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APPENDICES
(See Volume 2)

[Appendix 8A: Environmental Justice Evaluation Approach](#)

[Appendix 8B: Minority and Low-Income Population Estimates by One-Mile Segments from Houston to El Paso](#)

8.0 ENVIRONMENTAL JUSTICE

This chapter describes the results of an environmental justice (EJ) analysis conducted for Longhorn Pipeline System (System) to determine if there would be any disproportionately high and adverse human health or environmental effects on minority or low-income populations. The analysis was based primarily on relative failure probabilities of 1-mile pipeline system segments and included potential impacts expected to occur from normal operation of the System and from pipeline failure.

Based on the results of the EJ analysis, the proposed project would not have any disproportionately high and adverse effects on minority and low-income populations during normal pipeline operation scenarios. Furthermore, there is no evidence of disproportionately high and adverse effects along a majority of the pipeline in the event of a pipeline failure. There is some indication that a failure event could result in potential disproportionately high and adverse effects if a pipeline failure were to occur in a portion of Harris County from milepost (MP) 11.0 to MP 18.0. However, the area of concern for those potential effects can be addressed through the mitigation measures in Chapter 9.

The levels of EJ concern in areas potentially affected by the proposed project were defined by comparing minority and low-income population percentages to Texas average minority and low-income population percentages. The potential for disproportionately high and adverse human health or environmental effects was determined by comparing relative pipeline failure probability levels in areas of EJ concern with levels in areas of low EJ concern.¹

8.1 PURPOSE OF EJ ANALYSIS

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority populations and low-income populations. The Council on Environmental Quality (CEQ), US Environmental Protection Agency (EPA), and US Department of Transportation (DOT) have issued guidance documents addressing EJ under the National Environmental Policy Act (NEPA) consistent with the purpose and goals of Executive Order 12898 (EPA, 1998a; EPA, 1998b; DOT, 1997; CEQ, 1997).

¹ The terms “areas of low-EJ concern” and EJ “areas of concern” are based on quantitative demographic information and are merely used to describe categories of an environmental justice concern indicator variable used for purposes of statistical analysis.

An EJ analysis was conducted for the System for the following reasons:

- The President has directed federal agencies to comply with Executive Order 12898 and its accompanying memorandum to achieve the goal of EJ through various means, including the NEPA process.
- Orders and guidance documents from various federal agencies, including EPA and DOT, emphasize consideration of EJ concerns.
- The Settlement Agreement (Settlement) provides for an analysis under EPA's NEPA Guidance (EPA, 1998) of any EJ issues associated with operation of the Longhorn pipeline, including but not limited to any issues raised by the prices of fuels in El Paso, Texas, and other markets in Texas and New Mexico to be served by Longhorn and the location of the pipeline in certain residential areas.

Under EPA guidance, DOT guidance, and the Settlement, this EJ analysis of the System addresses the following concerns:

- Whether the proposed project could have disproportionately “high and adverse”² human health and environmental effects on minority or low-income populations;
- Whether some portion of the proposed project could have disproportionately high and adverse human health and environmental effects on minority or low-income populations;
- If so, whether reasonable and feasible measures could eliminate or mitigate disproportionately “high and adverse effects”; and
- Whether it is appropriate to modify recommended mitigation measures to meet the needs of a disproportionately affected minority or low-income population.

In addition, an assessment of the equality of post-mitigation pipeline failure risk levels was conducted based on concerns raised by EJ interest groups. Ultimately, this evaluation addresses both whether the proposed project poses risks to minority or low-income populations that are disproportionately high, and whether the risks to minority or low-income populations are adverse.

The approach is designed to ensure that minority and low-income populations potentially affected by the proposed project have substantial opportunity to participate in the NEPA process, and if potential disproportionately high and adverse effects on minority and low-income populations exist, evaluate whether reasonable and feasible measures could eliminate or mitigate

² “Disproportionately high and adverse” is a term used in the Executive Order 12898 and was determined in this Environmental Assessment (EA) during Step 3 of the analysis described in the table “EJ Evaluation Method.”

potential effects. In this case, we have identified mitigation measures that fully address such potential impacts in the areas of EJ concern.

8.2 EVALUATION APPROACH

This section describes the approach used for the EJ analysis. The table below describes the sequence of steps performed during the evaluation. Each of the steps is described in the following subsections. Further discussion of the evaluation approach is included in Appendix 8A.

EJ Evaluation Method

Step	Description
1	Identify potential effects of the proposed project. Identify potential human health, socioeconomic, and environmental effects of the proposed project, as well as cumulative effects from other related projects.
2	Identify potential impact on minority and low-income populations. Determine whether potential effects would impact minority or low-income populations and identify the locations of those populations.
3	Determine potential disproportionately high and adverse effects. Use established methods for each area along the pipeline route with potential effects on minority or low-income populations to determine whether potential effects on those populations could be disproportionately high and adverse (potential impacts are identified in Chapter 7).
4	Review mitigation measures. Review potential mitigation measures in areas where disproportionately high and adverse effects impact minority and low-income populations. Determine whether additional mitigation measures are appropriate.

8.2.1 Identify Potential Effects of the Proposed Project

The EJ analysis first evaluated potential impacts resulting from normal pipeline operations and potential impacts related to a potential pipeline failure event, based on relative failure probabilities of the pipeline system. Such potential impacts can include effects on health and safety, contamination of drinking water sources (both surface water and ground water), and noise. This first step identifies all potential effects, regardless of significance. The process for evaluating potential effects of the proposed project and for evaluating the results of the analysis is described in Chapter 7.

Traditional cumulative effects assessments look at the incremental impacts of the proposed project combined with similar impacts from existing sources or other proposed projects. For example, releases from nearby facilities would be considered in the case of a

proposed chemical plant. In the case of the Longhorn pipeline, there are no routine discharges and emissions, and thus, no incremental effects of normal operations. Potential adverse effects from this pipeline are possible only in the event of pipeline failure, and it is impossible to predict where these will occur. Thus, in 7.12 of this EA, cumulative effects were evaluated in relation to adjacent parallel pipelines with similar risks. The existence of several pipelines in a corridor increases the risks to nearby residences. The occurrence of parallel pipelines along the System ROW is the same for areas of EJ concern and areas of low-EJ concern.

8.2.2 Identify Potential Impact on Minority and Low-Income Populations

The EJ evaluation considered whether these potential effects could occur in areas with minority or low-income populations. This determination was made by identifying the geographic areas where potential effects could occur and by identifying the demographic characteristics of the population in each area. A uniform 1,250-foot (ft)-wide distance from the pipeline centerline (total corridor width of 2,500 feet [ft]) was defined as the maximum area of potential effects (Chapter 4). This buffer distance was selected for analytical purposes based upon catastrophic dispersion modeling of sudden gasoline releases from the pipeline. This threshold offers a practical, uniform approach to identifying communities that would experience the most significant human health effects and also encompasses areas that could be expected to experience other localized effects such as construction impacts, visual intrusion, and noise impacts.

A combination of minority population and low-income population factors, based on a ranking scheme developed by EPA Region 6 called the potential EJ index (EJI), was used as an EJ indicator for the proposed project (EPA Region 6, 1996). The EJI is composed of three factors: the percent minority population factor (DVMAV), the percent low-income population factor (DVECO), and the population density factor (POP). These factors can be used either individually or in combination to evaluate EJ concerns of proposed projects. The definition of each EJI factor is summarized in the following table.

Potential EJI Factors

Factor	Value Range	Data
Population Density (POP)	0 to 4	Derived using housing-unit estimates (See Chapter 4)
Percent Minority Population (DVMAV)	1 to 5	1990 Census, Block Groups and Summary Tape File 3A (STF3A)
Percent Low-Income Population (DVECO)	1 to 5	1990 Census, Block Groups and STF3A
Potential EJI	0 to 100	$POP \times DVMAV \times DVECO$

An EJ score based on the DVMAV and DVECO factors was computed for each area of potential effects for the proposed project. Scores for each 1-mile pipeline segment, based on estimated population within 1,250 ft (approximately 0.24 miles) of the pipeline centerline, are provided in Table 8B-1 in Appendix 8B.

8.2.3 Determine Potential Adverse Effects

The third step in the EJ evaluation was to evaluate potential effects from normal pipeline operation and potential pipeline failure scenarios to determine if they could have adverse human health or environmental effects. Adverse effects can include major impacts identified for the proposed project. The methods, criteria, and results of the impacts analysis are described in Chapter 7. The methods and results of the analysis to determine relative pipeline failure probabilities are described in Chapter 6. The qualitative evaluation for pipeline failure was selected as the best indication of adverse impacts because there are no major impacts of the proposed project during routine operations. The pre-mitigation EJ analysis is based upon risk assessment model results as of early July 1999.

8.2.4 Determine Disproportionately High and Adverse Effects

Next, potentially adverse effects were evaluated in a screening-level analysis to determine if they could disproportionately affect minority and low-income populations in the absence of mitigation measures. Adverse effects were defined as disproportionate if the risks of pipeline failure were predominantly borne in areas with minority or low-income populations or greater in magnitude in areas with minority or low-income populations than in other areas.

For the purpose of statistical analysis, areas of potential effects were divided into the following categories, based on level of EJ concern and level of relative pipeline failure probability scores. The categories are as follows:

- Low EJ concern and low relative failure probability score;
- Low EJ concern and high relative failure probability score;
- EJ areas of concern and low relative failure probability score; and
- EJ areas of concern and high relative failure probability score.

Categorizing an area as having low EJ concern does not imply there is no EJ concern, just that the concern is lower relative to areas of EJ concern. The distinction was drawn for purposes of statistical evaluation and is consistent with application of the EJI in other environmental assessments. The categorization was based on DVMAV and DVECO scores of the EJI and on relative failure probability scores for potential major impacts resulting from pipeline failure as described in Section 6.4. Each of these categories is described in the following table. Note that “risk” is numerically indicated as a relatively less safe situation. Therefore, the higher the failure probability score, the lower the risk.

Impact and EJ Categories for Areas of Potential Effects

Category	Value Range
Relative Failure Probability	
Low (lower risk)	≥ 185
High (higher risk)	< 185
EJ Score^a	
Low Concern	1 to 2
Areas of Concern	3 to 25

^a The EJ score is defined as the product of the DVMAV and the DVECO of the EJI. The POP of the EJI was not included in the EJ score to avoid “double counting,” since population density is a factor in computing relative failure probability scores (Chapter 6) and in identifying sensitive and hypersensitive areas along the pipeline route (Chapter 7).

Based on the above categorizations for relative EJ concern, any 1-mile pipeline segment with the following characteristics was defined as an area of potential EJ concern:

- Percent minority population and percent low-income population greater than the Texas state average of 39.4 percent minority and 27.6 percent low-income (DVMAV and DVECO > 1, possible minimum score of 4); and
- Percent minority population or percent low-income population greater than 1.33 times the Texas state average of 39.4 percent minority and 27.6 percent low-income (DVMAV or DVECO > 2, possible minimum score of 3).

This analysis therefore defines the presence of minority and low-income populations by comparing demographics of 1-mile pipeline segments to the demographics of the general population in the state of Texas (EPA, 1998b).

The population density factor was not used in determining areas of potential EJ concern because the population that lives within 1,250 ft of each 1-mile pipeline segment is already accounted for in two ways. First, the pipeline failure model (Chapter 6) incorporates population density as a factor for computing relative failure risk from third-party damage. Second, the definition of sensitive and hypersensitive pipeline segments (Chapter 7) includes population density as a factor. The EJI population density factor was eliminated to avoid double-counting population density in the statistical analysis.

Areas of potential effects with zero population ($DVMAV * DVECO = 0$) are considered areas which avoid possibilities for EJ concern. To facilitate the process of identifying possible areas of EJ concern, these unpopulated 1-mile segments were eliminated from the analysis. Some 548 of the 695 1-mile pipeline segments were estimated to have zero population within 1,250 ft of the pipeline centerline. Of the remaining 147 populated 1-mile segments, 98 fell into the low category for potential EJ concern. Forty-nine fell in the category for areas of potential EJ concern. The majority of the areas of potential EJ concern are in Harris County.

8.2.5 Analyses for Populated Segments

Two statistical tests were performed on the 147 populated 1-mile segments to identify potential disproportionately high and adverse effects on minority or low-income populations. First, a chi-square test was performed. This statistical procedure is used to determine whether probabilities associated with one variable are independent of probabilities associated with another. The chi-square test yields a percentage between zero and 100. This number represents the level of certainty that the probability that an area is of EJ concern is not independent of the probability that an area would experience a relatively high failure probability.³

For this analysis, a failure probability score less than 185 was used as a reasonable definition of areas with relatively high pipeline failure probability. Pipeline failure scores greater than or equal to 185 therefore indicated relatively lower pipeline failure probabilities. The chi-square evaluation did not differentiate between pipeline failure scores from 184 to 147 (the

³ Low percentages indicate that impact is not independent of EJ status. For example, a value of 5 indicates that there is only a 5 percent chance that impact is independent of status. This also can be interpreted as 95 percent certainty that impact is related to status. For purposes of this report, the results of the chi-square test are presented in terms of the certainty that there is relationship between impact and status. For example, a reported value of 95 indicates there is a 95 percent chance that impact is related to status.

highest probability of pipeline failure recorded) since any score within that range was considered to be a “relatively high” failure probability, compared to “relatively low” failure probability for scores of 185 or greater.

The chi-square analysis tests independence between the EJ population variable and the relative failure probability score for 1-mile pipeline segments. However, a conclusion that the variables are related does not, by itself, indicate disproportionately high and adverse effects on minority or low-income populations, since such effects may be borne by non-minority or non-low-income populations. To make this determination, a second statistical test, the ratio of means test, was used to indicate the direction of the statistical pattern. The ratio of means test compares the average impact score for areas of EJ concern to the average impact score for areas of low EJ concern. A ratio greater than 1 indicates that areas of EJ concern have a lower average impact score (higher average risk).

Both statistical tests have a level where results are considered statistically significant. Potential disproportionate effects of the proposed project were determined to be statistically significant if the following two conditions existed:

- The EJ analysis resulted in a chi-square result greater than 50 percent, indicating that the EJ and pipeline failure score variables are not independent. Statistical analyses typically avoid concluding that variables are not independent at less than 90 percent certainty. The lower statistical threshold of 50 percent provides a more conservative indication of disproportionate effects.
- The EJ analysis resulted in a means ratio greater than 1, indicating that statistically significant disproportionate effects are borne by minority and low-income populations.

As with any screening-level analysis, further analyses are performed if the results of the chi-square and ratio of means tests are found to be statistically significant. In this case, county-level chi-square analyses and statistical comparisons of average failure risks to local and system-wide populations were used as validation tests. These validation tests were conducted in order to further characterize the nature and degree of the potential disproportionate effects. The results provided further evidence for determining if the disproportionate effects should be characterized as disproportionately high and adverse and for determining the extent of measures approximate to mitigate the potential disproportionate effects.

8.2.6 Review Mitigation Measures

Due to the nature of this project, a final step in the EJ analysis was undertaken to evaluate the proposed mitigation measures to determine if they adequately address EJ concerns. The mitigation review analyzes post-mitigation relative failure probability scores using the same methods used to determine disproportionately high and adverse effects in the absence of mitigation measures. The intent of the post-mitigation analysis is to determine if mitigation measures have been applied appropriately to areas of EJ concern and areas of low-EJ concern.

8.3 RESULTS OF ANALYSIS

This section presents the results of the EJ analysis for the System.

8.3.1 Potential Effects of the Proposed Project

A broad range of potential socioeconomic, human health, and environmental effects were evaluated in Chapter 7 of this EA to determine if any major impacts would result from the proposed project. This section describes socioeconomic, human health, and environmental impacts of the proposed project that were evaluated in Chapter 7 and expected to affect minority or low-income populations.

8.3.1.1 Socioeconomic Effects

The Settlement specifically requires that this EA include in its EJ analysis any EJ “issues raised by the price of fuels in El Paso, Texas and other markets in Texas and New Mexico to be served by Longhorn....” This section looks briefly at whether there will be such price effects, where they might occur, and what economic effects might occur that would affect minority or low-income populations.

8.3.1.1.1 Background

The markets to be served by Longhorn have relatively high proportions of minority population compared to the United States as a whole, and some of these markets have a greater than average percentage of low-income persons. On average, the minority population comprises 24 percent of the United States population. For El Paso, Las Cruces, Midland-Odessa, Albuquerque, Phoenix, and Tucson, minorities comprise 74, 59, 34, 44, 23, and 31 percent, respectively. For the United States, 24 percent of the population is low-income. For El Paso,

Las Cruces, Midland-Odessa, Albuquerque, Phoenix, and Tucson, the low-income population is 33, 36, 28, 26, 21, and 29 percent of the total, respectively.⁴

Prior to the initiation of this EA, Longhorn retained an economic consultant to develop economic benefit estimates of the proposed project on various geographic markets where Longhorn would provide fuel. These include the direct markets to Midland-Odessa (Perryman Group, 1998a) and El Paso (Perryman Group, 1998b) and indirect markets via interstate links in New Mexico (Perryman Group, 1998c) and Arizona (Perryman Group, 1998d). A fifth study (Perryman Group, 1998e) specifically addressed Hispanic populations in Midland-Odessa and El Paso.

Because the issue of benefits was perceived to be important, Resource Economics, Inc. (REI) was contracted to review the methods and results of the Perryman Group studies. REI conducted a parallel analysis and modeling effort using a non-proprietary input-output model (Texas Comptroller's Office) to verify the reasonableness of the Perryman Group methods and results. The results from the Perryman Group and REI analyses were not majorly different. REI efforts also focused on some key assumptions that went into the Perryman analyses. These include transportation costs of fuels and the degree to which cost savings would be passed on by Longhorn to area consumers. The REI study found the Perryman methods, assumptions, and results to be reasonable.

However, REI found that a "likely negative impact on New Mexico and El Paso is not included" in the Perryman studies. REI estimates that Longhorn could achieve a 71 percent penetration of the Texas, New Mexico, Arizona, and Ciudad Juarez, Mexico markets by the year 2020, if as currently projected, Longhorn supplies 225,000 barrels per day (bpd) into this market area by 2020. This degree of market dominance would probably result in some layoffs or shutdowns at the smaller, less efficient, inland refineries that now provide part of this region's refined product supply.

8.3.1.1.2 Refined Product Pump Price Reductions by Market Area

The Perryman Group found that the price of gasoline and diesel at the pump would decline by 9 to 10 cents per gallon in El Paso. The Perryman Group found a similar price reduction in Arizona and a 6 to 7 cents per gallon reduction in Midland-Odessa. REI concurs with the estimates for Texas, but believes the price reduction in Arizona may be overstated. The

⁴ See "Note on Appropriate Reference Populations" in Appendix 8A.

estimates of price reductions are supported by historical rack prices in the Houston area, west Texas, and the West Coast (which supplies much of Arizona).

8.3.1.1.3 Economic Effects on Overall Population

Both REI and the Perryman Group agree that effects of the proposed project on minority populations and low-income populations will occur primarily as a result of increased economic activity resulting from the fuel price reductions. The table below includes Perryman Group estimates of these effects as well as jobs and spending directly associated with pipeline operations. (The Perryman Group also looked at impacts from the construction of new segments of the pipeline and the El Paso terminal. Because these positive economic effects have already occurred, only the estimates attributable to fuel price reductions and pipeline operations are shown below.)

Economic Effects of the Proposed Project on Overall Population

Geographic Area	Increase in Gross Area Product (\$million/year)	Increase in Total Personal Income (\$million/year)	New Jobs Created
El Paso, Texas	21	13	568
Midland-Odessa, Texas	11	7	295
Las Cruces, New Mexico	5	3	164
Albuquerque, New Mexico	17	10	581
Phoenix, Arizona	107	67	3,691
Tucson, Arizona	33	21	1,192

8.3.1.1.4 Economic Effects on Minority and Low-Income Population

The Perryman Group produced a report that examined economic impacts of the proposed project on Hispanics in Texas (Perryman, 1998e), which account for a majority of minority and low-income population groups in the Texas market areas. These estimates were for Texas as a whole, the El Paso region, and Midland-Odessa and are shown in the table below.

Economic Effects of the Proposed Project on Hispanics in Texas

Geographic Area	Increase in Effective Purchasing Power (\$million/year)	Increase in Personal Income (\$million/year)	New Jobs Created
Texas	14.9	10.1	590
El Paso, Texas	11.3	7.0	411
Midland-Odessa, Texas	2.2	1.4	95

Beyond Hispanics in Texas, the Perryman Group did not estimate what portion of new jobs, personal income, and gross area product would be accrued by minority and low-income population groups. The following table indicates the percentage of the total population comprised of minority and low-income population groups. If one assumes that the new jobs created in the economy by the proposed project are filled by minority or low-income individuals at a rate equivalent to their share of population, then a rough approximation of economic benefits to the poor and minorities can be estimated, as shown below.

Economic Effects of the Proposed Project on Minority and Low-Income Population

Geographic Area ^a	New Jobs Created	Percent of Area		New Jobs for	
		Minority	Low-Income	Minority	Low-Income
El Paso, Texas	568	74.33	32.82	422	186
Midland-Odessa, Texas	295	33.56	27.51	99	81
Las Cruces, New Mexico	164	59.39	35.66	97	58
Albuquerque, New Mexico	581	44.04	25.73	256	150
Phoenix, Arizona	3,691	22.66	21.05	836	777
Tucson, Arizona	1,192	30.91	28.87	368	344

^a Population estimates derived from 1990 Census of Population and Housing for each metropolitan statistical area.

The Perryman Group report estimated 411 new jobs created for Hispanics in El Paso, and 95 new jobs in Midland-Odessa. The results obtained by assuming that new jobs are filled by minority or low-income individuals at a rate equivalent to their share of population are 422 new jobs for minorities in El Paso and 99 new jobs for minorities in Midland-Odessa. These results are similar to the results obtained by the Perryman Group, and should provide reasonable

estimates of new jobs for minority or low-income individuals in the various geographic areas. These economic effects are projected to result primarily from increased economic activity in the geographic areas and do not include pipeline jobs.

In conclusion, by creating (1) new jobs, and in particular, (2) opportunities for fuel price savings in geographic areas with high Hispanic population and low-income populations, the System would provide benefits to these social groups.

8.3.1.2 Human Health and Environmental Effects

The analysis to determine potential human health and environmental effects relies upon the results of Chapter 7, Potential Impacts Analysis, and Chapter 6, Overall Pipeline Risk Assessment. As stated in Chapter 7, routine operations of the proposed project will not cause significant human health or environmental effects, but impacts may result from potential pipeline failure events. Taking this into account, there is no EJ concern related to routine operations and no further evaluation of routine operations is warranted. The EJ concern is the geographic distribution of relative risk of pipeline failure compared to the distribution of minority and low-income populations.

8.3.2 Potentially Affected Minority and Low-Income Populations

Table 8-1 lists each area of EJ concern potentially affected by the proposed project. Estimates of potentially affected minority and low-income population are for all 1-mile pipeline segments within each county. The totals represent the total number of 1-mile areas of EJ concern and the estimated total number of minority and low-income persons potentially affected by the proposed project. Based on these estimates, 22,995 minority persons are estimated to live within 1,250 ft of the proposed project, nearly 54 percent of the approximately 43,000 estimated total population. An estimated 9,236 low-income persons (21.5 percent) of the potentially affected population are estimated to live within 1,250 ft of the proposed project. In comparison, the percent minority for Texas is 39.4 percent, and the percent low-income is 27.6 percent.⁵

8.3.3 Adverse Effects

The potential for adverse effects to minority and low-income populations as a result of a potential pipeline failure event was evaluated. The methods for analyzing relative pipeline

⁵ The fact that 54 percent of the population living within 1,250 ft of the pipeline is minority, in comparison to a Texas state average of 39.4 percent, indicates there is a possibility for potential disproportionate impacts to occur, as do the statistics reported later on in this chapter. See a summary of “Alternative EJ Evaluation Methods” in Appendix 8A.

failure probabilities and the results of that analysis are discussed in Chapter 6. As a result of the analysis in Chapter 6, the potential for major human health and environmental effects resulting from pipeline failure was identified. The majority of the affected populations, 86 percent of minority persons and 88 percent of low-income persons, are in Harris County. Thus, for the Harris County area, adverse effects to minority and low-income populations may result from a future pipeline failure event.

8.3.4 Disproportionately High and Adverse Effects

This section presents results of statistical analyses performed on the 147 populated 1-mile segments to determine if minority and low-income populations may experience disproportionately high and adverse effects from the proposed project. A system-wide screening analysis was performed to determine whether disproportionately high and adverse effects to minority and low-income populations could result from a pipeline failure event. Next, county-level analyses were conducted to identify potential disproportionately high and adverse effects that may have been masked at the system-wide level, to identify the geographic extent of segments that contribute to potential system-wide disproportionate effects, and to determine the degree of difference, or magnitude, of potential disproportionate effects. Finally, a series of further analyses were performed to validate the results of the system-wide and county-level analyses.

8.3.4.1 Conclusions Regarding Environmental Justice Analysis

Since no potential disproportionately high and adverse effects to minority and low-income populations result from normal pipeline operations, a statistical analysis to determine such effects was not conducted for this operating scenario.

The remainder of this section presents the results of statistical tests conducted to determine if disproportionately high and adverse effects may result from potential pipeline failure scenarios. The following observations can be made regarding such potential effects of the proposed project and the statistical analyses discussed in this section:

- There are no potential disproportionately high and adverse effects of the proposed project related to construction and routine operation. Potential disproportionately high and adverse effects are related only to pipeline failure events.
- The only potential disproportionate effect identified based on county-level analyses occurs in Harris County and is related to a segment of the pipeline from MP 7.0 to MP 35.0, having similar population density and pipeline characteristics throughout its length. The areas of EJ concern and relatively high pipeline failure

probabilities within this pipeline segment extend from MP 11.0 to MP 18.0. The segment from MP 11.0 to MP 18.0 represents less than 1 percent of the total pipeline. This segment includes 35 percent of all minority persons and 36 percent of all low-income persons potentially affected by the proposed project.

- Further analyses conducted during validation of the chi-square analysis results indicate that a potential disproportionate effect along this pipeline segment is only apparent within a band of pipeline failure scores between 181 and 192. Disproportionate effects are not observed at more extreme pipeline failure levels, defined as pipeline failure scores from 170 to 180.
- Validation results further indicate that the average relative failure probability scores for areas of EJ concern and low EJ concern are 181.9 and 186.3, respectively. This represents a difference of less than five points on a scale ranging from 147 to 277 for the System. This difference in relative failure probability scores does not constitute a meaningful difference between areas of low EJ concern and areas of EJ concern between MP 7.0 and MP 35.0.
- More than 600 of the Longhorn pipeline 1-mile segments either have no residents or were judged as having low EJ concern.

For these reasons, the proposed project is not considered to result in disproportionately high or adverse effects on minority or low-income populations.

8.3.4.2 Results of System-Wide Pre-Mitigation Analysis

A system-wide screening analysis consisting of chi-square and ratio of means statistical tests was performed to assess whether disproportionately high and adverse effects resulting from a possible pipeline failure event could effect minority and low-income populations.

Of the 49 1-mile pipeline segments of EJ concern, 23, or 46.9 percent, had a minimum relative failure probability score of 185 or lower (relatively high risk). Of the 98 1-mile pipeline segments of low EJ concern, 30, or 30.6 percent had a minimum relative failure probability score of 185 or lower. Alternatively, areas of EJ concern with relatively high pipeline failure risk account for 15.6 percent of all populated 1-mile segments (23 out of 147). The confidence level of 94.8 percent was above the 50 percent significance level, indicating that relative failure risk and level of EJ concern are not independent. The average minimum relative failure probability score for 1-mile pipeline segments of low EJ concern was approximately 191.2 compared to an average of 191.0 for 1-mile areas of EJ concern. This resulted in a ratio of means slightly greater than 1.0 indicating that areas of EJ concern experience a somewhat higher average relative failure probability than areas of low EJ concern.

Based on the results of this system-wide screening analysis, it was determined that further analysis to characterize the geographic extent and relative magnitude of potential effects was warranted.

The 1-mile pipeline areas of EJ concern with high relative failure probability (scores less than or equal to 185) are shown below.

Pipeline Segments of EJ Concern with High Relative Failure Probability

Mile Segment	County	Estimated Population	
		Minority	Low-Income
3.0 to 4.0 7.0 to 8.0 11.0 to 18.0 21.0 to 23.0	Harris	12,899	5,471
56.0 to 58.0 59.0 to 60.0	Waller	5	7
64.0 to 65.0	Austin	8	9
104.0 to 105.0 112.0 to 113.0	Fayette	1	5
153.0 to 155.0 157.0 to 158.0	Travis	160	92
211.0 to 212.0	Blanco	0	1
339.0 to 340.0 342.0 to 343.0	Schleicher	3	5

8.3.4.3 Discussion of System-Wide Pre-Mitigation Analysis

The relative failure probability scores for the above analyses were computed using an indexing methodology described in Section 6.4. The relative failure probability is represented by an “index sum” variable, which comprises the sum of indices representing four failure modes: third-party damage, corrosion, design, and incorrect operations. Detailed discussion of the relative failure probability scoring method is presented in Chapter 6.

Relative failure probability scores ranged from 147 to 277 for the System, with a lower value representing a higher relative probability of failure. A value of 185 or lower was used as a reasonable definition for areas of high relative failure probability. The determination of this level to indicate the cutoff between relatively higher and relatively lower risk was based on a review of the distribution of system-wide relative failure probability scores. Approximately 36 miles, or 5 percent, of the pipeline system have a relative failure probability score of 185 or lower.

The minimum relative failure probability score was computed for each 1-mile segment of the pipeline, for comparison to EJI scores for each 1-mile segment. These same data and methods were used in the county-level analysis.

8.3.4.4 County-Level and Harris County Pre-Mitigation Analysis

Based on the statistically significant finding of the system-wide screening analysis, chi-square tests were also performed at a county-level for each county listed in the table titled “Pipeline Segments of EJ Concern with Highest Relative Pipeline Failure Probability.” As the table shows, approximately 99 percent of the total minority population (12,899 of 13,076) and 98 percent of the total low-income population (5,471 of 5,590) in areas of EJ concern are located in Harris County. The county-level analyses were conducted for two purposes: (1) to identify potential disproportionately high and adverse effects that may not be apparent at the system-wide level, and (2) to identify specific pipeline segments in the county or counties contributing to the system-wide disparity observed in the initial screen.

As expected, based on the population information presented for areas of EJ concern with high relative pipeline failure probability, the county-level analyses indicate that the highest, and only statistically significant, disparity occurs in Harris County. Of the 38 1-mile pipeline segments in Harris County, 20 segments are low EJ concern and 18 segments are areas of EJ concern. Of the 18 1-mile pipeline segments of EJ concern, 11 segments (61 percent) had a minimum relative failure probability score of 185 or lower (higher risk). Alternatively, 28.9 percent of EJ areas of concern with relatively high pipeline failure risk comprise 28.9 percent of all populated segments in Harris County (11 of 38 segments). Of the 20 1-mile pipeline segments of low EJ concern, 6 segments (30 percent) had a minimum relative failure probability score of 185 or lower. This resulted in a confidence level of 94.6 percent, which is above the 50 percent significance level.

8.3.4.5 Validation of System-Wide, County-Level, and Harris County Pre-Mitigation Results

This section summarizes observations from the validation of system-wide and county-level chi-square results. A more detailed discussion is included in Appendix 8A.

Further statistical tests were performed to verify the results of the system-wide and Harris County analyses. The results are useful for validating the chi-square tests by characterizing the specific geographic areas where potential disproportionately high and adverse effects may occur.

For all chi-square tests discussed to this point, relative failure probability scores equal to or below 185 were classified as relatively high risk and scores above 185 were classified as relatively low risk. To better define the cutoff between high and low relative risk, possible relative failure probability scores between 170 and 220 were analyzed to determine the range of scores within which disparity can be observed. For each test, a different cutoff value for high relative failure probability was used, but the definition of areas of EJ concern remained the same. The results of this analysis for Harris County are presented in Figure 8-1. This figure depicts a band of cutoff values that indicate potential disproportionate effects between relative pipeline failure values from 181 to 192.

The chi-square tests showed a potential disparity when relative failure probability scores between 181 and 192 were used to define areas of highest failure probability. Significant results apparent at other values (statistical confidence greater than 50 percent above or below cutoff scores from 181 to 192) are due to the extremely small numbers of 1-mile segments having very low or very high failure probability scores. This implies that when high relative risk is defined as the most extreme risk areas, (relative failure probability score of 180 or less) there is no apparent disparity. However, for areas with moderate to high relative risk (relative failure probability scores between 181 and 192 defining high risk), there is an apparent disparity.

This analysis of relative failure probability scores in Harris County also indicates that the pipeline segment driving the finding of potential disparity in the chi-square analysis is related to a segment of the pipeline from MP 7.0 to MP 35.0. The area of EJ concern and relatively high pipeline failure probabilities within this pipeline segment extends from MP 11.0 to MP 18.0. This segment represents less than 1 percent of the total pipeline. Along this segment live an estimated 7,975 (35 percent) of the total 22,995 minority persons and 3,318 (36 percent) of the total 9,236 low-income persons living within 1,250 ft of the System.

The Harris County analysis results and population data provide strong evidence that this pipeline segment from MP 11.0 to MP 18.0 is driving observed potential disproportionate effects in Harris County and system-wide. This segment is characterized as having high population density, EJ concern, and relatively high pipeline failure probability scores. During a 1995 videotape survey of the pipeline (Due Diligence Physical Asset Review) (Exxon, 1995), attention was given to documentation of right-of-way (ROW) encroachment and ROW maintenance issues along this segment of the pipeline. The videotape documents observations of areas of overgrown vegetation and buildings encroaching upon the ROW. The observations made during the video survey were confirmed during site visits.

8.3.4.6 Harris County Pre-Mitigation Comparison Analysis

Finally, in characterizing the magnitude of potential disproportionate effect along the segment of the pipeline from MP 11.0 to MP 18.0, analyses were performed to determine the average relative failure probability for areas of EJ concern and areas of low EJ concern. The results are useful for validating the chi-square tests by characterizing the magnitude or degree (low, moderate, or high) of observed disparity in order to determine if it is substantial enough to be considered disproportionately high and adverse. The segment of the pipeline from MP 7.0 to MP 35.0 was selected for this comparison because it exhibits similar pipeline and population density characteristics along its length. Differences in average relative failure probability scores between areas of low EJ concern and areas of EJ concern can therefore be compared to characterize the degree of disparity in failure probabilities. The following table presents these results.

**Average Pre-Mitigation Failure Probability Scores for Pipeline
Segments from
MP 7.0 to MP 35.0 in Harris County***

Area	Average Failure Probability Score
Areas of low EJ concern	186.3
Areas of EJ concern	181.9
Difference	4.4

*Average minimum failure probability score for each 1-mile segment

In comparison, the lowest observed failure probability score for populated 1-mile segments of the System is 167 (highest risk), and the highest observed failure probability score for populated segments of the System is 245 (lowest risk). The average failure probability score for populated segments of the pipeline is 191.⁶ Calculation of the variability of relative failure probability scores indicates that the difference between these average risk scores is negligible.

8.3.5 EJ and Pipeline Laterals

The analysis described above relates to the 695-mile Galena Park Station to El Paso main pipeline of the System. This section briefly discusses three lateral routes, for which data were not available at the time the detailed analyses were performed. The lateral routes, therefore, have not been assessed in the same degree of detail as the main pipeline.

⁶ These statistics are based on the minimum pipeline failure probability score for each populated 1-mile pipeline segment in the System.

There are two yet-to-be-constructed route alternatives that would connect the El Paso Terminal with the three interstate pipelines approximately 8.5 miles west of the terminal. These routes are discussed in Chapter 4. A comparison of the population within 1,250 ft of both alternatives and the relevant demographics are shown below. Hispanics account for a large portion of El Paso’s minority population.

**Population, Percent Minority, and Percent Low-Income
Comparison for El Paso Laterals**

	Proposed Fort Bliss Route	Montana Average Alternative
Population ^a	232	3,770
Percent minority ^b	64.46%	64.06%
Percent low income	42.64%	22.62%

^a Based on 1999 counts of housing units within 1,250 ft of the lateral

^b Based on 1990 census data

As shown in the above table, the proposed Fort Bliss lateral route effects far fewer persons. Based on estimated population, percent minority, and percent low-income, approximately 150 minority persons and 90 low-income persons are potentially affected by the proposed Fort Bliss lateral route. These effects are those related to construction. They include temporary dust, noise, and disruption of traffic. Approximately 2,415 minority persons and approximately 853 low-income persons are potentially affected by the proposed Montana Avenue lateral route. Compared to the state as a whole, the percent minority population is high along either route and percent low-income is high along the proposed Fort Bliss route, but the absolute number of persons affected, including minority and low-income persons, is much less for the Fort Bliss alternative.

The third lateral pipeline is the 27.7-mile Crane-to-Odessa pipeline. This already constructed lateral avoids populated areas. As discussed in Chapter 4, the count of dwellings within 1,250 ft of this lateral revealed only five mobile homes (with a population of 14 persons) near where the lateral crosses into Ector County. This small number of potentially affected persons is not an adequate sample to make generalizations regarding income and minority status from 1990 Census data.

8.4 REVIEW OF MITIGATION MEASURES

8.4.1 Mitigation Measures in Harris County

Based on results of the pre-mitigation analysis, which indicated the potential for disproportionately high and adverse effects to occur in Harris County, it was appropriate to evaluate proposed mitigation measures for the proposed project. The area of EJ concern in Harris County between MP 11.0 to MP 18.0 was identified because it is subject to relatively high pre-mitigation failure probability risk and includes relatively large minority and low-income populations in comparison to the remainder of the pipeline system. The following table lists the tier designations of pipeline segments from MP 11.0 to MP 18.0. As shown in this table, all but 0.2 miles of this segment are designated either sensitive or hypersensitive and will be mitigated accordingly.

Tier Designations for Pipeline Segments from MP 11.0 to MP 18.0

Milepost	Tier Designation
11.0 to 11.2	Normal Sensitivity
11.2 to 11.5	Sensitive
11.5 to 11.7	Hypersensitive
11.7 to 12.0	Sensitive
12.0 to 12.1	Hypersensitive
12.1 to 13.7	Sensitive
13.7 to 14.0	Hypersensitive
14.0 to 15.1	Sensitive
15.1 to 15.2	Hypersensitive
15.2 to 16.8	Sensitive
16.8 to 17.2	Hypersensitive
17.2 to 18.0	Sensitive

Chapter 9 describes the mitigation measures for the sensitive and hypersensitive areas. These mitigation measures would be implemented as part of the Longhorn Mitigation Plan (LMP) included as Appendix 9C. Although not officially designated as sensitive or hypersensitive, the segment from MP 11.0 to MP 11.2 would be treated as a sensitive area in the LMP because it is adjacent on both sides to areas designated sensitive for population (Davis and Harris, May 2, 2000).

8.4.2 Harris County Mitigation

Since the potential for disproportionately high and adverse effects is not great (as discussed in Section 8.4.1), effective implementation of the proposed mitigation measures across the pipeline as a whole and in areas of EJ concern, specifically in Harris County, should be sufficient to mitigate potential EJ issues. Minority and low-income populations will not have a statistically greater potential of experiencing a future pipeline failure event if the proposed mitigation measures reduce the relative probability of pipeline failure in the area between MP 11.0 and MP 18.0 to levels similar to areas of low EJ concern with comparable proximal conditions (e.g., west and northwest Harris County, MP 7.0 to MP 35.0).

8.4.3 Post-Mitigation Analysis

Section 8.4.2 discusses how the mitigation measures fully address pre-mitigation EJ issues. This discussion is based on results of the pre-mitigation analysis and comments received from the public based on review of the draft EA. In addition, concerns have been raised by EJ groups regarding the consequences of a Longhorn-proffered suite of mitigation measures arising from discussions with the US Fish and Wildlife Service (FWS) as part of the Endangered Species Act Section 7 consultation process. Specifically, the consultation resulted in a Longhorn commitment to replace 19 miles of existing pipeline in western Travis County. The EJ concern is that minority and low-income residents in eastern Travis County have a higher risk of experiencing adverse effects of a pipeline failure event than do residents in western Travis County.

Based on these concerns, an analysis of post-mitigation relative failure probability scores was performed to determine:

- That the proposed mitigation measures for Harris County are adequate; and
- Although post-mitigation pipeline failure risks are extremely low, if there are localized portions of the pipeline where areas of EJ concern experience meaningfully different failure risk in comparison to areas of low-EJ concern.

Sections 8.4.3.1 addresses the adequacy of the mitigation measures. Section 8.4.3.2 addresses concerns of post-mitigation failure risks.

These post-mitigation analyses use the same methods and approach utilized in the analysis of pre-mitigation relative failure probability scores. All analyses are based on final post-mitigation risk assessment model results.

8.4.3.1 Analysis of Harris County Mitigation

This analysis specifically addresses the mitigation measures described in Section 8.4.2. An evaluation of post-mitigation pipeline failure probability scores was performed to determine if the proposed mitigation measures, as specified in the LMP, reduce the probability of pipeline failure in the area between MP 11.0 and MP 18.0 to acceptable and comparable levels.

The analysis included all populated 1-mile pipeline segments from MP 7.0 to MP 35.0, which allowed for comparison of the EJ area of concern (MP 11.0 to MP 18.0) to a segment of the pipeline with low EJ concern and comparable proximal conditions, such as population density and pipeline characteristics. Mitigated and unmitigated pipeline failure probability scores and EJ scores used for this analysis are provided in Table 8B-1.

Average Post-Mitigation Failure Probability Scores for Pipeline Segments from MP 7.0 to MP 35.0 in Harris County

Area	Average Pre-Mitigation Score	Average Post-Mitigation Score
Populated 1-mile segments	184.1	276.1
Areas of low EJ concern	186.3	274.8
Areas of EJ concern	181.9	277.5
Difference	4.4	-2.7

Pre-mitigation pipeline failure probability scores for MP 7.0 to MP 35.0 ranged from 167.2 to 204.4, with an average pipeline failure probability score of 181.9 in areas of EJ concern and 186.3 in areas of low EJ concern. Post-mitigation scores for this same segment ranged from 249.0 to 288.3, with an average pipeline failure probability score of 277.5 in areas of EJ concern and 274.8 in areas of low EJ concern. The average failure risk has been reduced by 95.6 points in areas of EJ concern and 88.5 points in areas of low EJ concern. Thus, the mitigation measures proposed in the LMP would lead to an overall reduced failure risk in the pipeline segment from MP 7.0 to MP 35.0, including the EJ area of concern from MP 11.0 to MP 18.0. Furthermore, the average mitigated failure risk in areas of EJ concern would be equal to or even slightly lower than in areas of low EJ concern, whereas the average pre-mitigation failure risk was higher in areas of EJ concern than in areas of low EJ concern.

A series of chi-square tests were performed to determine whether proposed post-mitigation failure probability scores are independent of EJ level of concern. Mitigated relative

failure probability scores between 261 and 276 were analyzed to determine if disparity could be observed within that range of scores. For each test, a different cutoff value for high relative failure probability was used, but the definition of areas of EJ concern remained the same. The chi-square tests showed a potential disparity when a relative failure probability score of 261 was used to define areas of highest failure probability (see Figure 8-2). The average relative failure probability scores for 1-mile pipeline segments of low EJ concern was 274.8 compared to an average of 277.5 for areas of EJ concern. This resulted in a ratio of means slightly less than 1.0, indicating that areas of EJ concern experience a statistically significant lower mitigated average relative failure probability than areas of low EJ concern when a cut-off score of 261 is used. The observed slight difference in failure risk would not result in disproportionately high and adverse effects on minority or low-income populations.

Based on results of this analysis, it was determined that mitigation measures proposed in the LMP would be sufficient to address the potential disproportionate effects to minority and low-income populations that were observed in pre-mitigation pipeline failure probability scores from MP 11.0 to MP 18.0.

8.4.3.2 Analysis to Address Equality of Risk Levels

8.4.3.2.1 System-Wide Post-Mitigation Analysis

An evaluation of post-mitigation relative failure probability scores was performed to determine if the proposed mitigation measures, as specified in the LMP, present a comparable level of risk to minority or low-income populations.

The analysis included all 147 populated 1-mile pipeline segments of the System. Mitigated and unmitigated pipeline failure probability scores and EJ scores used for this analysis are provided in Table 8B-1.

Average Post-Mitigation Failure Probability Scores for Populated Pipeline Segments

Area	Average Pre-Mitigation Score	Average Post-Mitigation Score
Populated 1-mile segments	191.1	279.2
Areas of low EJ concern	191.2	280.9
Areas of EJ concern	191.0	275.8
Difference	0.2	5.1

Pre-mitigation pipeline failure probability scores for populated 1-mile segments of the System ranged from 166.7 to 244.6, with an average pipeline failure probability score of 191.0 in areas of EJ concern and 191.2 in areas of low EJ concern. Post mitigation scores for populated 1-mile segments of the System ranged from 237.7 to 348.0, with an average pipeline failure probability score of 275.8 in areas of EJ concern and 280.9 in areas of low EJ concern. The average failure risk has been reduced by 84.8 points in areas of EJ concern and 89.7 points in areas of low EJ concern. Thus, the mitigation measures proposed in the LMP would lead to an overall reduced failure risk in the System. The average mitigated failure risk in areas of EJ concern would be slightly higher than in areas of low EJ concern. However, a difference in average failure probability of 5.1 points is not substantial in comparison to an overall change in average failure probability scores of all populated segments from 191.1 pre-mitigation to 279.2 post-mitigation, which is a difference of over 88 points.

In order to determine if the higher average failure probability in areas of EJ concern represents a statistically significant difference in the level of protection to minority or low-income populations, a series of chi-square tests were performed to determine whether post-mitigation failure probability scores are independent of EJ level of concern. Mitigated relative failure probability scores between 249 and 279 were analyzed to determine if a difference could be observed within that range of scores. For each test, a different cutoff value for high relative failure risk was used, but the definition of areas of EJ concern remained the same. The chi-square tests showed that no statistically significant difference exists within a range of cutoff scores from 251 to 279 (see Figure 8-3). When a cut-off score of 249 was used, the test indicated an inequality slightly above the 50 percent significance threshold. However, this outcome results from a smaller proportion of high-risk areas being among areas of EJ concern than among areas of low EJ concern.

Based on results of this analysis, it was determined that mitigation measures proposed in the LMP for the entire System provide an acceptable and comparable level of protection to minority and low-income populations. However, since a specific allegation has been made of post-mitigation EJ concerns in Harris and Travis counties, county-level chi-square analyses and statistical comparisons of average failure risks to local and system-wide populations were conducted.

8.4.3.2.2 Harris County

An evaluation of post-mitigation pipeline failure scores was performed to determine if the proposed mitigation measures, as specified in the LMP, present a comparable level of risk to minority or low-income populations in Harris County.

The analysis included 38 populated 1-mile pipeline segments in Harris County from MP 0.0 to MP 50.0. Mitigated and unmitigated pipeline failure probability scores and EJ scores used for this analysis are provided in Table 8B-1.

Average Post-Mitigation Failure Probability Scores for Populated Pipeline Segments in Harris County

Area	Average Pre-Mitigation Score	Average Post-Mitigation Score
Populated 1-mile segments	188.6	280.3
Areas of low EJ concern	189.6	274.7
Areas of EJ concern	187.5	286.5
Difference	2.1	-11.8

Pre-mitigation pipeline failure probability scores for populated 1-mile segments in Harris County ranged from 167.2 to 221.8, with an average pipeline failure probability score of 187.5 in areas of EJ concern and 189.6 in areas of low EJ concern. Post-mitigation scores for populated 1-mile segments in Harris County ranged from 237.7 to 326.8, with an average pipeline failure probability score of 286.5 in areas of EJ concern and 274.7 in areas of low EJ concern. The average failure risk has been reduced by 99.0 points in areas of EJ concern and 85.1 points in areas of low EJ concern. Thus, the mitigation measures proposed in the LMP would lead to an overall reduced failure risk in Harris County. The average mitigated failure risk in areas of EJ concern would be equal to or even slightly lower than in areas of low EJ concern.

A series of chi-square tests were performed to determine whether proposed mitigation failure probability scores are independent of EJ level of concern. Mitigated relative failure probability scores between 251 and 281 were analyzed to determine if different risk levels could be observed within that range of scores. For each test, a different cutoff value for high relative failure risk was used, but the definition of areas of EJ concern remained the same. The chi-square tests showed a potential disparity when relative failure probability scores of 251 to 275 were used to define areas of highest failure probability (see Figure 8-4). The average relative failure probability scores for 1-mile pipeline segments of low EJ concern was 274.7 compared to an average of 286.5 for areas of EJ concern. This resulted in a ratio of means less than 1.0, indicating that areas of EJ concern experience a statistically significant lower post-mitigation average relative failure risk than areas of low EJ concern. The observed slight difference in the level of risk would not result in a disproportionately high and adverse effect on minority and low-income populations.

Based on results of this analysis, it was determined that mitigation measures proposed in the LMP for Harris County provide an acceptable and comparable level of protection to minority and low-income populations.

8.4.3.2.3 Travis County

County-level analyses to identify differences in failure risks were conducted for all counties in the System. In addition to Harris County, the only other statistically significant difference in post-mitigation failure probability scores between areas of EJ concern and areas of low EJ concern was observed in Travis County. As with the Harris County analysis, an evaluation of post-mitigation pipeline failure scores was performed to determine if the proposed mitigation measures, as specified in the LMP, may present an unequal level of risk to minority or low-income populations in Travis County.

As discussed below, there is a statistical disparity between levels of risk of pipeline failure between EJ and non-EJ areas in Travis County. However, as discussed in Section 9.2.4 and 9.2.5 of this EA, the post-mitigation probability of failure is very low for the entire pipeline, including the EJ areas in Travis County. Probabilities of failure for the entire pipeline have been reduced by more than twenty-fold. Over the 50-year life of the Longhorn pipeline, only three leaks are projected to occur over the entire 731-mile system. The disparate post-mitigation Index Sum scores in Travis County, discussed below, are an artifact of an extraordinary set of mitigation measures that Longhorn volunteered to implement as a result of its negotiations with FWS regarding an endangered species habitat.

The analysis included all 26 populated 1-mile pipeline segments in Travis County from MP 153.0 to MP 181.0. Mitigated and unmitigated pipeline failure probability scores and EJ scores used for this analysis are provided in Table 8B-1.

Average Post-Mitigation Failure Probability Scores for Populated Pipeline Segments in Travis County

Area	Average Pre-Mitigation Score	Average Post-Mitigation Score
Populated 1-mile segments	187.8	292.8
Areas of low EJ concern	188.4	303.0
Areas of EJ concern	186.4	274.7
Difference	2.0	28.3

Pre-mitigation pipeline failure probability scores for populated 1-mile segments in Travis County ranged from 166.7 to 213.0, with an average pipeline failure probability score of 186.4 in areas of EJ concern and 188.4 in areas of low EJ concern. Post mitigation scores for populated 1-mile segments in Travis County ranged from 256.7 to 340.0, with an average pipeline failure probability score of 274.7 in areas of EJ concern and 303.0 in areas of low EJ concern. Thus, the mitigation measures proposed in the LMP would lead to an overall reduced failure risk in Travis County. The average failure risk has been reduced by an average of 88.3 points for areas of EJ concern and 114.6 points for areas of low EJ concern. Thus, the mitigation measures proposed in the LMP would lead to an overall reduced failure risk in the pipeline segments in Travis County. However, the average mitigated failure risk in areas of EJ concern would be greater than in areas of low EJ concern.

In order to determine if the higher average failure probability in the Travis County areas of EJ concern represents a statistically significant difference in the level of protection to minority or low-income populations, a series of chi-square tests were performed to determine whether post-mitigation failure probability scores are independent of EJ level of concern. Mitigated relative failure probability scores between 259 and 293 were analyzed to determine if different risk levels could be observed within that range of scores. For each test, a different cutoff value for high relative failure probability was used, but the definition of areas of EJ concern remained the same. The chi-square tests showed a potential disparity when relative failure probability scores of 259 to 293 were used to define areas of highest failure probability (see Figure 8-5).

The average relative failure probability scores for 1-mile pipeline segments of low EJ concern was 303.0 compared to an average of 274.7 for areas of EJ concern. This resulted in a ratio of means greater than 1.0, indicating that areas of EJ concern experience a statistically significant greater post-mitigation failure risk than areas of low EJ concern. However, as discussed previously, the level of risk experienced by all areas of concern in Travis County, including areas of EJ concern is extremely low.

Proposed mitigation measures for Travis County include replacing 19.0 miles of existing pipe from MP 169.88 to MP 188.0. The purpose of these mitigation measures is to protect the endangered Barton Springs Salamander and its habitat, which consists of highly sensitive karst topography. These mitigation measures are the result of discussions between Longhorn and the FWS representatives, as part of the Endangered Species Act Section 7 consultation process. These mitigation measures are separate from the pre-mitigation pipeline risk analysis performed for the pipeline system in EA Chapter 6, and are intended to ensure protection of an area with a combination of environmental factors that make it extremely sensitive. FWS provided a Letter of Concurrence with the determination made by EPA and DOT that these mitigation measures, which are much more extensive than the analysis in the EA recommends, would not adversely affect listed species or critical habitat.

One consequence of this mitigation action is an increased variability in post-mitigation failure risk levels in Travis County compared to the variability in scores experienced along the pipeline as a whole. The extremely low-risk levels resulting from these mitigation measures are the cause of the statistically significant result discussed above. For example, 10 of 26 populated 1-mile pipeline segments in Travis County are included in these mitigation measures. The post-mitigation failure probability scores for these segments range from 321.0 to 340.0 with an average score of 331.4. In comparison, the remaining 16 1-mile pipeline segments in eastern Travis County have failure probability scores ranging from 256.7 to 277.8 with an average score of 268.6.

These 16 segments in eastern Travis County, from MP 153.0 to MP 170.0 experience a level of risk similar to that experienced on the average across the entire System. For example, the average post-mitigation failure probability score for all populated segments is 279.2 for the entire System and 268.6 in Travis County from MP 153.0 to MP 170.0. The difference of 10.6 points in comparison to the System average is not substantial when compared to the 88.3 point difference in pre-mitigation to post-mitigation risk levels in EJ areas of concern from MP 153.0 to MP 170.0. In all populated segments from MP 153.0 to MP 170.0, the average failure risk has been reduced by 84.6 points. This means that areas of EJ concern in the MP 153.0 to MP 170.0

segment actually experience a lower post-mitigation failure risk than do areas of low-EJ concern in the same segment.

Based on results of this analysis, it was determined that mitigation measures proposed in the LMP for Travis County provide an acceptable level of protection to minority and low-income populations. Furthermore, minority and low-income populations in Travis County will experience a post-mitigation level of pipeline failure risk similar to the average risk level experienced across populated segments of the System. The level of post-mitigation pipeline failure risk experienced in eastern Travis County areas of EJ concern is thus slightly different when compared to areas of low EJ concern in Travis County, but is comparable to (a) all populated 1-mile segments across the entire system, (b) all areas of EJ concern across the entire System, or (c) areas of low-EJ concern in eastern Travis County.

8.5 SUMMARY

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority populations and low-income populations. The Council on Environmental Quality (CEQ), US Environmental Protection Agency (EPA), and US Department of Transportation (DOT) have issued guidance documents addressing EJ under National Environmental Policy Act (NEPA) consistent with the purpose and goals of Executive Order 12898 (EPA, 1998a; EPA, 1998b; DOT, 1997; CEQ, 1997).

An EJ analysis was conducted for the System for the following reasons:

- The President has directed Federal agencies to comply with Executive Order 12898 and its accompanying memorandum to achieve the goal of EJ through various means, including the NEPA process.
- Orders and guidance documents from various federal agencies, including EPA and DOT, emphasize consideration of EJ concerns.
- The Settlement Agreement (Settlement) provides for an analysis under EPA's NEPA Guidance (EPA, 1998) of any EJ issues associated with operation of the Longhorn pipeline, including but not limited to any issues raised by the prices of fuels in El Paso, Texas, and other markets in Texas and New Mexico to be served by Longhorn and the location of the pipeline in certain residential areas.

Under EPA guidance, DOT guidance, and the Settlement, this EJ analysis of the System addresses the following concerns:

- Whether the proposed project could have disproportionately “high and adverse” human health and environmental effects on minority or low-income populations;
- Whether some portion of the proposed project could have disproportionately high and adverse human health and environmental effects on minority or low-income populations;
- If so, whether reasonable and feasible measures could eliminate or mitigate disproportionately “high and adverse effects”; and
- Whether it is appropriate to modify recommended mitigation measures to meet the needs of a disproportionately affected minority or low-income population.

In addition, an assessment of the comparability of post-mitigation pipeline failure risk levels was conducted based on concerns raised by EJ interest groups. Ultimately, this evaluation addresses both whether the proposed project poses risks to minority or low-income populations that are disproportionately high, and whether the risks to minority or low-income populations are adverse. Because the risks to minority or low-income populations are not significant (as employed by NEPA) and do not appreciably exceed the risks to other populations, for these two reasons, there are no disproportionately high and adverse effects.

The potential for disproportionately high and adverse effects in the absence of mitigation measures was determined by comparing relative pipeline failure probability scores to demographic information for 1-mile pipeline segments. The levels of EJ concern in areas potentially affected by the proposed project were defined by comparing minority and low-income population percentages in these areas to percentages for the Texas general population. The analyses indicate that the proposed project will not result in disproportionately high and adverse effects to minority and low-income populations during normal pipeline operation scenarios. Furthermore, there is no evidence of disproportionately high and adverse effects along a majority of the pipeline in the event of a pipeline failure. However, there are segments of the pipeline where a failure event could result in disproportionate effects. These segments are in Harris County.

The EJ concern and relative high pipeline failure probabilities within the Harris County pipeline segments extends from MP 11.0 to MP 18.0. The Harris County segments of EJ concern represent less than one percent of the total pipeline. Chi-square statistical analyses for the Houston segments indicated an association between EJ concern areas and the pre-mitigation pipeline failure impact scores. A means ratio analysis result was slightly greater than 1 (1.001). A comparison analysis showed that the difference between average pipeline failure scores for areas of EJ concern and areas of low EJ concern is negligible. The means ratio and comparison

tests indicate that areas of EJ concern have only a very slight increase in average relative failure probability compared to areas of low EJ concern. Although these two statistical tests do not indicate that the potential adverse effects on minority populations or low-income populations appreciably exceed or are likely to appreciably exceed those of the general population (NEPA guidance), they do identify a portion of the pipeline in Harris County for which mitigation measures should be discussed as in Chapter 9.

Economic effects on minority and low-income populations were also evaluated. An analysis performed by the Perryman Group included Texas as a whole, the El Paso region, and Midland-Odessa. The analysis concluded that by creating (1) new jobs, and in particular, (2) opportunities for fuel price savings in geographic areas with high Hispanic population and low-income populations, the System would provide benefits to these social groups.

Chi-square statistical analyses were performed to determine whether mitigation measures proposed in the LMP (1) reduce the relative probability of pipeline failure in the area between MP 11.0 and MP 18.0 to acceptable and proportionate levels, as discussed in 8.4.2, and (2) afford minority and low-income populations a reduction in pipeline failure risk comparable to the potentially affected population as a whole.

Results of the post-mitigation analysis for Harris County MP 7.0 to MP 35.0 indicate that the relative probability of pipeline failure in the area between MP 11.0 and MP 18.0 has been reduced to an acceptable and comparable level, as discussed in 8.4.2.

Results of the System-wide post-mitigation analyses indicates that areas of EJ concern would experience a post-mitigation pipeline failure risk comparable to areas of low EJ concern. Results of the county-level analyses indicate that areas of EJ concern in Harris County would experience a post-mitigation pipeline failure risk equal to or lower than areas of low EJ concern. Areas of EJ concern in Travis County may experience a higher risk of pipeline failure than areas of low EJ concern in Travis County. However, the level of pipeline failure risk in Travis County areas of EJ concern has been substantially reduced from pre-mitigation levels and is similar to the average risk experienced in all populated areas and areas of EJ concern along the System as a whole.

8.6 REFERENCES

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The Perryman Group(d), "The Impacts of Longhorn Partners Pipeline on Economic Activity in Arizona and the Phoenix-Mesa and Tucson Metropolitan Areas," September 1998.

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**Table 8-1. Minority and Low-Income Populations
Potentially Affected by the Proposed Project**

County	1-mile Areas of EJ Concern ^a	Estimated Population (total by county) ^b	
		Minority	Low Income
Harris	1.0 to 5.0 7.0 to 8.0 10.0 to 19.0 21.0 to 25.0	19,697	8,151
Waller	55.0 to 60.0	12	14
Austin	64.0 to 65.0 69.0 to 70.0 73.0 to 74.0	22	65
Fayette	104.0 to 105.0 106.0 to 109.0 112.0 to 113.0 114.0 to 115.0 116.0 to 117.0	8	25
Bastrop		134	162
Travis	153.0 to 155.0 156.0 to 161.0	3,093	983
Hays		13	19
Blanco	203.0 to 204.0 211.0 to 212.0	1	2
Gillespie		0	0
Mason		0	0
Kimble		0	0
Menard		0	0
Schleicher	333.0 to 335.0 339.0 to 340.0 342.0 to 343.0	8	12
Crockett		0	0
Reagan		0	0
Upton		0	0
Crane		0	0
Ward	522.0 to 524.0	4	2
Reeves	526.0 to 527.0	3	1
Culberson		0	0
Hudspeth		0	0
El Paso		0	0
Total	49.0 Miles	22,995	9,236

^a Mile segments with EJ score (DVMAV*DVECO) of 3 or greater.

^b Minority and low-income population estimates include all 147 populated 1-mile pipeline segments.

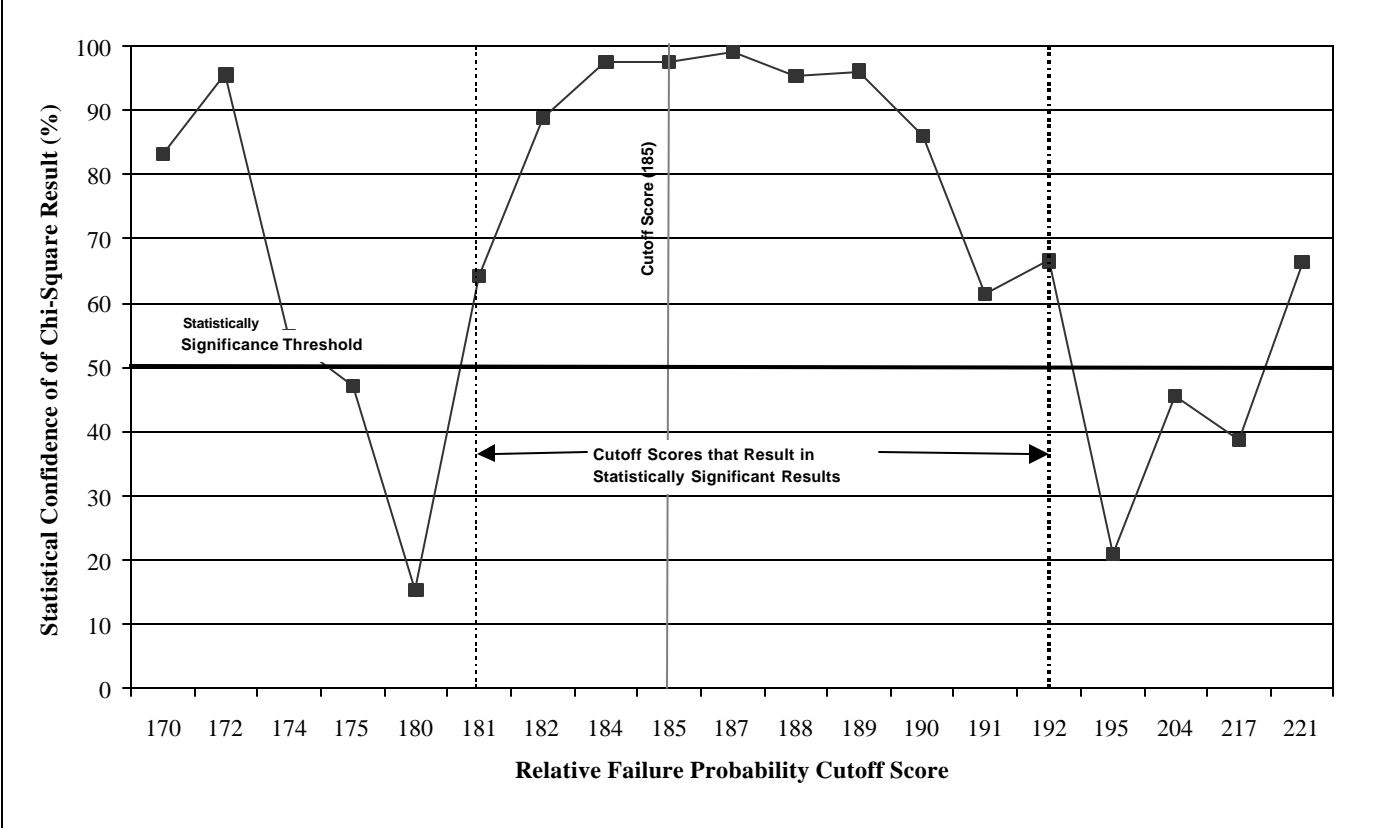
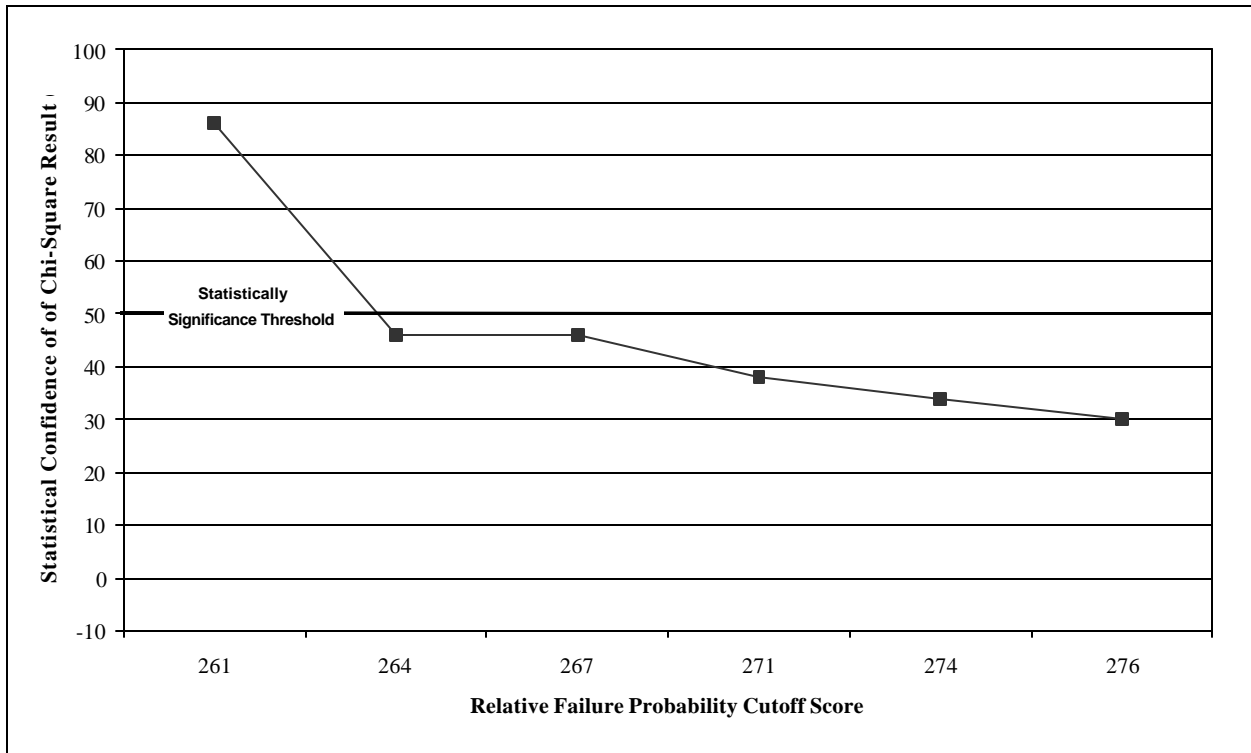
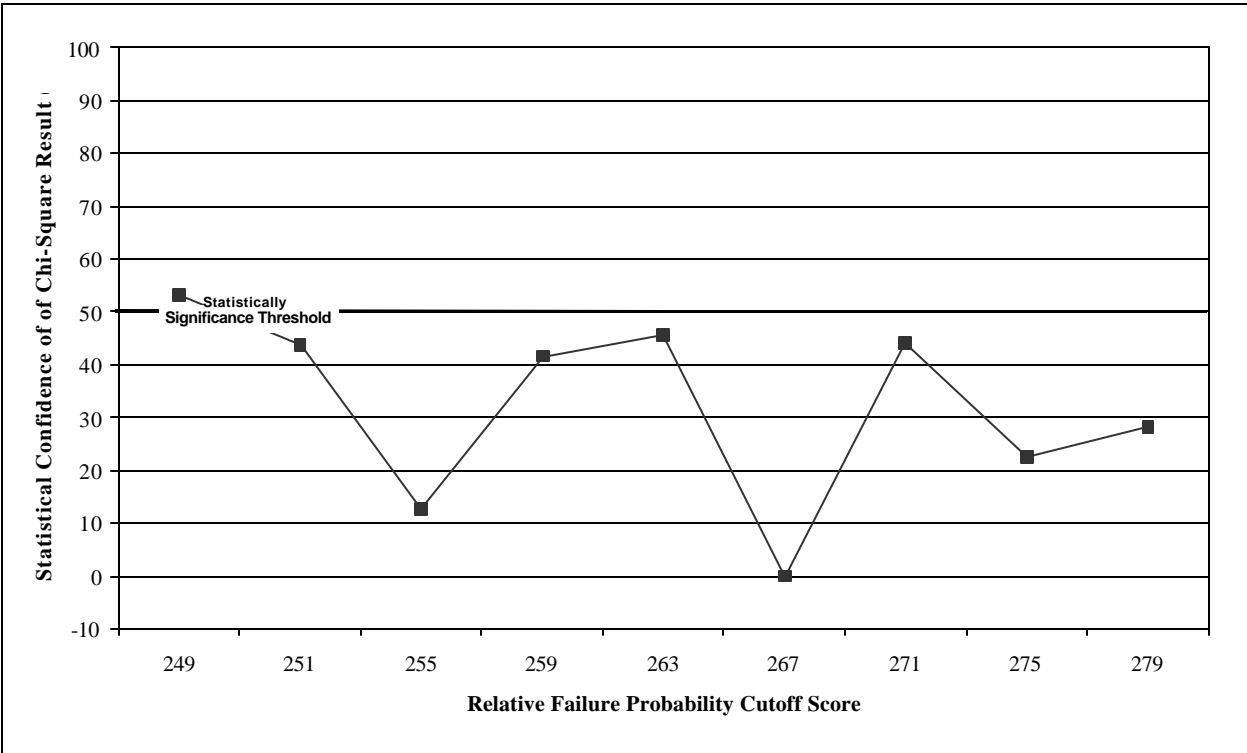


Figure 8-1. Statistical Significance of Chi-Square Result by Pre-Mitigation Failure Probability Cutoff Score in HarrisCounty



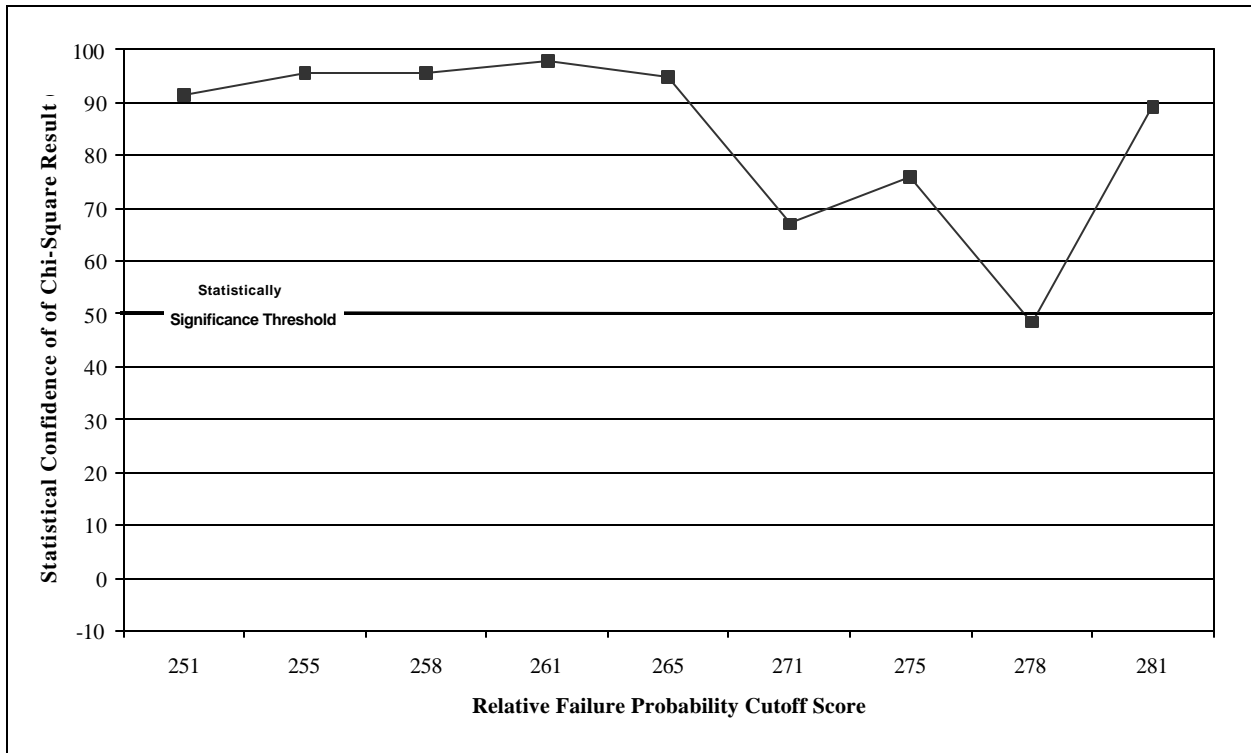
Means Ratio = 0.99, Significant results indicate statistically higher failure risk in areas of low EJ concern.

Figure 8-2. Statistical Significance of Chi-Square Result by Post-Mitigation Failure Probability Cutoff Score, Harris County MP 7.0 to MP 35.0



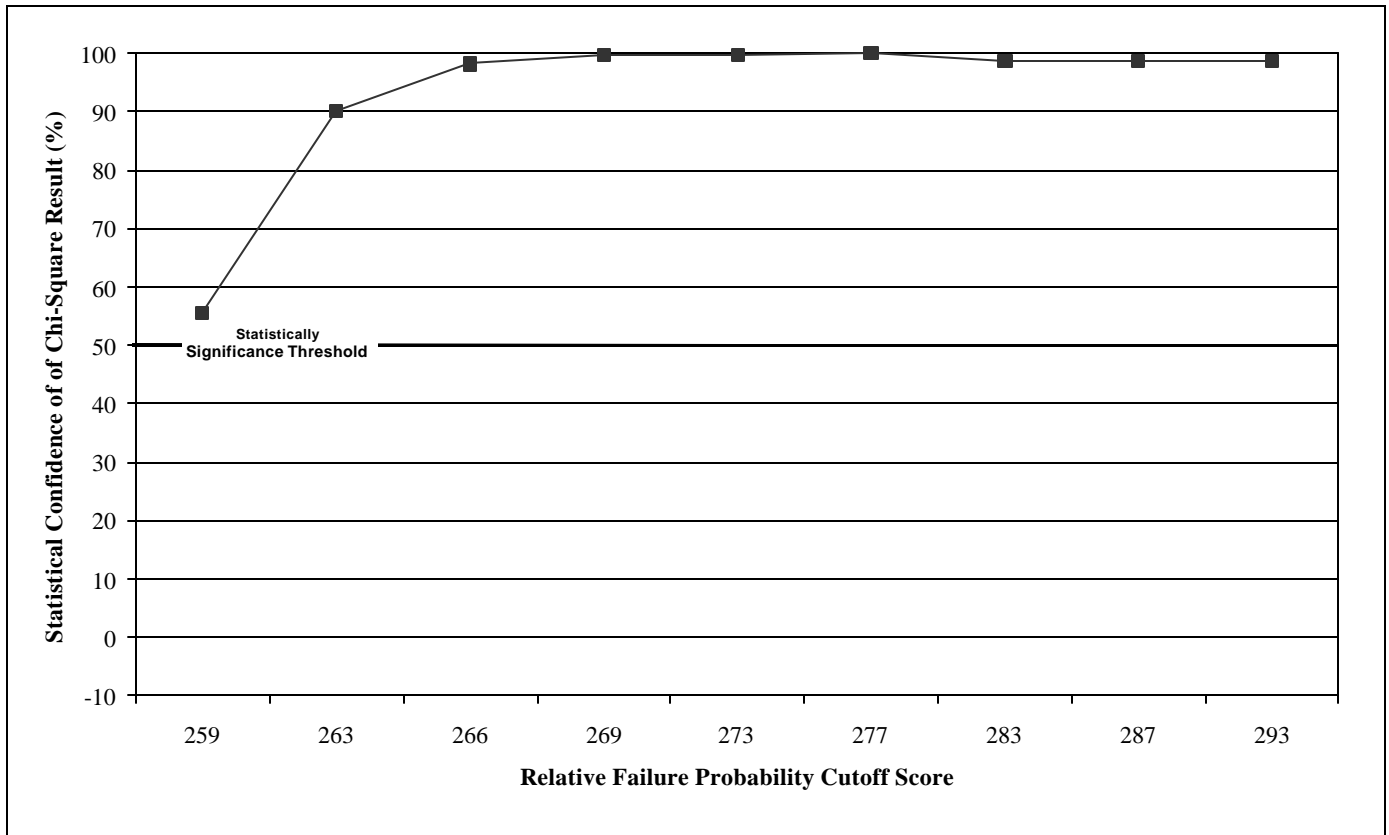
Means Ratio = 1.02, Significant results indicate statistically higher failure risk in areas of EJ concern.

Figure 8-3. Statistical Significance of Chi-Square Result by Post-Mitigation Failure Probability Cutoff Score, Longhorn Pipeline System



Means Ratio = 0.96, Significant results indicate statistically higher failure risk in areas of low EJ concern.

Figure 8-4. Statistical Significance of Chi-Square Result by Post-Mitigation Failure Probability Cutoff Score, Harris County



Means Ratio = 1.14, Significant results indicate statistically higher failure risk in areas of EJ concern.

Figure 8-5. Statistical Significance of Chi-Square Result by Post-Mitigation Failure Probability Cutoff Score, Travis County