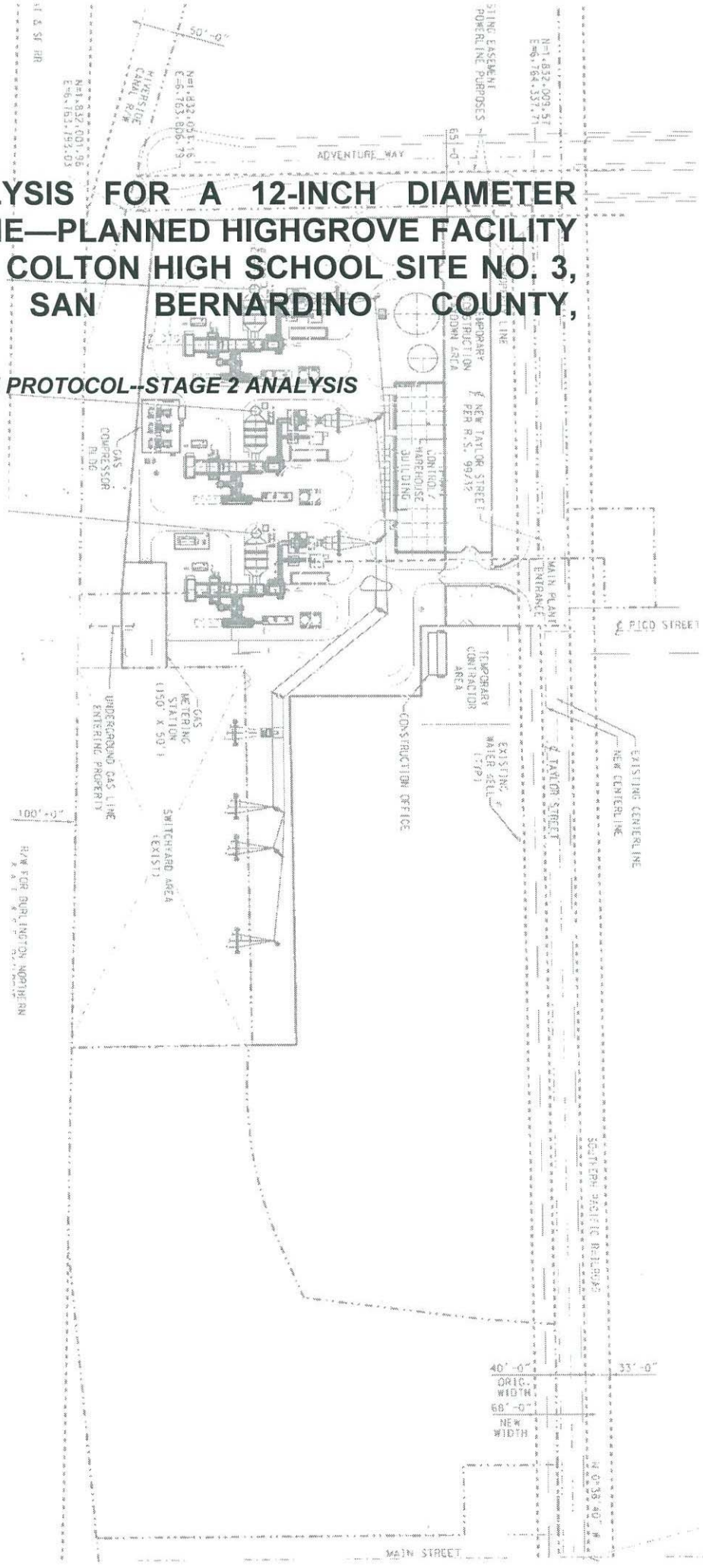
APPENDIX 8.12B

Gas Line Study

PIPELINE RISK ANALYSIS FOR A 12-INCH DIAMETER NATURAL GAS PIPELINE—PLANNED HIGHGROVE FACILITY NEAR THE PROPOSED COLTON HIGH SCHOOL SITE NO. 3, GRAND TERRACE, SAN BERNARDINO COUNTY, CALIFORNIA

CDE DRAFT STANDARD PIPELINE PROTOCOL--STAGE 2 ANALYSIS



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August 2005

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APPENDIX A - *CDE* Draft Protocol Stage 2 Analysis Results (Simple Frame Unreinforced Construction)

WILSON GEOSCIENCES INC.
Engineering and Environmental Geology

August 22, 2005

Julie D. Way, Project Director
AES Pacific, Inc.
690 Studebaker Road
Long Beach, California 90803

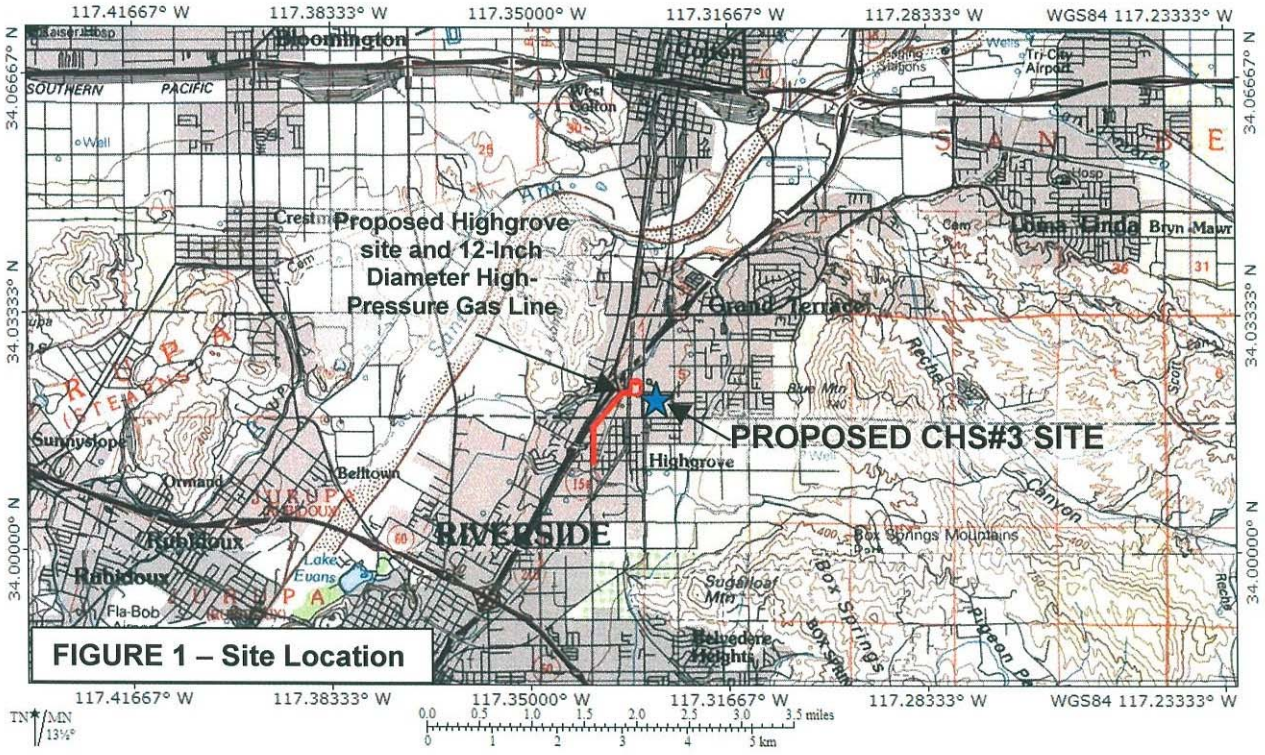
Subject: **TECHNICAL REPORT AND APPENDIX: Proposed Highgrove Site—An Update of the California Department of Education "Stage 2" Natural Gas Pipeline Risk Assessment for the Proposed Colton High School No. 3 Site, Colton Joint Union High School District, Grand Terrace, San Bernardino County, California**

Dear Ms. Way:

Introduction

INTRODUCTION, APPROACH, AND SCOPE

Based on your approval of our proposal (June 22, 2005), we have completed an update of the December 16, 2004 Stage 2 study report for the subject Colton High School No. 3 (CHS#3) site in the Colton Joint Union High School District (CJUHSD; Figure 1). In that report (for The Planning Center), Wilson Geosciences Inc. (WGI) evaluated the potential pipeline risk posed by the existing 8-inch diameter Southern California Gas Company (SCGC) high-pressure natural gas line located in the Riverside Canal Power Company property within 1,500 feet west of the proposed CHS#3 site. The proposed CHS#3 site is located north of Main Street, mostly south of Pico Street, east of Taylor Street, and west of Michigan Avenue in Grand Terrace (Figure 2).



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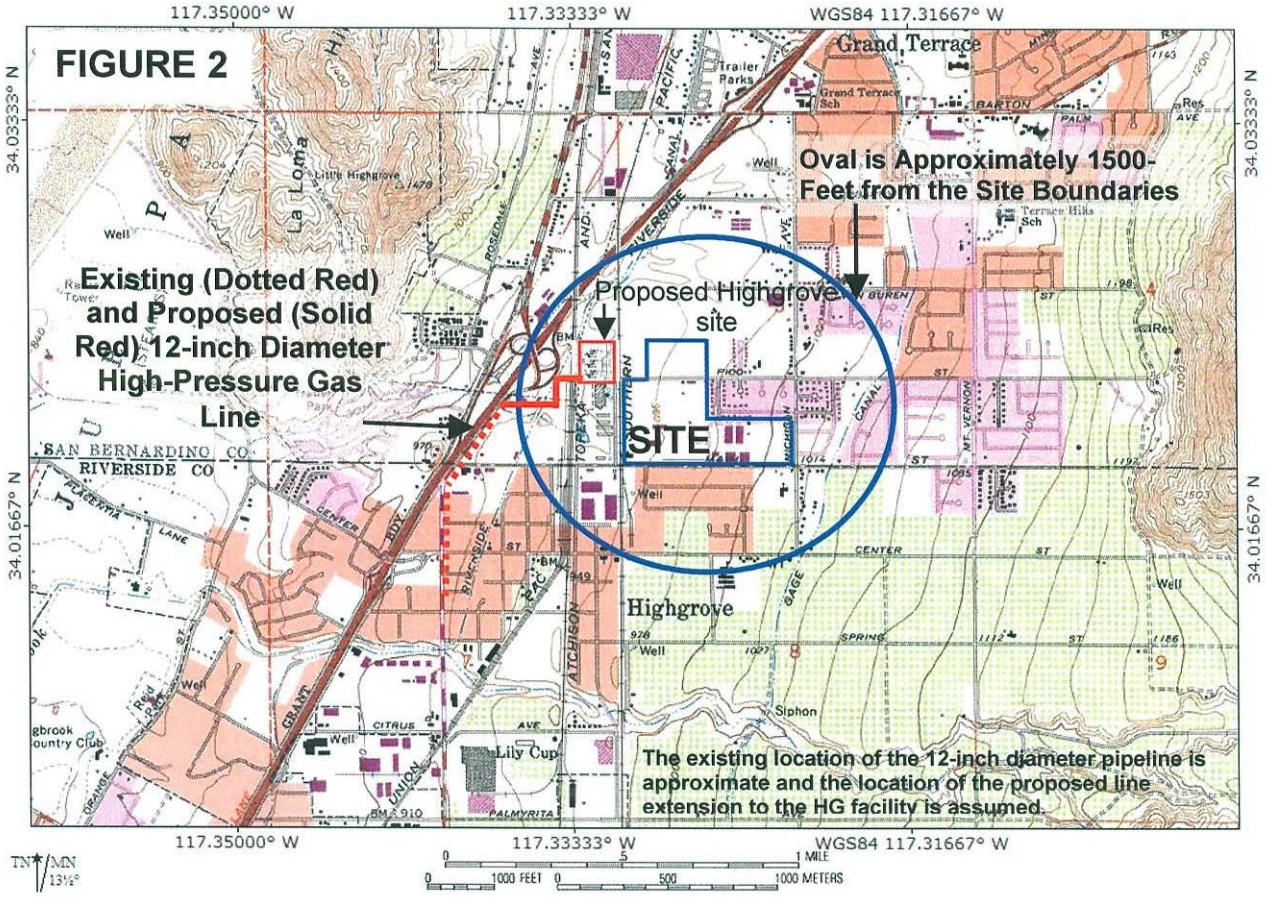
AES Pacific, Inc. (AES) plans to demolish the existing Riverside Canal Power Company plant and construct a new facility (AES Highgrove, LLC), which will require a new 12-inch diameter high-pressure pipeline. The new pipeline would most likely be constructed and owned by Southern California Gas Company (SCGC), and interconnect with SCGC Line 2001 several miles south of Grand Terrace. The new pipeline would enter the proposed Highgrove Site (HG) in close proximity to the existing 8-inch diameter line, except with a southerly approach that would parallel, then cross under the adjacent railroad tracks to enter the site. Pipeline pressure is expected to be a minimum of 300 pounds per square inch gauge (psig) for the proposed gas compressors and it is assumed that the delivery pressure will be approximately 450 psig.

We have utilized the information developed by AES (J. Way, 2005) regarding the high-pressure pipeline proposed near the CHS#3 site. For purposes of this report we are relying on this information as a final determination that this single high-pressure line will be located as described above within 1,500-feet of the proposed CHS#3 site (Figure 2) and have assessed the site risk based on this information. We have been provided with a proposed HG site plan (CH2MHill, 2005 from J. Way) that outlines the site boundary west and northwest of the intersection of Taylor and Pico Streets. This study is to establish the level of risk posed by the proposed 12-inch diameter pipeline where it enters the HG.



We have used the same school site plan originally provided by The Planning Center that outlines the proposed campus (parking, buildings, play areas, and open space) and have assumed the same population as in the previous study. This study establishes the level of risk posed to the proposed CHS#3 site given the pipeline and distance parameters involved using the California Department of Education (CDE, 2002) pipeline risk analysis methodology (protocol). In the analysis we consider the proposed 12-inch diameter pipeline up to the point at which it enters the AES HG Site. Once in the AES HG Site, the CDE protocol no longer applies to plant site-specific analysis; if necessary such an analysis of HG plant safety will be performed by others.

Approach: Prior to late 2000, the CDE site selection process required only that the school district indicate the presence and location of pressurized natural gas pipelines if they are located within 1,500 feet of the site boundary. Regulations (Title 5, California Code of Regulations, Division 1, Chapter 130, Subchapter 1, School Facilities Construction, Article 2. School Sites, § 14010, Standards for School Site Selection) that took affect in late 2000 require that a "site shall not be located near an above-ground fuel or water storage tank or within 1,500 feet of the easement of an above-ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission."

In June 2002 the CDE received a *"DRAFT California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis"* that proposed a staged evaluation method for pipeline risk studies. CDE is reviewing the protocol and has suggested that it be used now in advance of final changes. The protocol methodology has three basic steps, a Stage 1 Risk Screening Assessment, a Stage 2 Probabilistic Assessment, and a Stage 3 Detailed Risk Analysis.

Scope: Detailed elements of the scope of work were summarized in our June 22, 2005 proposal. We have prepared this report to provide the results of the Stage 2 analysis conducted in accordance with our understanding of the CDE protocol process. Pipeline annual incident rates (also called base failure or release rates) per mile of pipeline have been determined, for the proposed SCGC 12-inch diameter high-pressure pipeline, from Table B-4 in the CDE draft protocol (CDE, 2002).

We address the individual and societal risk consequences of an unplanned pipeline incident for the subject pipeline. An incident is assumed to be a break in the pipeline that would release natural gas into the air in proximity to the pipeline and the school. No other high-pressure natural gas or liquid petroleum pipelines are reported within 1,500-feet of the site (M. Watson, personal communication, 2004; L. Dowdy, CSFM, 2004). Due to the low pressures (less than 80 psig) in the neighborhood serving natural gas lines (normally less than 8-inch diameter) there is no need (from the CDE regulation) to include them in our analysis.

The study was conducted using the existing data described throughout the report. None of the study phases for a draft pipeline risk protocol include a) on- or offsite risks due to hazardous materials or toxic substances on or near the prospective site, b) offsite risks to any other facilities due to failure of the pipeline, or c) risks due to any other man-made or natural hazards other than as they may affect the pipeline described above within 1,500 feet of the proposed school site. On-site is considered to mean within the prospective school site. The draft protocol is subject to

further detailed technical and administrative peer review, and aspects of it may change in the future.

NATURAL GAS PIPELINE

The high-pressure natural gas pipeline analyzed is a proposed 12-inch diameter distribution line that would serve the Highgrove Site (HG) across Taylor Street west of the site. We assume the pipeline would be built from Iowa Avenue east to the west side of the existing Burlington Northern Santa Fe railroad corridor trending nearly south-to-north, then north and east under the railroad tracks into the site (Figures 2 and 3; J. Way, 2005). The closest approach of the proposed SCGC line to the site would be about 510 feet on the west, which would be about 1,560 feet northwest of the site building mass centerpoint. About 2,530 feet of the pipeline would be located within 1,500-feet of the site boundaries and 1,520 feet within 1,500 feet of the site centerpoint (Figure 3). Pipeline maximum operating pressure (MAOP) is proposed to be 560 psig, with an expected average operating pressure of 300 to 450 psig (J. Way, 2005).

It is anticipated that the pipeline would be buried at a depth of 42- to 60-inches (J. Way, 2005 based on discussions with SCGC). Pipeline construction is anticipated to occur in 2007-2008 and would be constructed of modern materials; the valve locations are unknown. It is estimated that the gas flow could be shut down within 30 minutes of an incident.

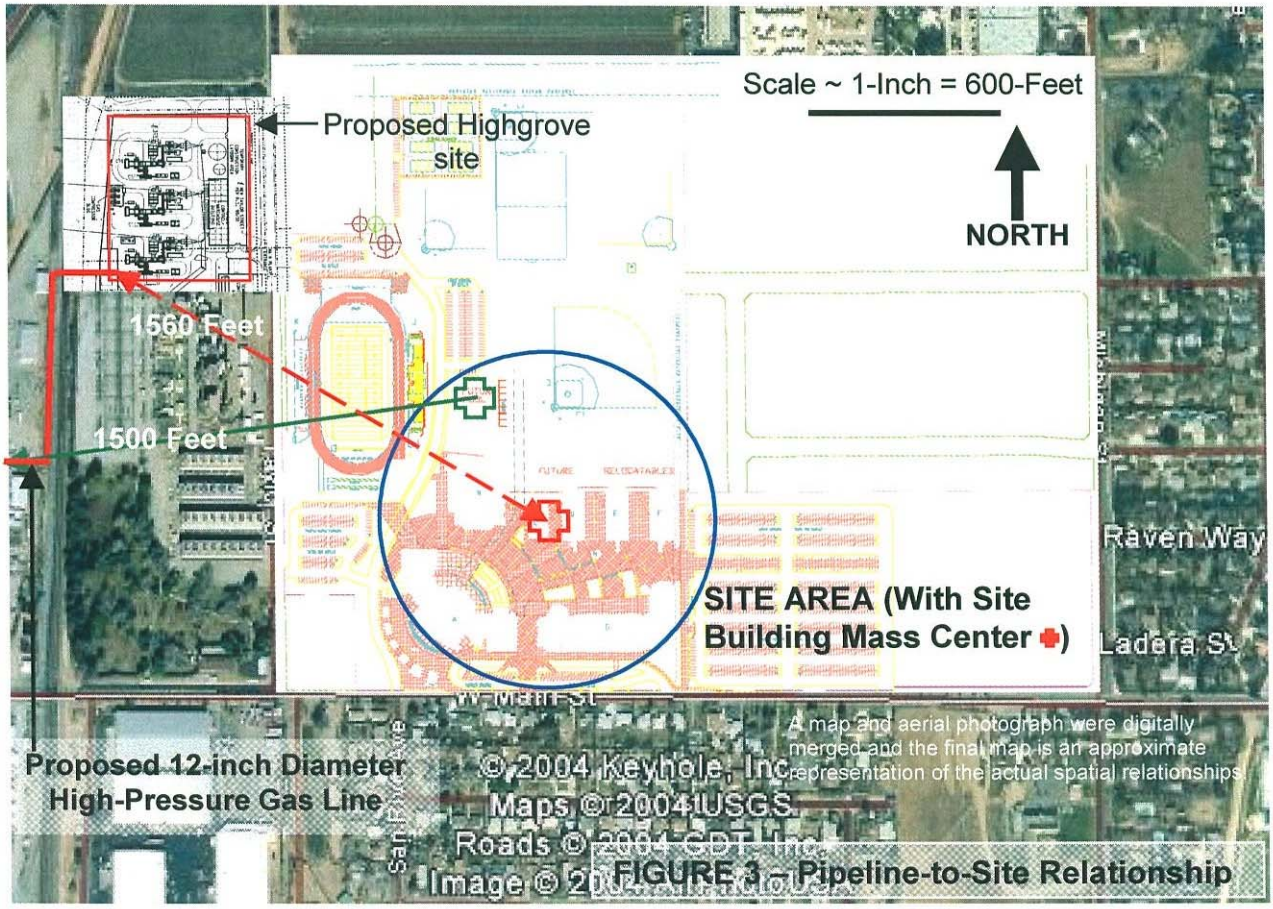


FIGURE 3 – Pipeline-to-Site Relationship

ANNUAL PROBABILITY OF PIPELINE FAILURE

Table 1 summarizes the conditions for the propose 12-inch diameter SCGC natural gas pipeline that would be constructed near the proposed CJUHSD Colton High School Site No. 3 site in support of the proposed Highgrove project. The annual failure probability for the SCGC pipeline was taken from Table B-4 of the draft CDE protocol, rather than calculating a unique annual failure probability for this site and this pipeline. Table B-4 lists incidents for the category of >12-inch diameter pipelines for all operators consisting of the annual failure probabilities per pipeline mile (2.5×10^{-4}), which would encompass the subject pipeline. This value was derived from data for 663 miles of >12-inch diameter pipeline. Due to the older pipelines considered in the statistical database, this value is considered very conservative for a pipeline to be constructed in 2005-2006.

The 2.5×10^{-4} estimate is an average value for all distribution pipelines within the diameter class considered in California for the period 1984-2001. For the same period SCGC-only pipelines in this class (201 miles) have a per mile failure probability of 2.8×10^{-4}, and the more conservative value for all companies was used for the Stage 2 analysis. This estimate does not include consideration of the specific features (age, wall thickness, joint type, etc.) of this 12-inch diameter pipeline or the CHS#3 site-specific earthquake, geology, and geotechnical factors. When this annual per mile failure probability (frequency) is normalized to the length of pipeline within 1,500 feet of the preferred site (940-feet), a frequency of 4.98×10^{-5}, or once every 20,080 years, is obtained. Such failures can be categorized as "rare" during the life of the proposed school facility based on pipeline risk criteria used by the California Public Utilities Commission (Aspen, 1998).

Table 1 – Pipeline Characteristics, Distance to CJUHSD School Site No. 3, Annual Failure Probability (Per Table B-4 of the CDE Draft Protocol), and Failure Return Period

PIPELINE CHARACTERISTICS	DISTANCE TO SCHOOL SITE	ANNUAL FAILURE PROBABILITY	FAILURE RETURN PERIOD
12-inch diameter, natural gas distribution (SCGC), 560-psig MAOP, 2007-2008 construction date	Approximately 510 Feet From West Side (1,560 feet to building mass centerpoint)	4.98×10^{-5} (for the 940 feet within 1,500-feet of the site; see Figure 2)	20,080 years

POTENTIAL GEOLOGIC AND EARTHQUAKE IMPACTS ON PIPELINE FAILURE PROBABILITIES

The site rests on old and very old alluvial fan deposits of Pleistocene age (Morton and Miller, 2003). Strong earthquake groundshaking (from any of several nearby faults, but primarily the San Jacinto and San Andreas) is a hazard for the pipeline near the site and local ground conditions should not be conducive to potential geotechnical/geologic hazards (settlement, soil consolidation, liquefaction). The pipeline within 1,500 feet of the site is not located along a known active or potentially active fault (Morton and Miller, 2003). With an anticipated 2007-2008 construction date for the new pipeline, all advancements in pipeline design and construction determined from the 1971 San Fernando M6.4 earthquake, and other subsequent

large events, would be used in the design and construction of the 12-inch SCGC pipeline. Normal SCGC regulatory compliance, and compliance with Underground Service Alert procedures should minimize future age-related affects such as corrosion, settlement, and outside damage so that this pipeline should perform much more favorably (on a statistical basis) than the Statewide averages used in this evaluation. Very detailed site-specific studies along the pipeline would be necessary to determine if local hazards exist that could impact the future pipeline.

In general, underground pipelines are not subject to as much damage as surface structures (O'Rourke and Liu, 1999) during large seismic events, absent the potential for permanent ground displacement (PGD; e.g., landslides, fault rupture, liquefaction, lateral spreading). Since none of these PGD factors is known to be present along the adjacent pipeline based on the studies cited, there appears to be no significant potential for their occurrence within 1,500-feet of the site. A pipeline specific settlement/stability analysis would be necessary to evaluate the impact of up to several inches of area-wide earthquake-settlement on the future subject pipeline. Barring severe local differential settlement (8-inches occurring over a very short distance), the pipeline should perform as designed under modern standards (i.e., without a failure).

Based on only the potential for severe groundshaking, a pipeline failure (leak or less likely a rupture) has a lower potential than for an average southern California site. We estimate the pipeline within 1,500 feet of the site would experience geologic and earthquake hazards somewhat less severely than the pipelines represented in the CDE Table B-4. Therefore, considering the new construction and earthquake shaking potential, there is no reason to consider a change in the estimate for annual pipeline failure frequency for the segment within 1,500-feet of the site.

INDIVIDUAL AND SOCIETAL RISKS BASED ON CDE DRAFT PROTOCOL

Assumptions and Procedures: We applied the draft CDE Stage 1 and 2 protocol to (1) determine by Stage 1 if the site-to-pipeline relationships posed sufficient potential for hazard at the proposed site to perform a Stage 2 analysis (which it did for pipeline length within 1,500-feet), and (2) then evaluated using Stage 2 the individual and societal risks for the natural gas pipeline segment within 1,500-feet of the site. Assumptions and procedures used are consistent with our understanding of the protocol based on reviewing the draft report and discussing it with various meeting participants in Sacramento in early July 2002. We used the per mile base frequency/annual failure probability value obtained from Table B-4 of the protocol for the natural gas pipeline.

A distance of 1,560 feet was used for the subject natural gas pipeline distance to the proposed site building mass centerpoint for the CDE protocol methodology (Figure 3). As shown on Figure 3, the overall site centerpoint-to-pipeline distance (including outdoor populations in all the but the easternmost parking area and athletic fields) would differ somewhat (it would be 1,170 feet away or 390 feet closer) from the building area (population indoors). This is due to the shape of the site as well as the internal distribution of the building area placed along the south boundary. We selected the site building mass centerpoint as the center of the smallest circle to encompass the buildings and future portable classrooms. This resulted in the pipeline-to-site building mass centerpoint distance of 1,560 feet. This is a somewhat conservative (shorter)

distance than actual due to the shape of the proposed building cluster. All distance measurements are approximate, and based on the plan provided by WLC Architects (B. Wu, 2004) and the proposed SCGC pipeline location (J. Way, 2005).

Results: Simple frame unreinforced construction was analyzed; base annual failure probability was taken from Table B-4 (CDE, 2002). A site population of 3200 persons was assumed, including 3000 students (B. Wu, 2004), and 200 teachers, support, and visitors. The individual risk and all societal risks were determined by the CDE protocol analysis to be insignificant (below established thresholds; Table 2).

Table 2 – Significance of Individual Fatality and Societal Risks Relative to the Site Building Mass Centerpoint for the 12-Inch Diameter SCGC Pipeline

***RISKS AND* CORRESPONDING EVENTS**	**12-Inch Diameter Pipeline** [2] Industry Distribution Line Failure Rate (Table B-4, CDE Protocol)
Type of Construction →→→	SFC [1]
Individual Risks [3]	I
Societal Risks	
Leak Flash Fire	I
Rupture Flash Fire	I
Leak Jet Fire	I
Rupture Jet Fire	I
Leak Explosion	I
Rupture Explosion	I

1) SFC = Simple Frame Construction; 2) Table B-4 is from the CDE Draft Protocol Appendix B page B-12; and 3) Individual Risks are Significant (S) or Insignificant (I) if above or below the 1×10^{-6} threshold.

Appendix A provides the risk analysis spreadsheet, details of the site-specific input data, and standard CDE protocol factors used in the analysis. The CDE protocol Figures 2, 5, 9, 18, and 22 were used to estimate the heat flux and overpressure values for the 1,560-feet pipeline-to-site building mass centerpoint distance considering a 12-inch diameter pipeline at 560 psig. Figures 27 and 28 were used to estimate the overpressure and heat flux impacts.

With respect to other possible SCGC pipelines within 1,500- feet of the site, in a July 21, 2004 letter to The Planning Center, the SCGC indicated two high-pressure pipelines were within 1,500-feet of the site boundaries, a 2-inch diameter line and an 12-inch diameter line. Subsequently, Haley & Aldrich (M. Watson, personal communication, 2004) contacted the SCGC (C. Dahl, Redlands) and they mutually determined that no 2-inch diameter line could be found on the atlas sheets within 1,500-feet of the site. Our inspection of the atlas sheets provided (specifically RCO 526) indicates a 12-inch diameter high-pressure line at the intersection of Iowa Avenue and Main Street that appears to continue northeast along Iowa Avenue, however the atlas sheet for the northern area (SBD26) was not provided. Watson (personal communication, 2004) indicates that Dahl determined that the 12-inch diameter pipeline diverges from Iowa Avenue to the west passing under the 215 Freeway where Iowa curves to the east before it crosses the freeway at the Iowa/La Cadena overcrossing. This would place the existing 12-inch diameter line approximately 1,620 feet away from the site. It is from roughly this point

that we have assumed an extension of the pipeline would be made into the Highgrove site and therefore is the subject pipeline analyzed in this study.

CONCLUSIONS AND SUGGESTED ADDITIONAL MEASURES

Conclusions: Due to the relatively small diameter of the 12-inch diameter 560-psig natural gas pipeline and the distance to the site building mass centerpoint (1,560 feet), the individual and societal fatality risks were found to be insignificant based on the CDE protocol analysis method. While the consequences from the rupture of the new 12-inch diameter pipeline could potentially be greater than for the 8-inch pipeline previously analyzed in our December 2004 report, the risk outcome in both analyses using the CDE draft protocol is insignificant.

There are three fire stations within approximately 3.5 miles of the CHS#3 site (nearest at Center Street and Michigan Avenue about 0.7 miles east) that could provide emergency services within 5 to 10 minutes of any pipeline accident. Southern California Gas Company (SCGC) would respond from its Beaumont facility (approximately 30 miles east) or more likely with local crews in the area.

Suggested Measures to Increase Site Safety: Statistically the annual potential for a pipeline incident (unplanned release) within 1,500-feet of the site is very low with a recurrence interval of over 200 times longer than a 100-year useful life for a public building. This includes the individual probabilities of releases for the one pipeline considered, specifically the SCGC 12-inch diameter natural gas high-pressure line that is proposed to be extended into the Highgrove site located within 1,500 feet of the proposed Colton High School No. 3 site. The results indicate the probability of an individual fatality is less than one in one million for the pipeline, with no measurable risk of societal fatalities. It therefore appears that there is no need to add confidence to these findings for the pipelines near the site by instituting mitigation measures. However, with regard to school site emergency planning it is assumed that all evacuation and emergency response planning required by local State and Federal laws would be implemented prior to school construction. AES could assist the CJUHSD with the plan and could include a discussion of pipeline and plant safety considerations using available information from AES, SCGC and the local fire agency. For example, evacuation related to all pipeline incidents should avoid Taylor Street and Pico Street north of the school focusing egress to the south and east along Pico and Main Streets.

With regard to third-party digging accidents, current law requires that any subsurface excavation contractor, including responsible agencies and individuals, contact Underground Service Alert (USA) at least 48 hours prior to the planned start of an excavation (e.g., backhoe, drill rig, trench excavator). Utilities and underground structures are marked and identified to minimize the chance for "dig-in"-type accidents. SCGC, the District and the City could consider the addition of numerous pipeline warning markers within 1,500-feet of the school site boundaries adjacent to the new portion of the subject 12-inch diameter high-pressure pipeline to further decrease the probability of an accidental "dig-in" type accident near the school.

AES could consider a "safe shutdown" valve or other devise at the point where the 12-inch diameter pipeline enters the facility. Connections may be the most vulnerable points in the pipeline and if any plant emergency occurred (e.g., large seismic event or accident), minimizing releases from the 12-inch diameter pipeline at the nearest point to the campus would have a positive impact on potential consequences to the CHS#3 population.

RECOMMENDATION

It is recommended that AES discuss the protocol-developed risk levels outlined in this report with CJUHSD and the CDE representatives, and determine if these risk levels are acceptable since they fall within acceptable CDE thresholds for individual and societal risk. If additional measures are considered necessary to reduce the risk, an emergency plan could be prepared. In addition, additional pipeline markers could be established.

CLOSURE

The results and conclusions presented in this report were prepared in compliance with normal industry practice in the San Bernardino and Los Angeles County areas. Other consultants may arrive at different results and conclusions with the same information. Although some hazard risk may always remain, a lower risk of future problems may result if more site-specific evaluation is undertaken, and if conservative criteria for pipeline design, safe and reliable pipeline shutoff valves, pipeline identification markers, and contingency evacuation planning are adopted. Distance and length measurements cited in this report are estimates from available maps (e.g., USGS, Thomas Guide, The Planning Center, WLC Architects, SCGC, and AES). The scope of this portion of the risk analysis did not include modeling of detailed site-specific probabilities or of site-specific hazard impacts (Stage 3 consequence analysis) associated with failure of the pipeline considered herein. The CDE draft protocol is the work of others and as such, WGI is not responsible for errors or omissions made by the authors of the protocol. Use of the protocol requires interpolation and estimation of certain values used in the risk analysis. Final pipeline design and location decisions are the responsibility of others. We make no warranties expressed or implied.

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O'Rourke and Liu, 1999, Response of Buried Pipelines Subject to Earthquake Affects, MCEER Monograph No. 3.

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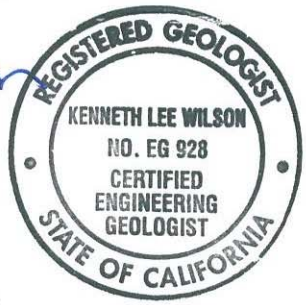
Wu, B., 2004, E-mail project description, site aerial photo, WLC Architects site plan, and student population, November 2004.

Please contact the undersigned at 626 791-1589 if you have any questions.

Sincerely,
WILSON GEOSCIENCES INC.

Kenneth Wilson



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APPENDIX A

CDE Draft Protocol Analysis Results for 12-inch Diameter Natural Gas Pipeline—Highgrove Site near the Proposed Colton High School Site No. 3, Colton Joint Union High School District, Grand Terrace, California

- Site Building Mass Centerpoint-to-Pipeline Distance-Simple Frame Unreinforced Construction Type - 12-inch Diameter SCGC Natural Gas Distribution Pipeline

California Department of Education Proposed Standard Protocol for Pipeline Risk Analysis--DRAFT

SITE: Highgrove Energy Facility--CHS #3 **DATE: 8/2/2005 (Rev 8/22)** **BY: WILSON GEOSCIENCES INC.**

Southern California Gas Company 12-inch Diameter [Table B-4]

Performed for AES North America-West

STAGE 1 - RISK SCREENING ANALYSIS

CENTER OF BUILDING MASS | **NATURAL GAS PIPELINES** | **SIMPLE FRAME CONSTRUCTION**

Line	Gas Pipelines	CDE DRAFT Protocol Variable Value	Corresponding Site Variable Value	Resultant Site Grade (Pass/Fail)	
G-1	Segment Length Within 1500 Feet of the Site Center (Feet)	1000	940	Pass	USGS Topo Map (site edge) ALL ESTIMATES ARE CENTER OF BUILDING MASS FOR THE SITE
G-2	Distance From Pipeline to Site Centerpoint (Feet)	600	1560	Pass	
G-3	Pipe Diameter (Inches)	20	12	Pass	
G-4	Pipeline Pressure (Maximum Operating = MAOP) (psig)	400	560	Fail	Incidents in Table B-4 for >12" diameter for SCGC.
G-5	Maximum Failure Rate (FT; Releases/Mile-Year)	10E-03 (i.e., 0.001)	2.80E-04	Pass	
	Comparison of Site Conditions To Protocol		Pass vs. Fail	1 = Fail and 4 = Pass SITE FAILS	

STAGE 2 - PROBABILISTIC ANALYSIS

	Release Probability Calculations	Variables	Values or Units	Data Source	
1	Baseline frequency per pipeline mile	FT (releases/mile-year)	2.80E-04	Historical or default release frequency from Table B-4	Incidents in Table B-4 for >12" for SCGC.
2	Baseline segment miles within 1500-ft buffer	SEG (miles)	0.1780303	Determine from site maps, GIS, or other sources	Site Map by WLC Architects (2004), J. Way (2005), and Pipeline Map by SCGC (2004)
3	Base release frequency	F0 (releases per year)	4.98E-05	F0 = FT × SEG	
4	Base release probability	P0	4.98E-05		
5	Probability adjustment factor	PAF	1	Default value = 1	
6	Adjusted base probability	P1	4.98E-05	P1 = P0 × PAF	
7	Probability of leak	PC1	0.8	PC1 = 0.8, (FEMA, 1989)	
8	Probability of rupture	PC2	0.2	PC2 = 0.2, (FEMA, 1989)	
9	Probability of ignition	PC3	0.3	PC3 = 0.3, (FEMA,1989)	
10	Probability of fire upon ignition	PC4	0.7	PC4 = 0.7, (FEMA, 1989)	
11	Probability of explosion upon ignition	PC5	0.3	PC5 = 0.3 (FEMA, 1989)	
12	Probability of leak-fire (fire resulting from leak)	PC6	8.37E-06	PC6 = P1 × PC1 × PC3 × PC4	
13	Probability of rupture-fire (Fire resulting from rupture)	PC7	2.09E-06	PC7 = P1 × PC2 × PC3 × PC4	
14	Probability of leak-explosion (Explosion resulting from leak)	PC8	3.59E-06	PC8 = P1 × PC1 × PC3 × PC5	
15	Probability of rupture-explosion (Explosion resulting from rupture)	PC9	8.97E-07	PC9 = P1 × PC2 × PC3 × PC5	

Flash Fire Impacts

16	Leak-fire impact at site centerpoint – Does the LFL extend beyond the centerpoint? – Enter Yes or No?		No	Using appropriate **1-inch** release LFL figure (see Figures 1-4), select LFL distance for pipeline conditions. Select Rural (Figures 1-2) or Urban (Figures 3-4).	Reaches approximately 400 feet.
17	If Line 14 is Yes, enter probability of flash fire fatality if exposed. If No enter 0.	PC10	0	Default value	The protocol methodology assigns a default value of zero.
18	Rupture-fire impact at site centerpoint – does the LFL extend beyond the centerpoint? – Enter Yes or No?		Yes	Using appropriate **Full Bore** release LFL figure (See Figures 1-4), select LFL distance for pipeline conditions	
19	If Line 16 is Yes, enter probability of flash fire fatality if exposed. If No enter 0.	PC11	0	Default value	This reaches approximately 3400 feet. The protocol methodology assigns a default value of zero.

Jet Fire Impacts

20	Leak-fire impact at site centerpoint	LFI (kW/m2)	<10	Using appropriate **1-inch** release Jet Fire Radiation figure (See Figure 5), select Jet Fire Radiation value (kW/m2) for centerpoint distance.	Less than 10 kW/m2 at approximately 47 feet from the pipeline
21	Probability of leak-fire fatality if exposed	PC12	0	Probability of fatality associated with LFI from Figure 28	
22	Rupture-fire impact at site centerpoint	RFI (kW/m2)	<10	Using appropriate **Full Bore** release Jet Fire Radiation figure (See Figures 6-11), select Jet Fire Radiation value (kW/m2) for centerpoint distance.	Less than 10kW/m2 at approximately 550 feet from the pipeline
23	Probability of rupture-fire fatality if exposed	PC13	0	Probability of fatality associated with RFI from Figure 28	

Explosion Impacts

24	Leak-explosion impact at site centerpoint	LEI (psi)	<1	Using appropriate **1-inch** release figure (See Figure 18), select release overpressure value (psi) for centerpoint distance.	Less than 1 psia at approximately 520 feet from the pipeline
25	Probability of leak-explosion fatality if exposed	PC14	0	Probability of fatality associated with LEI from Figure 27	SIMPLE FRAME UNREINFORCED CONSTRUCTION
26	Rupture-explosion impact at site centerpoint	REI (psi)	<1	Using appropriate **Full Bore** release figure (See Figures 19 - 25), select release overpressure value (psi) for centerpoint distance.	Less than 1 psia at approximately 1170 feet from the pipeline
27	Probability of rupture- explosion fatality if exposed	PC15	0	Probability of fatality associated with REI from Figure 27	SIMPLE FRAME UNREINFORCED CONSTRUCTION

Individual Risk Calculation

28	Probability of occupancy	PC16	0.2	Default value
29	Annual fire fatality individual risk	FFIR	0.00E+00	FFIR=PC16 × (PC10×PC6 + PC11×PC7 + PC12×PC6 + PC13×PC7)
30	Annual explosion fatality individual risk	EFIR	0.00E+00	EFIR= PC16 (PC14 X PC8 + PC15 X PC9)
31	Total Individual Risk	TIR	0.00E+00	TIR= FFIR+EFIR
33	Individual Risk Criterion	IRC	1.00E-06	Default Value
	Check shaded box as follows:			
33	If TIR / IRC > 1.0		0.000	
35	If TIR / IRC < =1.0	X	0.000	**INSIGNIFICANT**

Societal Risk Calculation

	Event	Exposure Probability PCi	Value	Fatality Probability PCj	Value
36	Leak Flash Fire	PC6 x PC16	1.67E-06	PC10	0
37	Rupture Flash Fire	PC7 X PC16	4.19E-07	PC11	0
38	Leak Jet Fire	PC6 X PC16	1.67E-06	PC12	0
39	Rupture Jet Fire	PC7 X PC16	4.19E-07	PC13	0
40	Leak Explosion	PC8 X PC16	7.18E-07	PC14	0
41	Rupture Explosion	PC9 X PC16	1.79E-07	PC15	0

Societal Impacts

	Site Population (SP)	Site Casualties (SC)	Societal Risk Criterion (SRC) - FIGURE D-1	SC/SRC
36	3200	0	2.41	0
37	3200	0	4.77	0
38	3200	0	2.41	0
39	3200	0	4.77	0
40	3200	0	3.66	0
41	3200	0	7.25	0

	Significant? Yes (SC/SRC>=1)	No (SC/SRC<=1)		
36		X	Leak Flash Fire	INSIGNIFICANT
37		X	Rupture Flash Fire	INSIGNIFICANT
38		X	Leak Jet Fire	INSIGNIFICANT
39		X	Rupture Jet Fire	INSIGNIFICANT
40		X	Leak Explosion	INSIGNIFICANT
41		X	Rupture Explosion	INSIGNIFICANT