Environmental Justice in The East Houston Ship Channel: Rethinking the Chavez High School Location

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Introduction to G.I.S.
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I. Executive Summary

In this project, I will study environmental justice concerns regarding the location of the Chavez High School near Houston’s ship channel. Urban pollution, particularly from industrial activities, is commonly understood to adversely affect human health. Children are particularly vulnerable to air pollution and hazardous substances, making healthy school environments integral to their well-being. Accordingly, The U.S. Environmental Protection Agency (EPA) is currently in the process of creating guidelines on future school siting.

Difficulties and ethical dilemmas arise in siting schools in areas in which the populations of planned schools are located in highly industrial areas. The Chavez High School is exemplary of this point. The Chavez High School and the majority of its student body are situated just south of Houston’s ship channel. The region is home to a large number of refineries and petrochemical plants, and other polluting sources, some of which are located in dangerously close proximity to the Chavez High School. While this raises serious environmental justice concerns, it also represents a demand for schools and other amenities nearby industrial and hazardous zones. My central research goals are to better understand the environmental justice implications of the school’s siting, to determine if there is a more suitable location for the school, and to provide insight on the EPA’s Proposed School Siting Guidelines.
II. Introduction

It is widely understood that urban pollution stemming from industrial activities and high levels of motor vehicle activity adversely affects human health. A wide array of harmful impacts may result from urban pollution, especially air pollution, including respiratory and cardiovascular complications, headaches, eye and throat irritation, cancer and premature death. Additionally, pollutants can negatively impact development processes, nervous, reproductive, immune, digestive, urinary and endocrine systems (Report of Mayor’s Task Force on the Health Effects of Air Pollution).

More recently, researchers have pointed to the unique vulnerability of children to air pollution. Children have been diagnosed with leukemia, brain cancer, and asthma at increasing rates (Landrigan et al., 1998 and Gilliland, 2009.) Children are considered more vulnerable to toxins due to disproportionately high levels of exposure and biomedical susceptibility (Landrigan et al., 1999). For instance, children partake in more outdoor activity in comparison to adults in urban environments, such as participating in outdoor sports at schools (Gilliland 2009). A number of studies have documented the link between air pollution, especially caused by hazardous industrial facilities and high volume traffic areas, and health of school-age children (Chakraborty and Zandbergen, 2007). While this is especially true for infants and young children, some studies have noted that this vulnerability continues in teenage years. For instance, one study showed that exposure to air pollution is associated with deficits in lung function in children ages 10-18 (Gauderman, 2004).

As many environmental justice activists and researchers have long noted, poor and minority communities often suffer from the effects of urban pollution at disproportionate rates. Poor and minority populations have historically been more likely to bear the burden of living near industrial facilities and being exposed to environmental hazards (Pastor et al., 2002 and Apelberg et al., 2005). For instance, a landmark study by the United Church of Christ found hazardous waste facilities to be disproportionately located near minority communities (Pastor et al., 2002). A more recent study found that Hispanic residents in the Los Angeles Area were twice as likely to live in a census tract with a Toxic Release Inventory (TRI) industry (see more on TRI below), with African American residents following close behind (Morello-Frosch et al., 2002). Low-income communities may also be more greatly impacted due to lack of resources to cope with and recover from health problems associated with pollution (Mayor’s Task Force Report).

In light of this research, it is unsurprising that children of low-income and minority communities have also been found to suffer from industrial pollution at higher rates than other children (Pastor et al., 2002). Poor minority children, especially blacks, have been repeatedly documented as having higher rates of respiratory problems, mainly asthma (Landrigan et al., 1998 and Gilliland, 2009). While much of the research focuses upon where children live, an increasing amount of attention has paid attention to school environments. Recent studies in Los Angeles, California and Orange County, Florida have found correlations between school proximity to TRI facilities and high traffic volumes (Pastor et
al., 2002; Chakraborty and Zandbergen, 2007). This evidence points to the need for researchers and policy makers to understand children of low-income and minority communities as a dually vulnerable population and to include this understanding in policy recommendations and decisions, especially in regards to schools.

Healthy Childhood Environments & School Siting Initiatives

Research on childhood vulnerability has prompted initiatives to more carefully monitor the built environment in which children spend their time. Most significantly, the Environmental Protection Agency (EPA) has taken a number of steps to more adequately monitor and respond to the environments in which our nation’s children attend school. Because children spend more time in schools than any other location than their homes, schools are an integral component of addressing the environment of children (EPA School Siting Guidelines).

As a result of the passage of the Energy Independence and Security Act (EISA) of 2007, EPA has also commenced developing guidelines on school siting taking into account, amongst other factors, the unique vulnerabilities of children to hazardous substances and pollution. Recently, the EPA released a proposed school siting guidelines (the original draft was released in July). The guidelines recommend that school districts consider a complex set of criteria, including the need for a new school, desirable site attributes, staff and student activities and a comprehensive site study that includes intensive public involvement. Currently, the guidelines are under a public comment period until lasting until February 18, 2011 (EPA School Siting). The School Siting Task Force of the Children’s Health Protection Advisory Committee Taskforce comments on the draft guidelines include specific recommendations on exclusionary zones – buffer zones between pollution sources and schools - in which schools should not be located (School Siting Task Force Report).

Additionally, on March 2, 2009 EPA Administrator Lisa Jackson announced the launching of a new initiative to measure toxic air pollution near a large number of schools. Notably, NEH, EPA’s council on environmental justice issues, has been charged with helping make the process more useful and accessible to environmental justice communities (Strategies to Enhance School Air Toxics Monitoring in EJ Communities: A NEJAC Report of Recommendations 2010).

Pollution & Environmental Justice in Houston

As one of the country’s largest cities and primary ports, Houston unsurprisingly possesses one of the largest air pollution problems in the United States. There are over 400 chemical manufacturing facilities in Houston, including 2 of the 4 largest refineries and the largest petrochemical complex in the country (Texas Observer, 3/3/2007). Due at least in part to the absence of zoning laws in Houston, Houstonians often live precariously close to large industrial facilities. Poor and minority residents are far more likely to be located near industrial or waste facilities, and therefore bear much of the burden of Houston’s largely industrial based economy. This raises a number of health, safety, and environmental justice
concerns, amongst them where to place school in environmentally toxic regions in which people live.

This issue is perhaps most difficult in East Houston, which is home to the United States’ largest concentration of petrochemical plants and at least 30 refineries and petrochemical plants (Dallas News and Texas Observer). In fact, according to *A Closer Look at Air Pollution in Houston, Identifying Priority Health Risks: The Mayor’s Task Force on The Health Effects of Air Pollution*, (herein The Mayor’s Task Force Report), half of all point sources of pollution in Houston are found in the eastern region. This pollution is compounded by substantial non-point source air pollution created by The Port of Houston and the Ship Channel that winds through East Houston and a large concentration of high-volume freeways, including Interstate highways 10, 610 and 45 and State Highway 225 (and 35 in the southeastern portion) (Mayor’s Task force Report).

In The Mayor’s Task Force Report, East Houston neighborhoods were found to have significantly higher levels of “definite risk” air pollutants than in the rest of Greater Houston. While 80% of Houston census tracts have 3 or less of these pollutants at a level of definite risk, 90% of census tracts in East Houston contain four or more definite risk pollutants at a high level. Half of the census tracts with 6 or more definite risk pollutants at high-risk levels are located in East Houston. This is particularly alarming when considering that pollutants may have cumulative effects. Additionally, a study by the University of Texas School of Public Health revealed that “children living within two miles of the Ship Channel had a 56 percent higher risk of contracting acute lymphocytic leukemia than children living more than 10 miles from the channel,” (Houston Chronicle, 1/17/07). Furthermore, East Houston, or the neighborhoods surrounding the Ship Channel, are comprised of predominantly low-income and minority populations, making it a prime area of environmental justice concerns. Unsurprisingly, this has posed unique problems for the appropriate location of amenities in the area, especially with concern to school siting.

*The Chavez High School Controversy*

Chavez High School is located in East Houston, in a predominantly Latino neighborhood just south of the Ship Channel. According to the school’s Continuous School Improvement Planning Goals (CSIPG) for 2008-2009, it serves a predominantly Hispanic area in which 83% of its community is economically disadvantaged. Eighty-three percent of the student body is Hispanic, and 11.5% is African American. Nearly two-thirds of the student body is considered at-risk for dropping out of school, and 13% are English Language Learners (ELL) (Continuous School Improvement Planning Goals, 2008).

Built in 2000 to respond to the areas high demand for a new school, it is one of Houston’s newest schools. In a state of the art building, it is an Applied Science and Engineering Magnet School; one subset of this program is Environmental Science. Its CSIPG boasts that it is named after Cesar Chavez who organized farmworkers in California during the 1960s (somewhat ironic due to his prolong fight against the use of pesticides for its adverse health impacts on farmworkers.) At the same time, Chavez sits within a quarter-mile of three petrochemical plants and on top of natural gas and oil pipelines. A Goodyear Tire &
Rubber Co. plant and an Exxon Mobil Corporation chemical plant are also in close proximity (Texas Observer).

In 1992, Houston Independent School District (HISD) chose the school site and purchased the land based on its large size and affordable price. The Texas Observer reports that HISD did little more than a cursory study of the health concerns involved in locating a school at such a close proximity to industrial hazards. Three environmental studies were performed, including one that noted pervasive ground contamination; air pollution was never considered (Texas Observer). Moreover, with such close proximity to industrial facilities, Chavez youth are also at risk of industrial disasters, such as oil spills, chemical leaks, and explosions. Although moving the school is unlikely, community activists such as Juan Parras of Texas Environmental Justice Advocacy Services (T.E.J.A.S.) continue to fight for the school’s relocation (Texas Observer).
III. Problem Statement

The dangers posed by the Chavez High School location in both long and short-term health effects and potential industrial catastrophes oblige a closer look at HISD’s decision to place the school in its current location. While it is clear that all of East Houston suffers from a highly polluted environment, a more suitable sight may have been available within the Chavez High School Zoning district or nearby. The availability of other land for the school to be located may suggest potential for the school’s relocation, and at least serve as an example for future school sitings within HISD or in other school districts. In addition, applying the EPA’s School Siting Task Force recommendations for school siting guidelines to the Chavez High School case study offers an opportunity to test and evaluate the proposed guidelines.

IV. Research Questions

- Are there environmental justice concerns with respect to the East Houston neighborhood and, more specifically, with the Chavez High School?
- Based on the EPA’s School Siting Task Group’s report on the proposed guidelines, is the current location of Chavez High School suitable or is there a more suitable location?
- What are the policy implications of the Chavez High School siting, especially for EPA’s Proposed School Siting Guidelines?
V. Methodology

A suitability analysis was conducted to evaluate the current Chavez High School site and to locate potentially more suitable school locations within the Chavez High School Zone. The analysis took into consideration motorized vehicle (highway and railroads) and industrial pollution factors. The analysis was divided into three main components:

1.) A demographic analysis was completed to provide a better understanding of the socio-economic demographics across Harris County and in the Chavez High School region and to reveal if there was potential for environmental justice concerns.

2.) An analysis of the concentrations of toxic emissions releases in Harris County.

3.) A suitability analysis, using guidelines from the School Siting Task Force Recommendations, was performed to rank the suitability of available parcels for school siting.

Demographic Information

In order to better understand the demographics of Harris County and the Chavez High School region, I created a series of maps based on socio-economic status characteristics, including race (Hispanic, Black, White, and Asian), median-family income, rates of renter-occupied units, and educational attainment (high school and bachelor’s degree for the sampled population above the age of 25). These maps were created using a combination of SF1 and SF3 Harris County Census Tract data and combining it with spatial data provided by ESRI, Harris County Public Infrastructure and HISD data (for a reference to the location of Chavez High School and Attendance Zone). The Harris County Census Tract shapefile and the SF1 data (including racial demographic and renter-occupied information) was downloaded from the ESRI free download website. Data for the demographic maps portraying median family income and educational attainment was obtained from the U.S. Census Bureau’s SF3 Detailed Tables.

Boundary and School Information

Because I needed to better understand the boundaries and zoning in which HISD operates, I created a reference map of school location data and school attendance zones. This map also provides a general reference of school locations in comparison to toxic emissions (shown in the next map.) School attendance zones are the boundaries that HISD uses to determine which school’s residents are zoned to. For instance, if a student lives inside the boundaries of the Chavez High School Zone, she is zoned to the Chavez High School. This information was obtained from the HISD demographer. High school locations were obtained from the Texas Education Agency.

In addition to the Chavez High School location and zone information, all maps contain the Harris County boundary, major highways, and the Ship Channel for reference. This information was obtained from the Harris County Infrastructure Department.
Toxic Emissions and Pollution Data

I used a combination of EPA’s Toxic Release Inventory (TRI) data and Houston City Appraisal District Land Use Code information to assess environmental pollution. I used TRI data to show concentrations of toxins released in the air, land, and water throughout Harris County. TRI data is based on information provided to EPA through annual reports of industrial and waste facilities; it “reflects the quantities of TRI chemicals that are disposed of, released to the environment, or managed,” (EPA Toxic Release Inventory Program). Because TRI data does not take into consideration the level of toxicity or other site-specific considerations, TRI data alone does not directly implicate health effects. Nonetheless, the data is widely used to study environmental hazards in communities and is often used as a proxy to measure potential health concerns (Morrel-Frosch et al, 2002 and Chakraborty and Zandbergen 2007).

I created the Toxic Emission Release Map by georeferencing EPA’s Toxic Release Inventory preliminary database information. Toxic Release Inventory data was separated for air, land and water and the total number of emissions was calculated for the facilities in each category. All facilities with emissions below one pound for each category subtotal (land, air, water) were omitted. Each category was added separately into the map to spatially represent levels of emissions to land, air, and water.

Because EPA and Texas Commission on Environmental Quality (TCEQ) data is based on point source locations (longitude/latitude information that can be georeferenced) and parcel (polygon shapefile) information, I used Harris County Appraisal District Information combined City of Houston parcel information in the suitability analysis. This was necessary to more accurately determine distances between potential school site parcels and industrial or hazardous parcels. In addition, in the suitability analysis, I used landfill and superfund boundary data obtained from the TCEQ. This data did not appear to be reflected in the HCAD land use data for Houston parcels.

Parcel Information in the Suitability Analysis

In addition to industrial parcel information, I also isolated vacant (non-industrial) and recreational/health parcels to serve as potential alternative school sites. While vacant parcels are much more preferable than parcels currently used for recreational/health uses, the low amounts of vacant land necessitated the inclusion of recreational parcels.

Criteria for Suitability Analysis

The criteria for the suitability analysis was based on the Potential Hazards Screening Table found in the guidelines proposed by the EPA’s School Siting Task Force. This table lists environmental features (such as large industrial facilities, distribution centers, hazardous pipeline) and recommends exclusion zones, which are buffer zones around these “environmental features” in which schools should not be built. It also includes a screening perimeter for further analysis to consider site-specific features. A complete list of these
criteria is included as an appendix to this report. It should be noted that exclusion zones are often denoted by ranges in the table, though I chose higher or lower parts of the ranges for certain environmental features based on the size of the facility to the best of my ability.

Using HCAD land codes, I categorized each potentially hazardous parcel according to environmental feature. I then used the exclusion zone guidelines to create buffers around parcels with the listed environmental features. I also included landfill point source data and superfund boundary data obtained from the TCEQ, because, to the best of my knowledge, this data was not included in the HCAD parcel data. The chart below indicates the Land Use Code, Land Use Code Description, Environmental Feature, and Exclusion Zone for each pertinent land use type within a three-mile buffer around the Chavez High School. It also includes weights used in the parcel ranking portion of the suitability analysis.

<table>
<thead>
<tr>
<th>Land Use Code</th>
<th>Description</th>
<th>Buffer</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Centers/Rail yards/Maritime Shipping</td>
<td>1000</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>4423</td>
<td>Maritime Shipping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4690</td>
<td>Rail/Bus/Air Terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Stations</td>
<td>200</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>4333</td>
<td>Service Station (full)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4334</td>
<td>Service Station (Self)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4742</td>
<td>Gas Company, Distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Industrial Facilities</td>
<td>1000</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>4405</td>
<td>Research &amp; Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4416</td>
<td>Chemical &amp; Allied Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4417</td>
<td>Petroleum Refining/Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4418</td>
<td>Rubber &amp; Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4419</td>
<td>Concrete Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4420</td>
<td>Primary Metal Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4421</td>
<td>Metal Fabricating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Large Sources</td>
<td>750</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>4401</td>
<td>Manufacturing/Processing Products Recovered from Nat. Gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Small Sources</td>
<td>500</td>
<td>10.0%</td>
<td>(Reduced to 250)</td>
</tr>
<tr>
<td>4402</td>
<td>Auto Salvage Yard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4411</td>
<td>Food Kindred Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4422</td>
<td>Machinery &amp; Transportation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As indicated on the last column of this chart, I reduced two of the exclusion zone recommendations. This was necessary in order to perform any kind of parcel ranking because all available parcels overlapped with industrial or road buffers (i.e. there were no parcels left to rank).

**Other Consideration in the Suitability Analysis**

After determining the available parcels and excluding any parcels that coincided with exclusion areas (the vector analysis), a raster analysis was performed to rank areas before finally intersecting the raster and vector analysis. (Weights used in the raster analysis can be seen in the chart above).

The suitability analysis was applied to a three-mile buffer in order to take into consideration all nearby industrial activity or land use of the Chavez High School Attendance Zone. Even though only parcels within the Chavez High School Attendance Zone were ultimately considered for alternative school placement, hazardous or polluting features in close vicinity to the attendance zone boundaries were also included in the analysis because they may equally affect the Chavez High School or other potential parcels within the Chavez Zone. In addition, only parcels large enough to support a school site apt to serve 3,000 students were considered in the final decision.

A step-by-step explanation of map methodology may be found as an appendix to this report.
VI. Findings

Maps A-J: Demographic Maps of Harris County

All demographic maps show the extent of Harris County and include an extant map, which focuses on the Chavez High School Attendance Zone region. All maps are based on natural breaks.

Map A:
Distribution of Hispanics in Harris County by Census Tract shows the percentage of self-identified Hispanics by census tract.

Map B:
Distribution of Blacks in Harris County by Census Tract shows the percentage of self-identified blacks by census tract.

Map C:
Distribution of Asians in Harris County by Census Tract shows the percentage of self-identified Asians by census tract.

Map D:
Distribution of Whites in Harris County by Census Tract shows the percentage of self-identified whites by census tract.

Map E:
Distribution of Renter-Occupied Households by Census Tract shows the percentage of renter-occupied units by census tract.

Map F:
Median Family Income in Harris County by Census Tract shows the median family income by census tract.

Map G:
High School Graduation Rates by Census Tract shows the percentage of high school graduates by census tract.

Map H:
College Graduation Rates by Census Tract shows the percentage of college graduates by census tract.

Reference Map of Schools in H.I.S.D.

Map I:
Schools and School Attendance Zones in Houston Independents School District (HISD) shows the location of high schools and high school attendance zones in H.I.S.D. (and some high schools in greater Harris County). The focused map of the Chavez region shows all schools recognized by the Texas Education Agency.
Analysis Map of Toxic Emissions In Harris County

Map J: Concentration of EPA Regulated Toxins in Air, Land, and Water shows the concentrations of TRI regulated toxins released in the air, land, and water throughout Harris County.

Suitability Analysis Maps:

These maps show the Chavez High School Attendance Zone and a three-mile radius around it.

Map K: Hazardous Environmental Features with EPA’s Recommended Exclusion Zones indicates parcels with industrial environmental features that are listed in EPA’s School Siting Task Force Potential Environmental Hazards Screening Table, and includes a buffer to represent the recommended exclusion zone associated with each feature. It also shows available parcels, which include available parcels defined as parcels associated with land use codes indicating vacancy and recreational uses. This map also represents the preliminary vector analysis required in the suitability analysis.

Map L: Suitability Analysis: Most Suitable Parcels in the Chavez High School Attendance Zone displays the final results of the suitability analysis. It ranks the few available parcels in the entire 3-mile radius. Ultimately, only parcels within the Chavez High School Attendance Zone with a comparable size to the current Chavez High School could be selected. Only one cluster of parcels was eligible under these criteria.
Distribution of Hispanics in Harris County by Census Tract

% Hispanic Population (2000)
- 0.0 - 15.2%
- 15.2 - 30.2%
- 30.2 - 48.1%
- 48.1 - 70.3%
- 70.3 - 97.2%

Chavez High School
Chavez Attendance Zone
Major Highways
Ship Channel

By Lindsey Engelman, November 14, 2010
Projection: Texas South Central State Plane NAD83 4204 (feet);
Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District
Distribution of Blacks in Harris County by Census Tract

% Blacks Population (2000)

- 0.0 - 8.2%
- 8.2 - 21.7%
- 21.7 - 42.2%
- 42.2 - 69.8%
- 69.8 - 98.3%

Chavez High School
Chavez Attendance Zone
Major Highways
Ship Channel

By Lindsey Engelman, November 14, 2010
Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District
Distribution of Asians in Harris County by Census Tracts

% Asian Population (2000)

- 0.0 - 2.5%
- 2.5 - 6.6%
- 6.6 - 12.2%
- 12.2 - 21.5%
- 21.5 - 38.1%

Chavez High School
Chavez Attendance Zone
Major Highways
Ship Channel

By Lindsey Engelman, November 14, 2010
Projection: Texas South Central State Plane NAD83
4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District
Distribution of the White Population in Harris County

% White Population (2000)

- 0.4 - 20.0%
- 20.0 - 43.1%
- 43.2 - 61.6%
- 61.7 - 78.6%
- 78.5 - 100%

By Lindsey Engelman, November 14, 2010

Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District
Distribution of Renter-Occupied Households in Harris County

By Lindsey Engelman, November 14, 2010

Projection: Texas South Central State Plane NAD83 4204 (feet); Sources :U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independant School District
Median Family Income in Harris County

By Lindsey Engelman, November 27, 2010
Projection: Texas South Central State Plane NAD83
4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District
High School Graduation Rates in Harris County

By Lindsey Engelman, November 27, 2010

Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District

* For population 25 years and older
College Graduation Rates in Harris County

By Lindsey Engelman, November 27, 2010

Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: U.S. Census Bureau, Harris County Public Infrastructure Department, Houston Independent School District

% with Bachelor Degree (1999)*

- 0% - 8.2%
- 8.3% - 16.6%
- 16.7% - 26%
- 26.1% - 36.5%
- 36.6% - 51.5%

* For population 25 years and older
Schools and School Attendance Zones
Houston Independent School District (HISD)

By Lindsey Engelman, November 23, 2010
Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: Harris County Public Infrastructure Department, Houston Independent School District, Texas Education Agency
Concentrations of EPA Regulated Toxins Released in Land, Air, & Water in Harris County

Air (lbs)
- 1 - 65,233
- 65,234 - 221,984
- 221,985 - 452,157
- 452,158 - 1,089,687

Land (lbs)
- 1 - 78,861
- 78,862 - 270,288
- 270,289 - 542,776
- 542,777 - 2,791,432

Water (lbs)
- 1 - 7,975
- 7,976 - 39,708
- 397,079 - 497,202
- 497,202 - 947,905

* This map was created using Toxic Release Inventory (TRI) data from the Environmental Protection Agency. There are currently 581 individually listed toxins that are included in the TRI.

By Lindsey Engelman, December 5, 2010
Projection: Texas South Central State Plane NAD83 4204 (feet); Sources: Harris County Public Infrastructure Department, Houston Independent School District, EPA Toxic Release Inventory
Hazardous Environmental Features with EPA Recommended Exclusion Zones

This map shows exclusion zones (buffers) based on EPA's School Siting Task Force's recommended guidelines for school siting, around land parcels with environmentally hazardous materials within a three mile radius around the Chavez High School. It shows a high level of industrial activity combined with a low number of available parcels in the study area, indicating a limited number of parcels available for ranking in the analysis.

By Lindsey Engelman, December 5, 2010; Projection: Texas South Central State Plane NAD83 4204 (feet) Sources: Harris County Public Infrastructure Department, HISD, TCEQ, City of Houston
Suitability Analysis:
Most Suitable Parcels in the Chavez High School Attendance Zone

This map represents a suitability analysis of available parcels within the study area, which is a three mile radius around the Chavez High School. While available parcels were ranked throughout this study area, ultimately, only parcels within the Chavez High School Attendance Zone with a comparable size to the current Chavez High School could be selected. Only one cluster of parcels was eligible under these criteria.

Suitable Parcels Ranked

1 Highest Ranked
2
3
4
5 Lowest Ranked

By Lindsey Engelman, December 5, 2010; Projection: Texas South Central State Plane NAD83 4204 (feet)
Sources: Harris County Public Infrastructure Department, HISD, TCEQ, City of Houston
VII. Analysis of Data

Demographic Maps

The racial demographic maps reveal that racial groups are concentrated in certain areas throughout Harris County. The population of census tracts in the outer suburbs is composed of a highly white population. Blacks are concentrated in the central south and the central northeast portion of the city. Asians are concentrated in small pockets, but never comprise a majority of the population. There are large percentages of Hispanics in north central section of the inner city and in East Houston, especially south of the ship channel. In accordance with figures from the Chavez High School already presented in this report, the Chavez Attendance Zone is primarily comprised of Hispanics. Almost all census tracts within the Chavez Zone contain a majority Hispanic population, from 48.1% to 97.2% Hispanic.

Economic demographic maps reveal strong disparities between the central city and the suburbs. While the median family income of some census tracts reaches as high as $200,000, most census tracts in the central and eastern portions of the inner city and the area south of the ship channel are below $33,393 and almost no census tract reaches an average median income above $50,065. While Houston overall shows a high-level of owner-occupied units, the suburbs show higher rates of home ownership. Most tracts with in the Chavez Zone are at least 25% renter-occupied, and some reach as high as a 38.2% - 66.7% range. High school graduation rates appear to be lower in the southern portion of Houston, but otherwise seem to be evenly distributed throughout the county. College graduation rates are extremely low throughout the central and eastern portion of the county. As in many other of these census tracts, the percent of college graduates is 16.6 or lower, most are 8.2 or lower.

In sum, these demographic maps reveal significant disparities between various regions in Harris County. The Chavez Attendance Zone is primarily Hispanic and very low-income. Many residents rent their living spaces. While high school graduation rates appear to be average, college graduation rates are extremely low. While this socio-economic profile does not in and of itself determine environmental injustice, it does call attention to the potential of environmental justice concerns.

Maps of School Locations & Toxic Emissions In Harris County

The TRI map reveals an extremely high concentration of toxic releases along the ship channel. The majority of these emissions are air emissions. Many schools are precariously located close to toxic regions. The Chavez High School is located near high levels of air and land emissions, mainly to the north. Small air emission sources also surround its perimeter.
Suitability Analysis Maps

The first map of the suitability analysis shows that an overwhelming portion of the study area (a three mile radius around the Chavez High School) is located within what would be considered an exclusion zone by the Task Force’s Potential Hazards Screening Table. The current location of the Chavez High School is located in dangerous proximity to hazardous environmental features. Only a small portion of the parcel, the southeastern most corner, lies outside of an exclusion zone. Almost the entire northern portion of the study area was excluded from the ranking portion of the suitability analysis because of its high levels of industrial activity. Nonetheless, small areas recommended for exclusion are found throughout the study area. Also, there is a limited amount of available parcels large enough to hold a school. Most large parcels are currently used for recreational uses.

The small number of available parcels combined with intensive industrial activities left few parcels for the final parcel suitability ranking. The highest ranked parcels were outside of the Chavez Attendance Zone, so were ultimately excluded from the parcel recommendation. The highest ranked parcel with a large enough area to support a school is located in the center of the Chavez Attendance Zone. It was given a middle level ranking of 3 (ranges were highest at 5 and lowest at 1).
VIII. Conclusions, Limitations, & Recommendations

Conclusions

The suitability analysis reveals the current location of Chavez High School as unsuitable for school siting because of its dangerously close proximity to industrial facilities, especially a large petrochemical facility. Within the Chavez High School Attendance Zone, the school is located in the portion most inundated by industrial activity. These industrial facilities pose both health and safety concerns. This analysis shows potential for the school to have been located on a more suitable parcel that is currently being used for recreational uses. (The parcel currently holding the high school could have alternatively bee used as a recreational area. While locating parks alongside industrial facilities is also undesirable, people spend considerably less amount of time in parks than children do in schools and no one is required to spend their time there.)

Furthermore, this study calls for scrutiny of the HISD’s process of siting the Chavez High School and schools in HISD more generally. While inconclusive, the seemingly lack of care involved in siting the school (and presumably drawing the attendance zones) in an overwhelming Hispanic and low-income community may point to environmental justice concerns. While school relocation would be difficult, the health of children must be prioritized and therefore the benefits and feasibility of relocation should be evaluated.

Limitations

Limitations of the data must also be taken into consideration. Most important to the suitability analysis, the parameters provided in the School Siting Task Force’s Potential Hazards Screening Table are only recommendations for the proposed guidelines and are not final. Moreover, even if they become final, the guidelines are not intended to be applied retroactively to already existing schools. Moreover, the guidelines will remain just that – guidelines and not legal requirements. It is also important to consider that an analysis of proximity alone to toxic emissions and industrial facilities is unable to account for the complexity of the issue. For instance, wind patterns may cause areas further away from an industrial facility to be more greatly impacted than its nearest neighbor. A more comprehensive analysis must be performed in order to fully evaluate environmental hazards in the Chavez region.

Recommendations

Despite these limitations, recommendations for future research and policies can be based upon this analysis:

For H.I.S.D.:
HISD should review the siting process that places the Chavez High School in its current location to fully understand its implications and shortcomings. HISD must implement the school siting guidelines when they are finalized.

H.I.S.D. should provide feedback and comment on the proposed guidelines based on the analysis of its own problems in the school siting process.

Closer, more comprehensive studies of pollution and contamination around the Chavez High School should be performed to better understand the potential health impacts to the school’s students and staff.

Based on these studies, HISD and city officials should consider moving the school to another location.

A feasibility analysis of moving the school to the parcel recommended in this study or parcels located outside of the Chavez region should be taken into consideration.

For EPA and Proposed School Siting Guidelines:

- The exclusion zones provided in the School Siting Task Force’s Recommendations should be included in EPA’s final school siting guidelines.
- EPA should provide clearer guidance to school districts regarding how to handle populations that live in highly industrial areas with high demands for new schools.
- Because school age children spend the most time in schools than in any other location other than their homes, providing students the opportunity to spend significant portions of their time outside of industrial areas during the school day may substantially reduce their total exposure to high levels of contamination and provide health benefits. EPA should evaluate the cost and benefits to requiring students living in highly industrial areas to commute further distances to attend schools in less polluted environments and include recommendations in the siting guidelines based on the results of these studies.
- EPA should include enforceable regulations and not just provide optional guidelines. Minimum exclusion zones that buffer schools from highly toxic facilities should be required and not just recommended.
- As EPA begins its study of schools currently located in highly toxic environments, it should also consider guidelines and/or regulations on when school relocation or facility closure should be required.
IX. References


Mayor’s Task Force on the Health Effects of Air Pollution. “A Closer Look At the Health Effects of Air Pollution in Houston: Identifying Priority Health Risks.” *University of Texas School of Public Health and the City of Houston*, 2006.


Appendices
Appendix A: Data Sources

U.S. Census Bureau
www.esri.com/data/free-data/index.html
Demographic data, census tract boundaries

City of Houston
http://www.houstontx.gov/planning/GIS/GIS.html
Parcel information

Harris County Appraisal District
Land use codes associated with parcels

Harris County Public Infrastructure Department
http://www.eng.hctx.net/GIS/gis.htm
county boundaries, school districts, highways & roads, appraisal district, water bodies

Texas Commission on Environmental Quality
http://www.tceq.state.tx.us/gis/sites.html
Landfills and superfund sites

Texas Education Agency
http://ritter.tea.state.tx.us/SDL/SDLescmetadata.html
School district data Harris county schools

Houston Independent School District
High School Attendance Zones and schools in HISD

Environmental Protection Agency, TRI Preliminary Data Set
TRI data for Harris County
Appendix B: Step-by-Step Map Methodology

A. Initial Steps
   1. Download all data
   2. Make sure all data is defined and projected to Texas South Central State Plane
      NAD83 4204 (feet)

B. Demographic Maps
   1. Create Demographic maps template
      a. Add the Harris County Census Tracts, Highways, High School
         Attendance Zones polygon file, High School point data locations,
         Bodies of Water and shapefiles to ArcMap
      b. Create Ship Channel layer
         i. Using the “select by attribute” tool in the attribute table, select
            the ship channel from the Harris County Bodies of Water
            shapefile
         ii. Export selected layer from Bodies of Water Shapefile and add
             to map
         iii. Remove Bodies of Water shapefile
      c. Repeat process for Chavez Attendance Zone, Chavez High School,
         and Relevant Highways
      d. Create extent map for area surrounding Chavez Attendance Zone
   2. Create SF1 Demographic Maps (race and renter-occupied)
      a. Download Demographic SF1 Harris County track information from
         ESRI
      b. Add Demog_Tracts_SF1 table to map
      c. Join the Census Track Demographics (SF1) to the Harris County
         Census Tract layer.
      d. Symbolize the Census Tract Layer (joined) by the distribution of
         Hispanic population.
      e. Resave as new map and symbolize map for each SF1 demographic
         category: Black, White, Asian, & Renter-Occupied percentage without
         Bachelor’s degree, percentage without high school diploma,
         percentage below poverty level, % renter-occupied
   3. Create SF3 Demographic maps (median family income & educational levels)
      a. Download SF3 tables from U.S. Census Bureau for Median Family
         Income, Bachelor’s Degree, and High School Graduation
      b. Join Median Income table to Harris County Census Tract file
      c. Symbolize the Harris County Census Tract Layer (joined) by Median
         Family Income
      d. Repeat for high school graduation and Bachelor Degree attainment

C. Map of Schools and School Attendance Zones
   1. Using map template, replace Harris County Census Tracts with Harris County
      Boundary shapefile
2. Add school point locations from the Texas Education Agency and HISD high school attendance zones
3. Clip schools to Harris County
4. Separate high schools and other schools using the select by attribute tool and exporting data and adding to map (erase original school point location layer)

D. Toxic Release Inventory (TRI) Maps
1. Download information from EPA’s TRI Preliminary data for Harris County into an excel file.
2. Separate the data into categories for land, air, and water emissions.
3. Because each facility is listed for each TRI chemical it emits, within each of the three categories, it is necessary to combine all toxic release information to one row.
4. Subtotal all of the emissions data, coming up with a subtotal for land, air, and water for each facility.
5. All facilities with total releases under one pound were omitted. (These were considered separately under each category.)
6. Georeference the emissions points based on longitude and latitude coordinates and create a point shapefile.
7. Add the TRI point shapefile to the template map
8. Symbolize the TRI data by category and amount of emissions.

E. Spatial Analysis Map: Part A Buffers
1. Categorize HCAD land use type based on “environmental feature” as defined by EPA School Siting Guidelines.
2. Join HCAD parcels to HCAD Land Use Codes
3. Separate the Chavez High school parcel and create a 3 mile buffer around it
4. Clip all pertinent shapefiles to the 3-mile buffer and added them to the map (parcels joined, highways, railroads, superfund sites and landfills).
5. Using the select by attribute tool, I create new features based on “environmental feature” of EPA guidelines (large industrial, small industrial, other large sources, other small sources, distribution center, railroad, highway, hazardous pipeline, hazardous waste (including landfills and superfund sites), and railroads
6. Again using the select by attribute tool, create separate layers for Vacant Land and Recreation/Health Land
7. Create Buffers & Dissolve layers:
   a. Freeways:
      i. Create 200 feet around freeways
      ii. Dissolve buffer and freeway
      iii. Remove original freeway layer
   b. Repeat for following shapefiles:
      i. Large Industrial, distribution centers, superfund sites, landfills (1,000 feet), Gas stations (200), other small sources (250), pipeline (500), rail (128),
Note: Certain buffers were adjusted due to feasibility problems within the study. See methodology section for further details.

c. Dissolve Vacant Parcels into one layer
d. Dissolve City of Houston Recreational/Health parcels into one layer

8. Union the “negative” layers (all dissolved layers except vacant & recreational parcels)
   a. Save as “undesirable areas”
   b. Dissolve negative layers and save as undesirable_areas_dissolve and available_parcel_dissolve respectively
   c. Remove undesirable_areas and available_area

9. Erase undesirable_areas_dissolved from available_dissolved(dissolved) from vacant parcels (dissolved)
   a. Save as suitable_areas.shp
   b. Remove unsuitable parcels (dissolved) and available parcels (dissolved)

F. Suitability Analysis: Part B Parcel Ranking
1. Activate spatial analyst toolbar
2. Reclassify features
   a. Set spatial analyst tool to distance/straight line and select the Parcels_distrib.shp and save as distrib_dist
   b. Reclassify distrib_dist file in equal intervals of 10 and save file as distrib_re.
   c. Repeat for all negative features
3. Weight and combine negative suitability criteria layers using the raster calculator. Weights are based on the classification system found in a chart in the Methodology section of this report.
   a. Activate the raster calculator
   b. Add equation to raster calculator based on above criteria and click evaluate
   c. Make data permanent and save as weights
   d. Remove individual reclassified files from table of contents
   e. Save new shapefile as weight_re and remove weights from table of contents
4. Convert weights_re into a vector shapefile using the convert feature on the spatial analyst toolbar
   a. Save file as rank
   b. Remove weights_re from table of contents
5. Intersect rank with suitable_areas using the intersect analysis tool
6. Save as suitable_parcel_ranked
7. Symbolize the Gridcodes field of suitable_parcel_ranked to differentiate between ranks
8. Due to the limited number of parcels remaining outside of buffer zones but on “available” classified parcels, no further steps were needed (such as preferencing vacant land above recreational land or limiting parcels to the Chavez High School Zone).
Appendix C:  
Potentially Hazardous Environmental Screening Table  
School Siting Task Force  
U.S. Environmental Protection Agency Children’s  
Health Protection Advisory Committee
### Potential Environmental Hazards Screening Table

<table>
<thead>
<tr>
<th>Environmental Feature</th>
<th>Description</th>
<th>Screening Perimeter&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Exclusion Zone&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Recommendation</th>
<th>Potential hazard</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Railyards and Major Rail-lines            | A major service and maintenance railyard; rail lines serving > 50 trains/day | 1 mile (rural) ½ mile (urban)    | 1,000 feet                 | Avoid siting schools within 1,000 feet of a major service and maintenance railyard. Within one mile of a railyard, consider siting limitations and mitigation approaches. | - Toxic air emissions  - Noise  - Subsurface contamination  - Accidental releases/spills of hazardous chemicals | - CARB Air Quality and Land Use Handbook (2005)  
- CARB rail yard air quality HRA’s [http://www.arb.ca.gov/railyard/hra/hra.htm](http://www.arb.ca.gov/railyard/hra/hra.htm)  
- CA Education Code 17213  
- LAUSD Distance Criteria  
- CA Code of Regulations Title 5 Section 14010                                                                 |
| Rail Lines                                | All rail lines                                                               | 1,500 feet                       | 128 feet                   | Keep all occupied spaces more than 128 feet from at-grade rail lines. Recommend safety study based on cargo, speed, traffic, etc. regarding setbacks and other mitigations | - Physical hazards due to derailment  
- Pedestrian safety  
| Ports                                     | Marine ports with > 100 truck visits/day                                     | 1 mile (rural) ½ mile (urban)    | 1,000 feet                 | Avoid siting schools within 1,000 feet of a marine port. Within one mile of a marine port consider siting limitations and mitigation approaches. | - Toxic air emissions  
- Noise  
- Subsurface contamination  
| Freeways and High-Traffic Roads           | Urban road with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day, or roadways with heavy diesel truck traffic. | ½ mile                           | 500-1,000 feet             | Avoid siting schools within 1,000 feet of a freeway, urban road with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day, or roadways with heavy diesel truck traffic. | - Toxic air emissions  
- Noise  
- Accidental releases/spills of hazardous chemicals | - CA Education Code 17213  
- CARB Air Quality and Land Use Handbook (2005)  
- Gaudermann et al., (2007)  
- Kim et al., (2008)  
- NJDOT Chapter 308, Title 18A - "Terrell James Law." |

<sup>1</sup> If a potential school site is located within the screening perimeter of an environmental feature, then potential risks from that feature require further study.

<sup>2</sup> Exceptions can be made if supported by quantitative risk assessment (including consideration of mitigation measures) and compliant with applicable law.
<table>
<thead>
<tr>
<th>Environmental Feature</th>
<th>Description</th>
<th>Screening Perimeter</th>
<th>Exclusion Zone</th>
<th>Recommendation</th>
<th>Potential hazard</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Centers, bus garages, and truck-stops</td>
<td>Facilities with &gt;100 trucks/buses per day, or &gt; 40 refrigerated trucks per day</td>
<td>½ mile</td>
<td>1,000 feet</td>
<td>Avoid siting schools within 1,000 feet of a distribution center (that accommodates more than 100 trucks per day, more than 40 trucks with operating transport refrigeration units (TRU) per day, or where TRU unit operations exceed 300 hours per week).</td>
<td>-Toxic air emissions -Pedestrian safety -Subsurface contamination</td>
<td>-CARB Air Quality and Land Use Handbook (2005) -SCAQMD Air Quality Issues in School Site Selection (2007)</td>
</tr>
<tr>
<td>Large industrial facilities</td>
<td>Fossil fuel power plants (&gt;50mw), incinerators, refineries, chemical/rubber &amp; plastics plants, cement kilns, metal foundries and smelters, and industrial facilities with tall exhaust stacks</td>
<td>½ mile</td>
<td>500-1,000 feet</td>
<td>Avoid siting new schools immediately downwind of large industrial facilities. Consult with local air quality agencies to determine appropriate separation.</td>
<td>-Toxic air emissions -Subsurface contamination -Accidental releases/spills of hazardous chemicals -Odors</td>
<td>-CARB Air Quality and Land Use Handbook (2005) -SCAQMD Air Quality Issues in School Site Selection (2007)</td>
</tr>
<tr>
<td>Other large Sources</td>
<td>Metal platers (especially chrome), rendering plants, sewage treatment plants, composting operations, large manufacturing facilities</td>
<td>½ mile</td>
<td>500-1,000 feet</td>
<td></td>
<td>-Toxic air emissions -Subsurface contamination -Accidental releases/spills of hazardous chemicals -Odors</td>
<td>-LAUSD Distance Criteria</td>
</tr>
<tr>
<td>Hazardous Waste Sites</td>
<td>Superfund sites, landfills &amp; transfer stations,</td>
<td>1 mile</td>
<td>1,000 feet</td>
<td>Avoid siting new schools within 1,000 feet of Superfund Sites, an active Landfill, or Waste Transfer Station</td>
<td>-Toxic air emissions -Subsurface Contamination -Odors</td>
<td>-R.I. School Construction Regulations, Sec. 1.05-2(4) -LAUSD Distance Criteria</td>
</tr>
</tbody>
</table>

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3 See [http://www.ride.ri.gov/Finance/Funding/construction/Documents/FY08%20Housing%20Aid/Prior%20to%20May%2031%20Updates/School_Constr_Regs_FINAL.pdf](http://www.ride.ri.gov/Finance/Funding/construction/Documents/FY08%20Housing%20Aid/Prior%20to%20May%2031%20Updates/School_Constr_Regs_FINAL.pdf)
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<th>Exclusion Zone&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Recommendation</th>
<th>Potential hazard</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large agricultural growing operations</td>
<td>Operations employing aerial pesticide spraying</td>
<td>3 miles</td>
<td>¼ - 2.5 miles</td>
<td>Setback distances may vary depending upon local control/application practices for various crops</td>
<td>-Toxic air emissions -Subsurface contamination -Burning of agricultural stubble</td>
<td>-CA DPR Methyl Bromide Field Soil Fumigation Buffer Zone Determination -Kern County Department of Agriculture, California&lt;sup&gt;4&lt;/sup&gt; -NJDEP Pesticide Control Regulations, § 7:30-10.2(k)&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Airports</td>
<td>All private, commercial and military airports, consider flight patterns / runway configuration</td>
<td>2 miles (from runways)</td>
<td>1,200 – 3,000 ft</td>
<td>Avoid siting schools within 0.5 miles of existing or planned runways</td>
<td>-Safety concerns near runways -Noise -Toxic air emissions</td>
<td>-CA Code of Regulations Title 21 Division 2.5 Chapter 2.1</td>
</tr>
</tbody>
</table>


<sup>2</sup> Statute prohibits gypsy moth pesticide applications within 2.5 miles of schools during normal student commuting times (NJAC, Pesticide Control Regulations § 7:30-10.2(k)). NJDEP also restricts aerial applications 300 horizontal feet around any school property (NJAC § 7:30-10.6(q)).


<sup>4</sup> http://www.cals.ncsu.edu/wq/sfzn/PDFNorthCarolina/PDFNCPollutionStatutesandCode/SwineFarmSitingAct.PDF


<sup>6</sup> Study showed that children living or attending schools within half a mile of a CAFO have increased prevalence of asthma; some jurisdictions already have siting restrictions to protect school children from CAFOs within ½ mile or greater distances. See Pediatrics. 2006 Jul;118(1):e66-75.
<table>
<thead>
<tr>
<th>Environmental Feature</th>
<th>Description</th>
<th>Screening Perimeter$^1$</th>
<th>Exclusion Zone$^2$</th>
<th>Recommendation</th>
<th>Potential hazard</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drycleaners</td>
<td>Facilities using perchloroethylene (perc) or similarly toxic chemicals</td>
<td>1,000 feet</td>
<td>300 feet</td>
<td>Avoid siting new schools within 300 feet of any dry cleaning operation. For operations with two or more machines, provide 500 feet. For operations with three or more machines, consult local air quality agencies. Do not site new schools within the same building with perc dry cleaning operations.</td>
<td>-Toxic air emissions</td>
<td>-CARB Air Quality and Land Use Handbook (2005)</td>
</tr>
<tr>
<td>Gas Stations</td>
<td>Large gas station dispense &gt; 3.6 million gallons per year</td>
<td>1,000 feet</td>
<td>50 feet</td>
<td>Avoid siting new schools within 300 feet of a large gas station (defined as a facility with a throughput of 3.6 million gallons per year or greater). A 50 foot separation is recommended for typical gas dispensing facilities.</td>
<td>-Toxic air emissions</td>
<td>-CARB Air Quality and Land Use Handbook (2005)</td>
</tr>
<tr>
<td>Other small sources</td>
<td>Auto body shops, furniture manufacturing &amp; repair; wood product manufacturing or processing; printing, electronics and chip manufacturing; charbroilers, commercial sterilization, back-up generators; pharmaceutical, rubber, and plastic plants</td>
<td>500-1,000 feet</td>
<td>Site-specific</td>
<td></td>
<td>-Toxic air emissions</td>
<td>-CA Education Code 17213</td>
</tr>
<tr>
<td>Environmental Feature</td>
<td>Description</td>
<td>Screening Perimeter</td>
<td>Exclusion Zone</td>
<td>Recommendation</td>
<td>Potential hazard</td>
<td>Reference</td>
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</tr>
<tr>
<td>Power Lines</td>
<td>High voltage power lines &gt;50 kV</td>
<td>350 feet</td>
<td>25 – 350 feet</td>
<td>Setback distances vary on voltage (kV) and depending if lines are above ground or below ground.</td>
<td>-Exposure to electromagnetic fields -Safety concerns if power lines fall</td>
<td>-CA Code of Regulations Title 5 Section 14010 -CA Dept. of Ed. Power Line Setback Exemption Guidance (2006) -RI Dept. of Ed. School Construction Regulations (5/24/07), Section 1.05-2(2)</td>
</tr>
<tr>
<td>Cellular Phone Towers</td>
<td>All cellular phone towers and antennas</td>
<td>200 feet</td>
<td>On or adjacent to site</td>
<td>Avoid siting schools on or adjacent to cell towers or placing cell towers on or adjacent to school sites.</td>
<td>-Exposure to electromagnetic fields -Fall distance of towers</td>
<td>-LAUSD Board Resolutions -FCC’s “A Local Official’s Guide to RF Emission Antenna Safety -World Health Organization</td>
</tr>
<tr>
<td>Hazardous Material Pipelines</td>
<td>Oil/fuel pipelines, high pressure natural gas pipelines (80+ psi), chemical pipelines, high pressure/volume water lines</td>
<td>1,500 feet</td>
<td>Site specific</td>
<td>No hazardous pipelines on–site (except school serving natural gas), setbacks based upon risk analysis</td>
<td>-Subsurface contamination -Accidental release / spills of hazardous materials -Fire/heat from flammable fuels -Flooding/erosion from water</td>
<td>--CA Dept. of Ed. Guidance Protocol School Site Pipeline Risk -CA Code of Regulations Title 5 Section 14010 -LAUSD Pipeline Safety Hazard Assessment Protocol</td>
</tr>
<tr>
<td>Reservoirs, water or fuel storage tanks</td>
<td>All above ground large volume liquid storage tanks</td>
<td>1,500 feet</td>
<td>Site-specific</td>
<td>Allow 60 minutes warning time for arrival of first wave &gt;1 foot high</td>
<td>-Potential for inundation in an accident</td>
<td></td>
</tr>
</tbody>
</table>

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9 Rhode Island has larger exclusion zones for power lines. In RI, project sites must have a minimum separation of 500 feet from 50-133kV power-lines, 750 feet from 220-230kV power-lines, and 1,500 feet from 500-550kV power-lines. 
http://www.ride.ri.gov/Finance/Funding/construction/Documents/FY08%20Housing%20Aid/Prior%20to%20May%2031%20Updates/School_Constr_Regs_FIN_AL.pdf

10 California has setback distances that vary with kV and above ground (AG) or below ground (BG) lines as follows: kV 50-199: 100 feet AG or 25 feet BG; kV 200-230: 150 feet AG or 37.5 feet BG; and kV 500-550: 350 feet AG or 87.5 feet BG.
<table>
<thead>
<tr>
<th>Environmental Feature</th>
<th>Description</th>
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<th>Reference</th>
</tr>
</thead>
</table>
| Geologic features     | Earthquake faults, liquefaction zones, volcanic/geothermal activity, landslide zones, flood zones, methane zones, naturally occurring hazardous materials (examples: asbestos, uranium, radon) areas, etc.; reservoirs | ¼ mile              | 50 feet from active faults to buildings | Recommend geologic/geotechnical hazards report for every site. Avoid areas subject to high liquefaction, landslides, 100 year flood plains, etc. | -Natural hazards  
- Toxie air emissions                     | -CA Code of Regulations Title 5 Section 14010  
- CA Geological Survey Publication No. 48 Checklist |