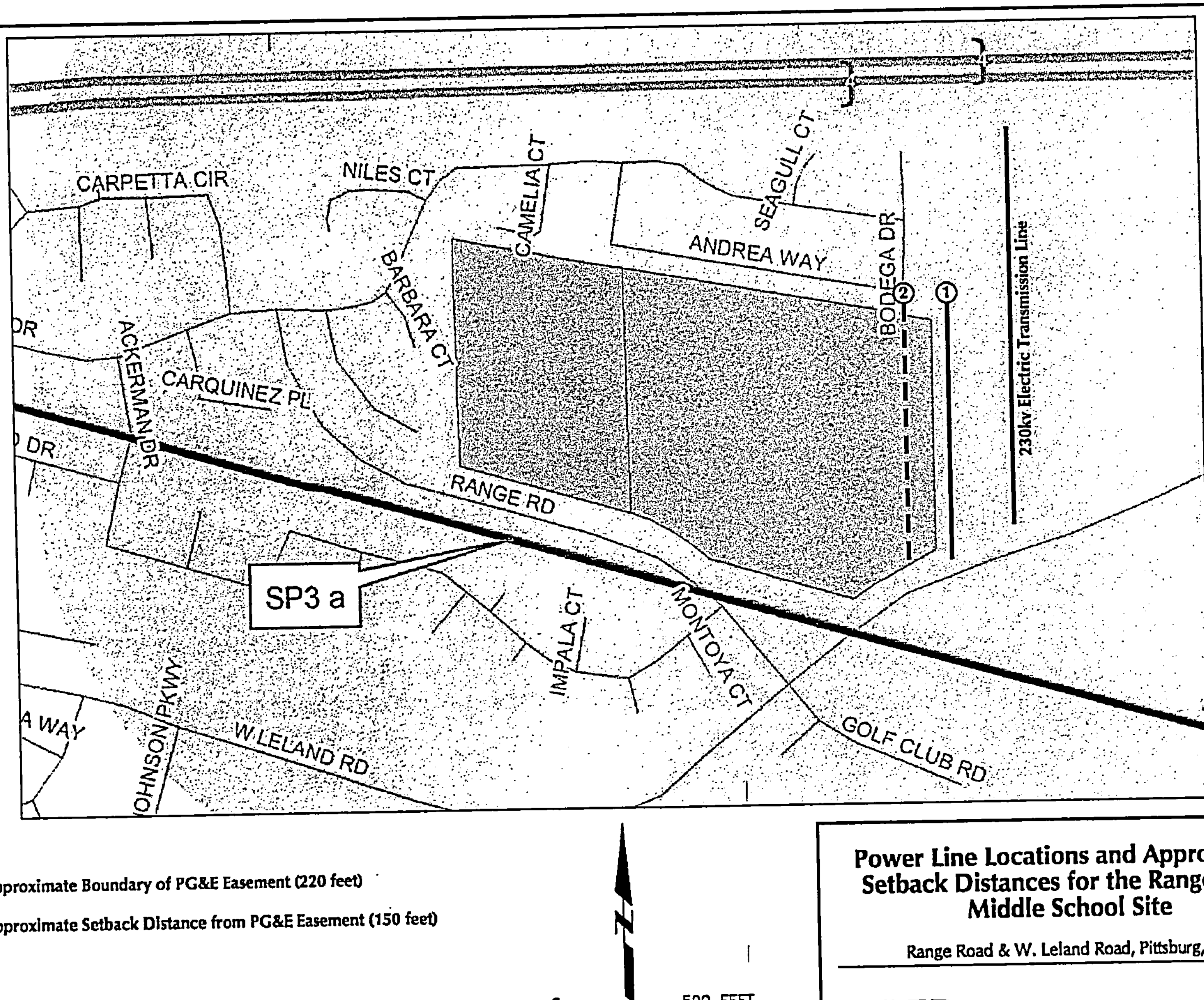
Figure 1

I:\Design\003\09226\01\dwg\Site Location - Range Road Middle School.dwg Jan 17,2007-3:55pm



① Approximate Boundary of PG&E Easement (220 feet)

② Approximate Setback Distance from PG&E Easement (150 feet)

Power Line Locations and Approximate Setback Distances for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

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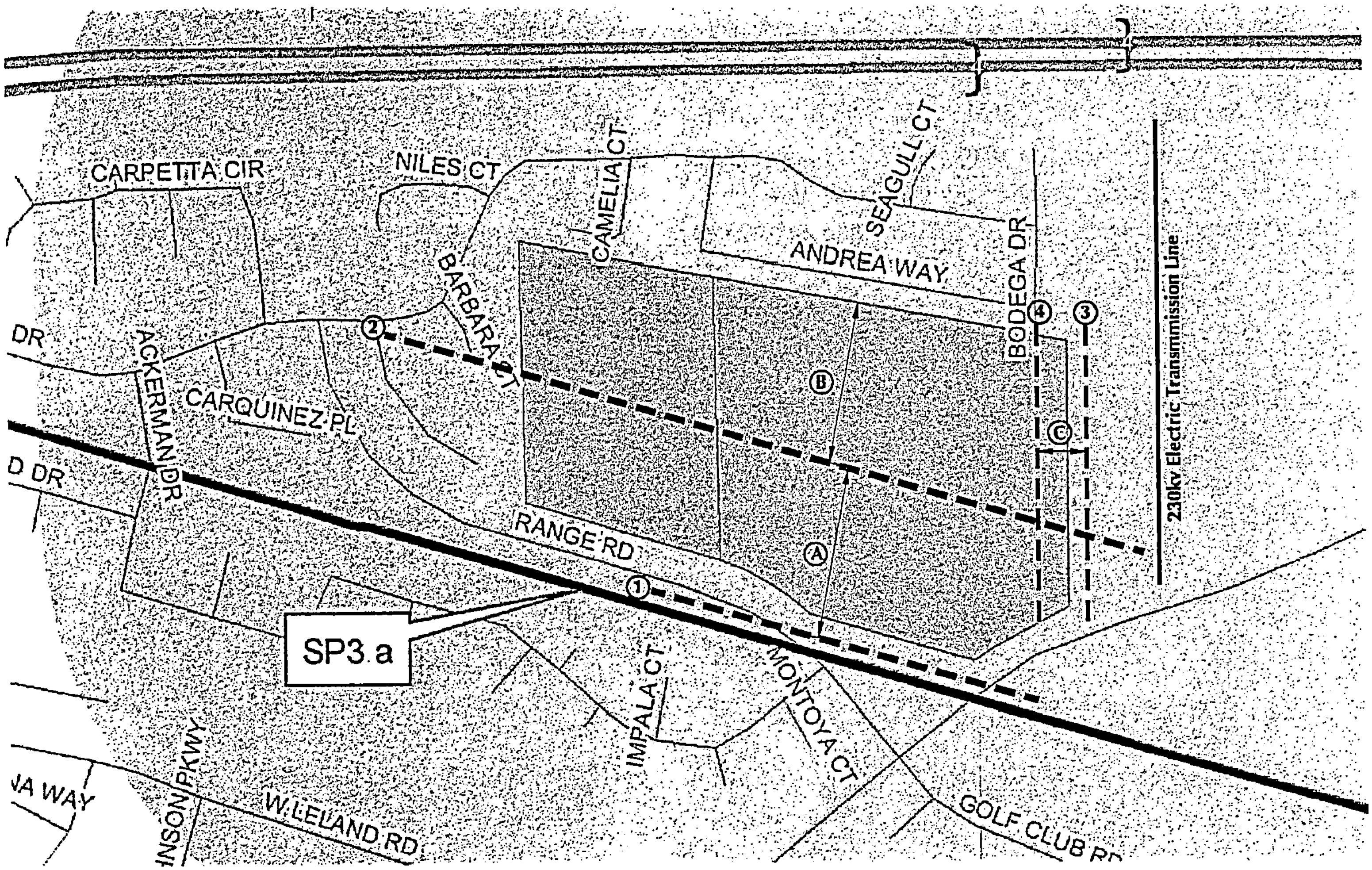
Figure 2

I:\Design\003\09226\01\dwg\Site Plan w PowerLines and Setbacks.dwg Jan 16,2007-10:54am



① SP3(a): Set-Back Distance for 10kw Leak-Jet Fire (48 ft)

② SP3(a): Set-Back Distance for 1 Psi Overpressure Leak-Explosion (530 ft)

③ Approximate Boundary of PG&E Easement (220 feet)

④ Approximate Set-Back Distance from PG&E Easement (150 feet)

Ⓐ Buildings & playfields may be permitted by CDE if protected by berms, blastwalls, or structural reinforcement designed for the listed psi value

Ⓑ Buildings, playfields, & parking will be permitted by CDE with no mitigation requirements

Ⓒ No buildings or playfields permitted by CDE. Parking & Driveways may be permitted by CDE.

N

0 500 FEET

Approximate Setback Distances for the Natural Gas Pipeline and Power Lines for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

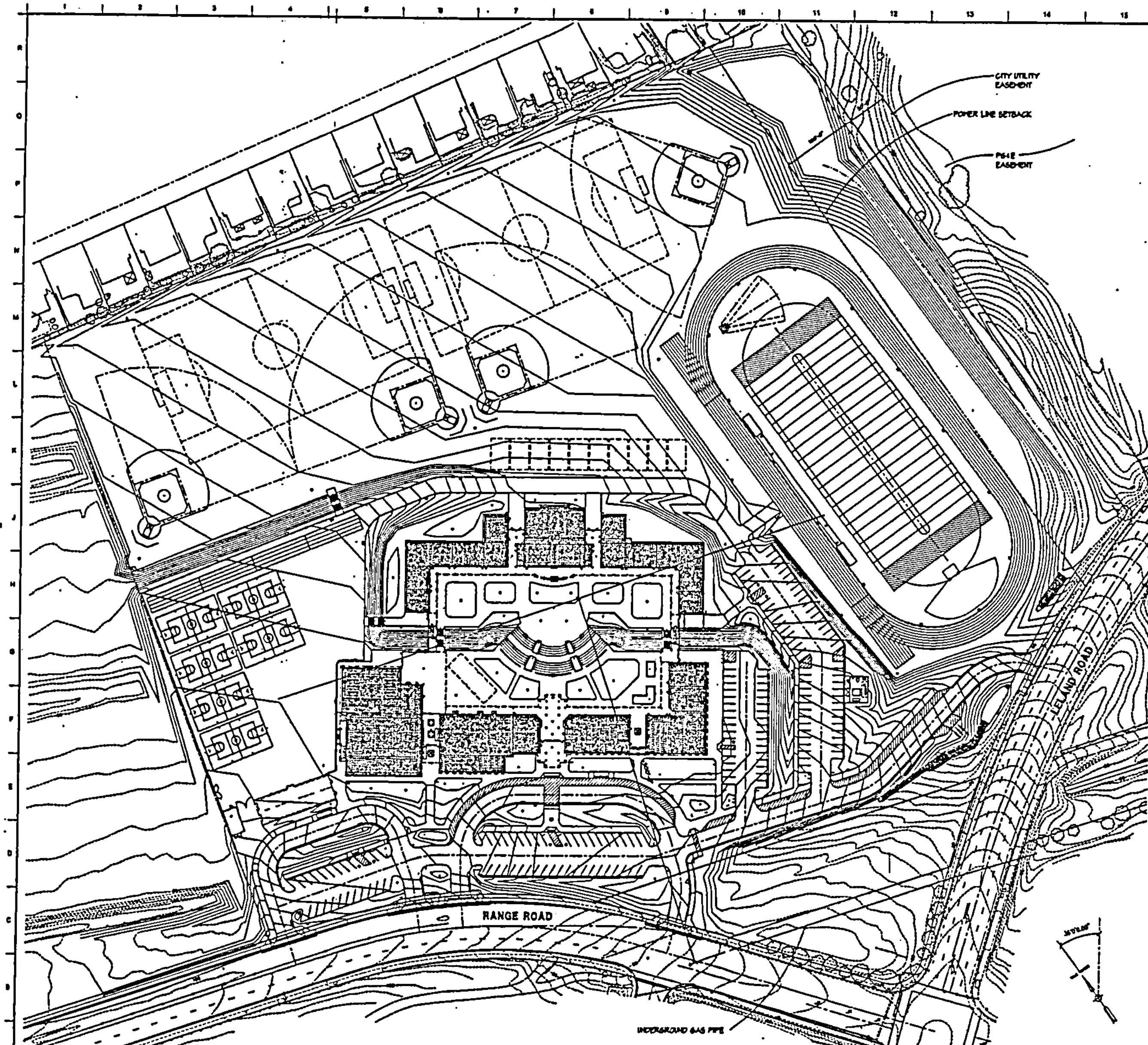
LFR

Figure 3

I:\Design\003\09226\01\dwg\Site Plan Natural Gas and Powerlines.dwg Jan 17,2007-3:50pm

ATTACHMENT 1

SITE PLAN FOR RANGE ROAD MIDDLE SCHOOL



A1 OVERALL DRAINAGE PLAN

LEGEND

NOTES

DESIGN California WEST

CALIFORNIA DESIGN WEST ARCHITECTS, Inc.

RANGE ROAD MIDDLE SCHOOL

RANGE ROAD
PITTSBURG, CA 94565

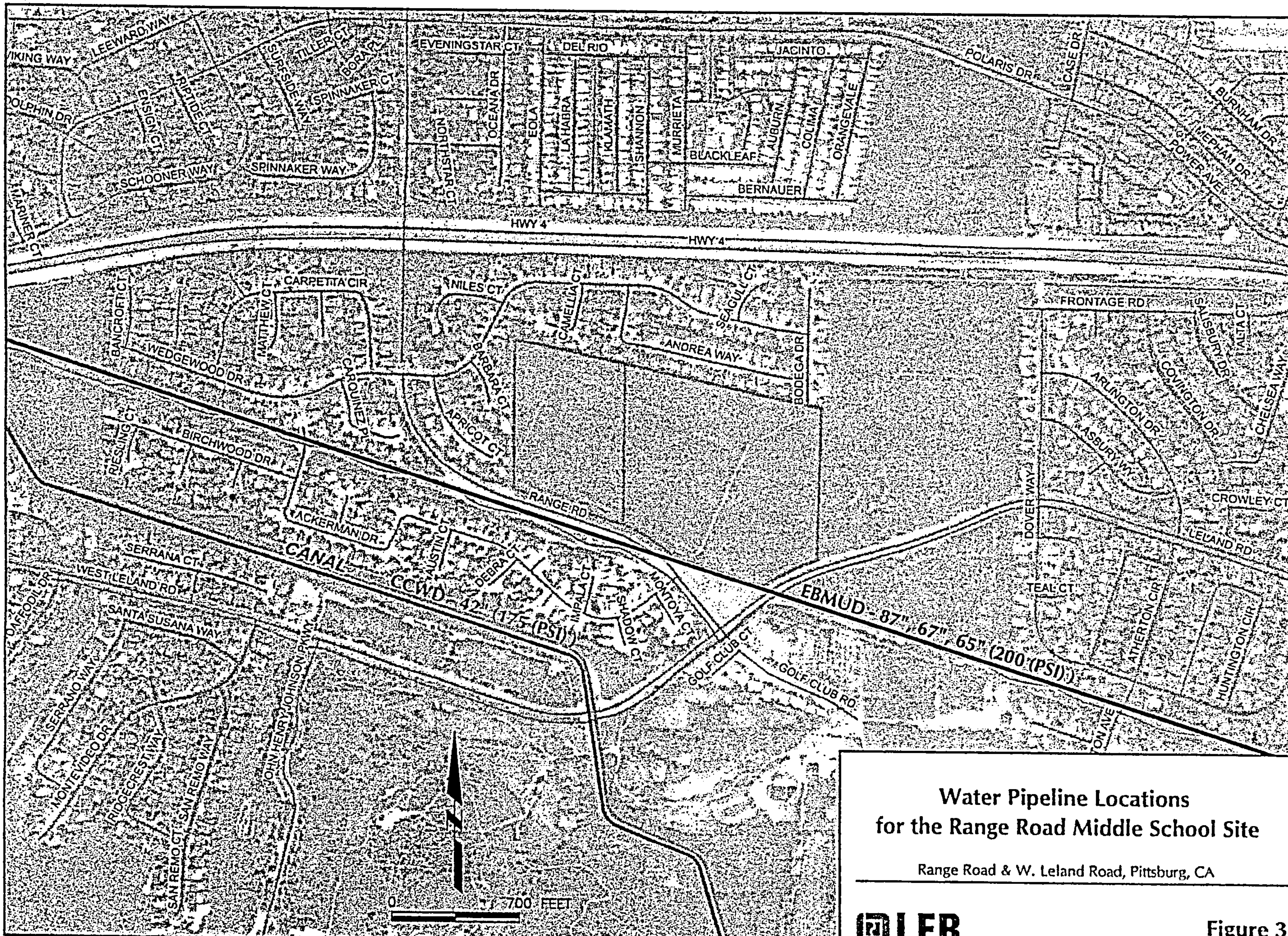
NEW CAMPUS

PITTSBURG UNIFIED SCHOOL DISTRICT

CONTRA COSTA COUNTY

OVERALL SITE PLAN

C101



Water Pipeline Locations for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

LFR

Figure 3

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ATTACHMENT 3

BLAST REQUIREMENTS FOR EXTERIOR GLASS AND WINDOWS

S.M.G CONSULTING
Exterior Wall Consultants – Quality Management

Mr. Douglas G. Wolf
LFR
1900 Powell Street, 12th Floor
Emeryville, California 94608

January 4, 2007

Re: Range Road Middle School, Pittsburg California
Subject: Blast Requirements for Exterior Glass and Windows

Dear Mr. Wolf

Pertaining to the above referenced project, the following comments are based on our peer review of the specification section 08800, two architectural sheets and miscellaneous details as reviewed in the December 15, 2006 meeting.

Window Specifications

As determined the blast force at 200 feet, the nearest window from the gas pipeline is 5- psi. The suggested performance requirements have been from this point.

Horizontal Sliding Window Performance Requirements: The suggested design for aluminum windows are those specified and recommended in AAMA/NWWDA 101/I.S.2 – 97. As reviewed in the December meeting, the Pittsburg School districts performance design for the sliding window is HS-HC40. The minimal blast resistance/hazard response for an HC 40 is 4.2 psi. As 200 ft is the nearest area from the pipeline and the wall distance increases, the 4.2-psi is close to the 5-psi. Reducing the manufactures normal frame anchorage spacing could be incorporated. The frames may slightly bend but will not disengage from the substrate; an alternative design criteria suggested would be to increase the windows to an HS-HC50 or HS-AW40; both will meet the design criteria without modification of the anchors.

08800 Glazing Specifications

As discussed there are two methods to comply with the 5-psi criteria.
#1. The currant LOW-E Glass specification calls for both the interior and exterior lite to be annealed. For compliance the interior type of glass of the 1' insulated unit will need to be ¼' laminated. The typical makeup suggested is as follows

Overall thickness of 1 inch with two lites of 1/4 inch glass.

(1) Exterior lite ¼" annealed. (#2 = ¼"laminated)
(2) ½" air space. Continuous metal spacer with formed corners and an in-line connector, containing desiccant.
(3) Interior lite ¼" laminated with 0.030" pvb interlayer
(4) Primary Sealant: Polyisobutylene applied to the edge of the spacer.
(5) Secondary Sealant: Silicone.

#2. If cost effective it was suggested to replace the ¼"exterior annealed glass with the ¼" laminated. There are two benefits to change both the interior and exterior lite of glass in the 1' insulated units. One being safety during normal school activity and the other is the broken glass will stay in place. The glass staying in place allows time for the new insulated units to be fabricated without the district boarding up the window.

For both the exterior hollow metal storefronts and sliding windows the installation of the 1"insulated units, or the 3/8" laminated glass at the hollow metal storefronts needs to be structurally glazed utilizing silicone sealant at the bedding and face sealant locations. Glazing rabbet needs to be a minimum of ½" contact surface between the insulated unit and the glazing frame.

Respectfully Submitted,

Steven Granieri
SMG Consulting

S.M.G. Consulting

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S.M.G. Consulting was established to provide the Contractor, Developer and Architect an avenue for independent investigation and consultation. This pertains to the proper detailing/design, product selection, testing and legal testimony of the specified materials as related to the exterior envelope of a building.

With the new technology in system design, the ever changing design and product development and the use of substitutions from those specified, the compatibility pertaining to each, needs to be thoroughly analyzed.

In too many instances the wrong/defective product has been specified, or accepted as a substitute. The involvement of the unqualified subcontractor or the introduction of a bad design or uncertified systems have resulted in the Architect, Contractor or Developer having to face a owner that is dissatisfied because of a non - functional building.

To insure the selection of compatible material, workable detailing and proper installation **S.M.G. Consulting** can serve as the independent body in:

- **Inspection and Evaluation**
- **Design Management**
- **Leak Investigation**
- **Product Selection**
- **Field Testing**
- **Quality Control**
- **Cost Budgeting**
- **Contractor Selection**

To verify our capabilities in these areas we have provided a partial list of major projects that we have been involved with. We can also provide a reference list upon request. Services provided by our company will fall within the guidelines of the documents referenced under professional services.

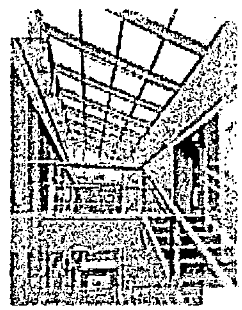
S.M.G. Consulting is committed in providing you, our customer, professional experience you can rely on!

S.M.G. Consulting

Professional experience you can rely on!

S.M.G. Consulting is an independent design/inspection firm specializing in investigation, quality management, testing, legal testimony and evaluation of constructions and related industries which make up the exterior building envelope. Our specialization's are as follows:

- Services and Appointments
- New Construction
- Existing Buildings
- Legal Dispute Resolution



Services and Appointments:

- ✓ Curtainwalls - Glass and Glazing
- ✓ Design Development
- ✓ Skylights
- ✓ Exterior Insulation and Finish Systems (E.I.F.S.)
- ✓ Joint Sealant
- ✓ Windows
- ✓ Waterproofing Systems
- ✓ Metal Panels and Components
- ✓ Pre-formed Concrete/Dimensional stone/GFRC Panels

New Construction:

- ✓ Specification Preparation
- ✓ Bid Review
- ✓ Material Selection Assistance
- ✓ System Design, Selection and Analysis
- ✓ Budget Costing
- ✓ Quality Management
- ✓ C.P.M. Scheduling

Existing Buildings:

- ✓ Leakage Investigation / Due Diligence Investigations
- ✓ Building Analysis / Seismic Damage Evaluation
- ✓ Development of Remedial Repair Programs
- ✓ Routine Inspections

RILEM 11.4 TEST
"Method of Testing Water Absorption Through Masonry Surfaces"

Legal Dispute Resolution:

- ✓ Investigation - Design Flaws - Material Defects
- ✓ Expert Testimony
- ✓ Development and Costing of Repair Programs
- ✓ Clarification of Existing or Potential Problems

S.M.G. Consulting — Professional experience you can rely on!

S.M.G. Consulting has an excellent reputation of completing projects in a professional manner, while controlling costs and keeping the investigation/project within budget.

S.M.G. Consulting has a solid commitment to provide the best quality control and testing services possible and serving the needs of our customers. Our level of professional experience extends not only through the practical theory and study of construction, but can also offer the knowledge gained by the hands on experience in 30 years of installation, design, project management and quality control through all phases of the industry. As the principal of S.M.G. Consulting, the following is a brief resume of my experience.

Steven Granieri
President, S.M.G. Consulting

Salt Lake City, Utah 1968 - 1982
Attended the University of Utah. Worked as field superintendent/quality control manager in the glass and glazing industry. Worked with State Officials developing the apprenticeship testing and quality control program for the state of Utah.

San Francisco, California 1982 - 1989
Worked as project manager/ quality control manager and superintendent for Cobbledick-Kibbe Glass Company.

Major projects are as follows:
1. ***San Francisco School of Ballet*** - Superintendent.
2. ***Dakin Building, Oyster Point*** - Superintendent
3. ***600 Gateway Building SSF***- Superintendent -Quality Control
4. ***San Francisco Hilton Hotel*** - Superintendent-Quality Control
5. ***San Francisco Marriot Hotel*** - Project Manager - Design Team Leader - Quality Control

San Francisco, California 1989 - 1994 Worked as project manager/ quality control manager for EFCO Corporation.

Major projects are as follows:
1. ***Resort at Squaw Creek, Squaw Valley***- Project Manager - Design Team Leader - Quality Control
2. ***Federal Home Loan, San Francisco*** - Project Manager - Design Team Leader - Quality Control
3. ***Sun Microsystems, Menlo Park*** - Project Manager - Design Team Leader - Quality Control
4. ***GSA Federal Building, Oakland*** - Project Manager - Design Team Leader - Quality Control
5. ***Sacramento Municipal Unified District*** - Project Manager - Design Team Leader - Quality Control

San Francisco, California 1995 to Present. Started S.M.G. Consulting.

Major projects are as follows:

- ✓ ***La Jolla village Towers, San Diego*** - Walsh Construction - Merlin Barth Architect 20 Story Condominium - New Project -Design/ Specification -EIFS Quality Control

---

- ✓ ***Embarcadero Center - Pacific Properties, L.P. 4*** - 40 Story Office Buildings - Sealant Failure - Window Leakage -Precast Deterioration

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- ✓ ***Buck Center for the Aging*** - Walsh Construction 3 Story Medical Development Building - New Project - GFRC Design Review Waterproofing/ Quality Control

---

- ✓ ***Ashtech 1170 Kifer, Sunnyvale*** - Mark/Okubo Construction Management 2 Story Concrete Tilt-Up - Window Failure - Sealant Failure

---

- ✓ ***Metro Towers, San Mateo*** - Glaspy & Glaspy Attorneys at Law Litigation of 20 Story Office Building - Design/Product Failure - Curtainwall Failure Sealant Failure - Precast/GFRC Failure

---

- ✓ ***General Sherman (Sacramento)*** - Metro V - Hoshida & Reyes Attorneys at Law Litigation of 3 Story Office Building - Design/Product Failure -Deck Waterproofing Failure Sealant Failure

---

- ✓ ***The Church Divinity School of the Pacific, Berkeley*** - S.O.M Architect 4 Story Dormitory - Brick/Concrete/Window Leakage - Sealant Failure

---

- ✓ ***John Swett Elementary School*** - Consulting Firm for San Francisco Unified School District Four Story School - Sealant Failure - Window/Curtainwall Leakage

---

- ✓ ***Peter Yorke Towers, SF*** - Stolti/PCL Construction - Anshen and Allen Architect 19 Story Condominium - Expansion Joint Failure - Deck Failure -EIFS & Sealant Failure

---

- ✓ ***Roosevelt Middle School*** - Consulting Firm for San Francisco School District. 3 Story School - Quality Control of Retro-Fit Window/Curtainwalls

---

- ✓ ***Downtown High School*** - Consulting Firm for San Francisco School District 4 Story School - Glass Block Failure - Design Failure

---

- ✓ ***Nike World Campus*** - Portland Oregon - B & B Glass New Construction - 6 Five Story Buildings - Design & Inspection

---

- ✓ ***Bishop Ranch, San Ramon, California*** - Sunset Development Company Four Three Story Office Buildings - Sealant Failure - Window/Curtainwall Leakage GFRC Design Failure

---

- ✓ ***2010 N. 1st Street, San Jose, California*** - TishmanSpeyer Properties Five Story Office Building - Sealant Failure - Window/Curtainwall Leakage Parapet Leakage - GFRC Design Staining Investigation

---

- ✓ ***Rotary Plaza, So. San Francisco, California*** - Eugene Burger Management 4 Story Retirement Facility - Contract Documents - Quality Control of Retro-Fit Windows

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- ✓ ***Tenderloin Elementary School*** - Consulting Firm for San Francisco School District. 3 Story New School - Storefront - Windows - Quality Control

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- ✓ ***Lincoln High School*** - Consulting Firm for San Francisco School District. 4 Story School - Quality Control of Retro-Fit Window/Curtainwalls

APPENDIX A

STAGE 2 PIPELINE RISK ANALYSIS

ATTACHMENT 2

RISK MANAGEMENT PLAN (RMP)

Risk Management Plan
Range Road Middle School
Range Road and West Leland Road
Pittsburg, California

Prepared for
Pittsburg Unified School District
2000 Railroad Avenue
Pittsburg, CA 94565

CONTENTS

CERTIFICATIONS

All hydrogeologic and geologic information, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by an LFR California Registered Geologist.

Alan D. Gibbs — 1/15/2007

Alan D. Gibbs, R.G., C.HG., R.E.A. II — Date
Principal Hydrogeologist
California Registered Geologist (4827)

1.0 INTRODUCTION

LFR, Inc. (LFR) has prepared this Risk Management Plan (RMP) on behalf of Pittsburg Unified School District (PUSD) for the proposed Range Road Middle School in Pittsburg, California ("the Site"; Figure 1). The Site is located northwest of the intersection of Range Road and West Leland Road.

1.1 Purpose

Sections of ten pipelines, including six natural gas pipelines and four water pipelines, are located within 1,500 feet of the Site. The purpose of the RMP is to outline essential requirements for public/private utility company notification to school officials before excavation or maintenance activities take place on the pipeline segments within 1,500 feet of the school boundary and describe emergency evacuation procedures to be followed in the event of an accidental pipeline release within 1,500 feet of the Site.

This RMP contains the following:

- a description of the site background
- a summary of the pipeline risk analysis conducted for the nearby pipelines
- a description of the school notification process
- emergency evacuation procedures

The risk management activities and protocols specified in this RMP are based on a current understanding of site conditions and the proposed land use. If environmental conditions are found to differ from those described herein, then risk management protocols may have to be modified to accommodate the changed conditions. If changed environmental conditions are encountered, the City of Pittsburg, the PUSD, or other concerned agencies should be notified, as appropriate. LFR will propose adjustments to the risk management protocols, if warranted, based on changed environmental conditions.

2.0 SITE AND VICINITY DESCRIPTIONS

2.1 Site Description

The Site is located on the western side of West Leland Road and the northern side of Range Road in Pittsburg, California. The Site is currently undeveloped land. PUSD's plans for the Site include constructing buildings for the proposed Range Road Middle School.

2.2 Surrounding Land Use

Properties surrounding the Site consist predominantly of residential developments. Highway 4 is located approximately 501 feet north of the Site.

The ten pipelines located within 1,500 feet of the Site are shown in Table 1 and identified in Figures 2 and 3.

Operator	Pipeline Reference	Contents	Pressure (maximum) (psig)	Diameter (inches)
PG&E	SP3(a) SP3(b)	Natural Gas	600	26
	191	Natural Gas	720	24
	191-1(a)	Natural Gas	390	20
	191-1(b)	Natural Gas	720	20
	191-1(c)	Natural Gas	390	24
EBMUD	Mokelumne Aqueducts	Raw Water	200	87
		Raw Water	200	67
		Raw Water	200	65
CCWD	MPP	Treated Water	175	42

Notes:
PG&E = Pacific Gas and Electric Company EBMUD = East Bay Municipal Utility District
CCWD = Contra Costa Water Districtpsig = pounds per square inch-gauge

3.0 BACKGROUND

Based on the proximity of the pipelines listed in Table 1 to the Site, LFR performed a risk analysis for the natural gas pipelines in accordance with the California Department of Education "Proposed Standard Protocol for Pipeline Risk Analysis," dated May 2002 (the May 2002 Protocol) and a risk analysis for the water pipelines in accordance with the "California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis, Revised Draft 2" dated September 2005 (the September 2005 Protocol).

These analyzes identified that all six of the natural gas pipelines would have an impact on the Site and a significant health and safety threat would result from a hypothetical release and explosion or pool fire from the PG&E SP3(a) natural gas pipeline. Due to the surrounding topography, water from a leak or rupture of one of the water pipelines would most likely not accumulate on the Site in a way that would pose imminent health and safety risks to the Site population.

The May 2002 Protocol identifies commonly adhered to risk control measures. Title 49 CFR, Part 192, defines prevention and mitigation measures for many different types of pipeline leaks. An operator's practice must conform to the minimum requirements of applicable federal or state regulations. In practice, most pipeline operators, including PG&E and KMEP, adhere to these requirements.

Codes, standards, regulations, and operators' own best management practices commonly comprise prevention activities. Specific prevention activities generally focus on specific causes of pipeline failures. For example, prevention measures associated with excavation damage include pipeline markers, patrols, and on-call notifications.

For the pipeline risk analysis, two types of accidental release scenarios were assessed. The first type of scenario assessed was a leak from a 1-inch-diameter hole in a pipeline. Such a leak could result from various incidents, including accidents during excavation. This is the most common type of release event and is evaluated in all pipeline assessments. The second scenario was a full pipeline rupture. A full pipeline rupture is less likely and is usually only considered if the subject site is within an active seismic region or may be subject to potential landslide or ground erosion.

Geologic or geotechnical conditions that could affect the performance of a pipeline are related to ground movement such as landsliding, fault rupture, and/or ground shaking. Based on the Site's location only a low level of concern for the potential of a full rupture to the pipeline exists because regional seismic hazards are low in the Pittsburg area.

For this site, it is far more likely that only a small line leak or small gas leak would actually occur due to events resulting in an accidental release. The risk mitigation measures for the pipeline risk analysis are therefore focused on the higher likelihood and prevention of a leak from a 1-inch-diameter hole in a pipeline.

In the pipeline risk analysis report, LFR recommended mitigation measures. These measures are usually preengineered systems, procedures, and practices that reduce the consequences of a pipeline product release. Emergency preparedness and emergency response plans are among the basic elements of mitigation.

4.0 POTENTIAL ISSUES OF CONCERN

The following issues of concern have been identified from information obtained during LFR's pipeline risk analysis:

- future excavation or maintenance activities on segments of the pipelines within 1,500 feet of the school boundary that could result in damage to the pipelines
- an accidental release due to a leak in the natural gas pipelines
- a full pipeline rupture in the natural gas pipelines

4.1 Future Excavation or Maintenance Activities

Exposure of the pipeline segments within 1,500 feet of the school boundary to conduct maintenance activities or other work increases the probability of an accidental release and possible impact to the Site. Therefore, future excavation or maintenance activities have been identified as a potential issue of concern.

4.2 Accidental Release

An accidental release from the segment of the natural gas pipeline within 1,500 feet of the school boundary could have a possible impact to the Site. Therefore, an accidental release from this pipeline has been identified as a potential issue of concern.

4.3 Rupture

A rupture from the segment of the pipelines within 1,500 feet of the school boundary could have a possible impact to the Site. Therefore, a rupture from the pipelines has been identified as a potential issue of concern.

5.0 RISK MANAGEMENT

This section describes actions to be taken with regards to the natural gas pipelines located across Range Road and West Leland Road from the Site.

5.1 Future Excavation or Maintenance Activities

Prior to excavation or maintenance activities on pipeline segments within 1,500 feet of the school boundary, PG&E, KMEP, other pipeline owners and/or operators, utility owners, or street maintenance workers will notify PUSD school officials of the pending work. The following school officials are to be notified:

Mr. Mark Bonnett
Assistant Superintendent
Pittsburg Unified School District
2000 Railroad Avenue
Pittsburg, California 94565
Phone: (925) 473 - 4235

Mr./Ms. ________
Principal
Range Road Middle School
____ Range Road
Pittsburg, California
Phone: (925) ___-_____

Excavation and maintenance activities on pipeline segments within 1,500 feet of the school boundary should be performed before or after school hours, or when the school is not occupied (weekends, holidays), if possible. The above noted school officials should be contacted to establish school hours.

5.2 Accidental Release and Rupture

In the event of an accidental pipeline release or rupture on a pipeline segment within 1,500 feet of the Site, the principal of Range Road Middle School must be notified immediately. If the Principal is not available, then immediate notification should be left with the designated school office personnel with the authority to also take immediate action to evacuate the school. Pertinent information, including location of the release or rupture, extent of the release or rupture, time when the repairs will be completed, and need to evacuate the school, should be provided to the school officials.

In the event that the pipeline owners and/or operators recommend that the school be evacuated, the school's Emergency Evacuation Plan should be implemented.

All occupants of the school buildings, including students, teachers, school staff, visitors, and others, will assemble on the north end of the track located on the northeastern side of the school campus (see Figure 1). Everyone must stay in the assembly area until notified by a senior school official (i.e., a district director, the school principal) to return to the buildings or leave the Site.

6.0 LIMITATIONS

This work was conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The observations and conclusions presented in this letter are professional opinions based on the scope of activities, work schedule, and information obtained through the work described herein. Opinions presented herein apply to site conditions existing at the time of our work and cannot necessarily be taken to apply to site conditions or changes that we are not aware of or have not had the opportunity to evaluate. It must be recognized that conclusions drawn from these data are limited to the amount, type, distribution, and integrity of the information collected at the time of the assessment and the methods used to collect and evaluate the data; a full and complete determination of environmental risks cannot be made. Although LFR has taken steps to obtain true copies of available information, we make no representation or warranty with respect to the accuracy or completeness of this information.

7.0 REFERENCES

California Department of Education. 2002. Proposed Standard Protocol for Pipeline Risk Analysis. May.

California Department of Education. 2005. Proposed Standard Protocol for Pipeline Risk Analysis, Revised Draft 2. September.

LFR. 2006. Stage 2 Pipeline Risk Analysis of the Natural Gas Pipelines and Water Pipelines located within 1,500 feet of the proposed Range Road Middle School site, Pittsburg, California. September 30

EMERGENCY EVACUATION PLAN

(Accidental Pipeline Release and Rupture)

1. Leave building in a quiet and orderly manner. WALK! – DO NOT RUN!!

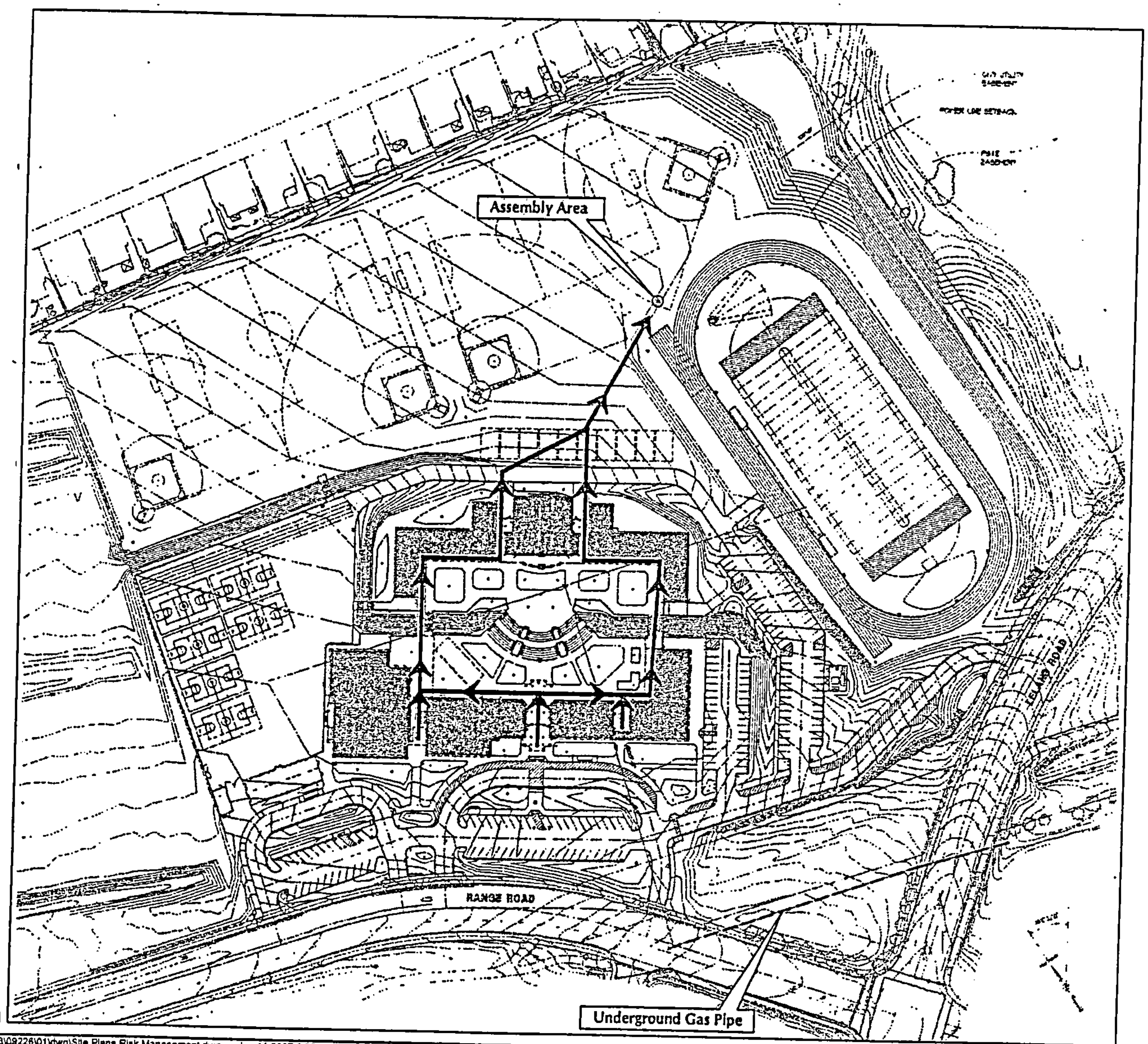
2. Maintain order and take roll when reaching assigned staging area, as above.

3. Proceed to assembly area behind setback noted on attached Site Plan.

4. Stand quietly in assembly area until notified by a senior school official to return to the buildings or leave the site.

5. Return to the classroom in a quiet and orderly manner.

6. If the fire alarm sounds during recess or lunch, go quietly to your assigned area.



SOURCE: CALIFORNIA DESIGN WEST ARCHITECTS, INC.

Evacuation Route Map and Assembly Area

Range Road and W. Leland Road, Pittsburg, CA

LFR

Figure 1

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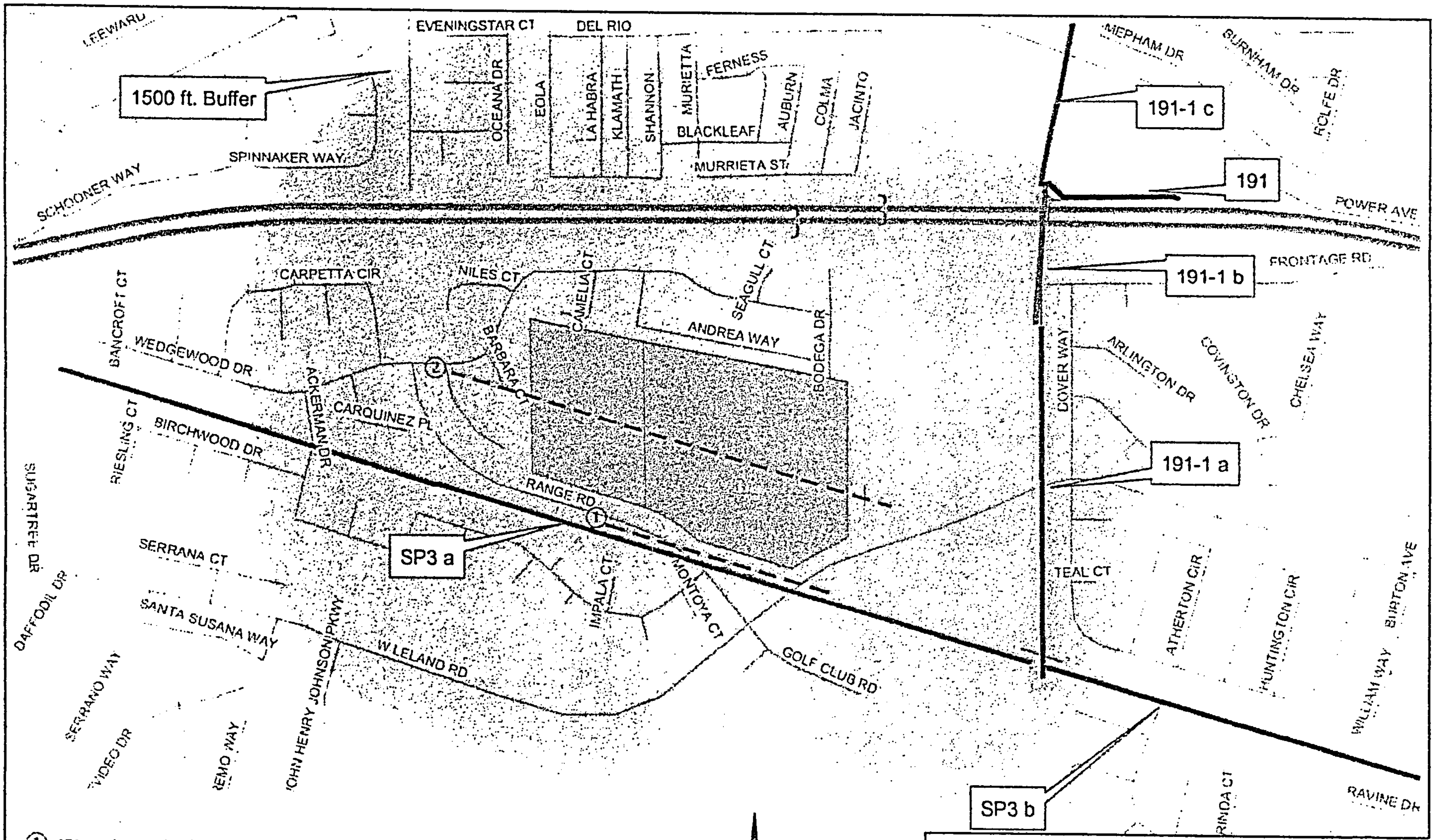

Pipeline Location and Approximate Setback Distances for the Range Road Middle School Site

Range Road & W. Leland Road, Pittsburg, CA

LFR

Figure 2

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